Members of the public often hear news about the deteriorating state of the nation’s infrastructure, but in general they are unaware of the efforts and costs required to maintain and operate the transportation systems they rely on every day.

In a recent study, U of M researchers sought to better understand stakeholder attitudes, knowledge, and engagement about financing for local road system management. “It’s important for people to be informed and to be listened to, and to have their opinions taken into consideration in decision making,” says Guillermo Narváez, a former research associate with the Humphrey School of

Engaging the public in local road funding decisions may lead to better outcomes
New guide helps road crews choose the best pothole patch

For most road crews, repairing potholes is an essential and highly visible duty. Choosing the best or most cost-effective pothole repair method, however, has remained a complicated puzzle.

“Selecting the appropriate patching method and materials varies depending on several factors, including the size of the pothole and its location on the roadway,” says Manik Barman, an assistant professor with the University of Minnesota Duluth (UMD) Department of Civil Engineering. “Patching methods and materials also face seasonal challenges in Minnesota when asphalt plants shut down for the winter, turning cold-weather repairs into short-term fixes.”

To help solve this puzzle, the Minnesota Department of Transportation (MnDOT) funded research to help road crews choose patching methods that match specific repair conditions. UMD researchers explored patching tools, materials, and methods to identify which ones were most appropriate for specific pothole conditions, road locations, and time of year. They also evaluated the effectiveness of different methods based on durability, road safety, ride quality, and driver satisfaction.

“We wanted to develop a decision tree for choosing the right pothole repair method that could be laminated for use in the field,” says Susan Lodahl, assistant state maintenance engineer with the MnDOT Office of Maintenance.

Researchers began by reviewing existing literature to identify the four repair methods best suited to Minnesota: cold mix, hot recycled asphalt, mastic material, and mill-and-fill with hot-mix asphalt. Next, they identified five sites near Duluth, where they oversaw 20 pothole repairs. Investigators then monitored these repairs for two years to assess the methods and their best applications. Their findings include:

- Cold-mix asphalt patch should only be used for temporary fixes in small to medium potholes. The material is not designed to be structurally sound for depths beyond two inches.
- Virgin hot-mix asphalt during the regular season is the most acceptable option for filling milled areas. This option can be used in any situation—mill-and-fill or established potholes.
- Mastic, although expensive, is the best option for repairing small potholes as well as longitudinal joints.

Using the findings from this study, researchers developed decision trees in both flowchart and flash card form to help road crews choose the most suitable method for each repair. They also compiled best practice guidelines for patching method selection, placement, compaction practices, and moisture control to provide further guidance.

“The decision trees and best practices we developed can be easily combined into a patching guide that, with laminated flash cards, can be distributed to MnDOT road crews throughout the state and will also be invaluable to our local public agencies in Minnesota and beyond,” Barman says.

READ Catalyst ONLINE for links to research reports and other resources.
The U of M Extension Regional Sustainable Development Partnerships (RSDP) recently began a project that connects small- and medium-sized farms to wholesale markets using existing infrastructure.

The pilot project is the first in the nation to develop and test “backhauling” as a way to help these farms get their produce to wholesalers for wider distribution. Backhauling uses the return trip of a delivery truck to carry locally grown foods from rural grocers back to wholesale distribution centers. The long-term goal is to increase the viability, competitiveness, and sustainability of the farms through access to the wholesale market.

“We need to understand the complexities of farm-to-grocery-to-wholesale, including logistical, financial, and regulatory challenges,” says Kathryn Draeger, statewide director of RSDP, who is co-leading the study with U of M applied economics professor Hikaru Peterson. “This innovative research will help us learn how we can build systems for local food growers, help wholesalers, and support local grocers, who are such an essential part of Main Street across Minnesota.”

The two-year project is funded by a grant from the National Institute of Food and Agriculture at the United States Department of Agriculture. The research will bring Extension and the U of M together with stakeholders from across the food supply chain, including producers, grocers, wholesalers, and regulators.

One of the RSDP’s partners in this project is Mason Brothers Wholesale Grocery, a family-owned wholesale grocery distributor that serves independent small grocery stores in Minnesota and parts of North Dakota, South Dakota, Iowa, Wisconsin, and Michigan. Farmers will be able to bring their crops to local grocery stores, where trucks in the Mason Brothers fleet will pick them up and transport them to wholesale distribution centers.

“Our trucks travel 45,000 miles per week and are 60 percent full on average during the course of our routes. So we have the infrastructure to link local farmers to distribution,” says Duke Harrison, head of warehouse operations at Mason Brothers. “We can haul these products and get them back to markets without adding much on our end.”

Over the next two years, the project will test the backhauling model, starting with three crops: garlic, organic potatoes, and strawberries. Once tested, this model could be replicated in rural areas throughout the country.

In a 2015 survey of rural Minnesota grocery stores, 54 PERCENT said meeting demand for locally grown produce was a challenge.

In the same year, Big Stone Garlic donated MORE THAN HALF of its total garlic crop to food shelves.
Modern public transit networks are one way a disease outbreak can spread rapidly throughout a region, particularly in areas where a large portion of the population lives and commutes in increasingly dense conditions. As a result, the ability to identify components of the public transit system most likely to be carrying infected individuals during an outbreak is critical to planning for and controlling the spread of outbreaks.

In a new study, researchers outlined a novel method to identify the components of a public transit system that are most likely to transport infected passengers and therefore play a vital role in the continued spread of infection during an outbreak.

“We defined a new network structure—the vehicle trip network—that is capable of representing the entire system in a compact way,” says Alireza Khani, an assistant professor in the Department of Civil, Environmental, and Geo-Engineering. “Redefining passenger movements using this novel network structure provides a way to efficiently identify the critical components of the network that should be targeted for surveillance and control in efforts to mitigate an ongoing outbreak.”

Khani collaborated with Lauren M. Gardner and András Bóta of the Research Centre for Integrated Transport Innovation at the University of New South Wales on the study. It was funded by Australia’s National Health and Medical Research Council; a paper about the study appears in the Journal of Networks and Spatial Economics.

For the study, the researchers used public transportation data from a major U.S. transit system to conduct a four-stage data analysis. First, they simulated the movement of nearly 300,000 passengers in the entire regional transit network; then, they generated a passenger contact network using the simulation results.

Next, they used the passenger contact network to model how infection spreads between individuals during epidemic outbreaks based on contact patterns and a range of outbreak scenarios. These scenarios varied based on the number and location of initially infected individuals as well as disease characteristics, representing both naturally occurring and malicious introductions of infection into the system. During this stage, researchers also interpreted passenger-level outbreak results to determine the risk posed at the vehicle level.

In the final two stages of data analysis, researchers created and modeled their vehicle trip network, which is significantly smaller than the passenger contact network. Their network was capable of accurately identifying the majority of high-risk trips, even when real-world data uncertainty of passenger infection levels and travel patterns was introduced.

“Because of its smaller size, the metrics of the vehicle trip network are significantly easier to compute than running the entire simulation model multiple times, which gives this new network structure a significant computational advantage,” Khani says.

Using this approach would make it easier to identify transit system hot spots that should be closely monitored and potentially targeted for outbreak control in real time. “The vehicle trips identified by the model to be at highest risk would be optimal locations to implement vehicle surveillance,” Khani says. “Identifying the critical spreading components of the transit system can aid public health authorities in deploying surveillance resources in the most strategic and cost-effective way in order to mitigate outbreaks.”
Work-zone intrusions—in which vehicles breach the boundaries of roadway construction or maintenance operations—are a serious safety concern. From 2005 to 2010, 733 road workers were killed in work zones in the United States, with about half struck by motorists, according to the Federal Highway Administration. Motorists themselves are also injured or killed by intrusion crashes.

To address this safety risk, it’s critical to understand what contributes to work-zone intrusions. Yet little is known because the methods and standards for capturing data around these events are not well established.

To fill this gap, researchers with the U of M’s HumanFIRST Laboratory created a system for road crew workers to report work-zone intrusions. The research was sponsored by the Minnesota Department of Transportation (MnDOT) and the Minnesota Local Road Research Board.

The data collected by the system could be used to examine risk factors, provide feedback to workers and MnDOT, and provide an empirical basis for future policy recommendations to the state.

HumanFIRST research associate Curtis Craig says that in aiming to make the system comprehensive yet efficient and user friendly, the researchers needed to first learn about the work zone crews—what they knew, the context of their work, and how they carried it out. “And we wanted to make sure we were testing [the system] in ways that reflect how they would use it in the real world,” Craig says.

The researchers interviewed workers across Minnesota in both urban and rural settings. They found that workers understood an intrusion as a vehicle entering the area cordoned off by cones, but they felt it was practical to report an intrusion only when there was an actual increased risk to the workers onsite. “Whenever there were high risks, they were more likely to want to report it,” Craig says.

During testing of the initial design, researchers asked potential users to input either a researcher-generated intrusion scenario or an actual one from their experience—“and they all had experiences that they were scared by or that were very memorable to them,” Craig says.

Workers and supervisors were asked to “think aloud” as they interacted with the interface and were timed as they completed the reports. “We wanted to make sure it wasn’t taking too much time out of their day. And we wanted to get a feeling for how usable the interface was,” Craig says.

The second phase of testing showed that workers struggled with whether they would use the report to record minor intrusions they personally didn’t feel at risk for, Craig says. “Like a car coming in to and out of the work zone and knocking over a few cones. They could just go put the cones back up and get on with their workday. So that was an ongoing tension between what we wanted, which was to get as much data as possible, and what they felt they needed to provide,” he says.

As a result, the researchers revised the earlier reporting logic by splitting it into an immediate “minor” report and a more comprehensive “major” report for higher-risk incidents. Users also tested different modes of the interface with a laptop, a tablet, and a paper form.

Work crew supervisors noted that the final version of the system should provide a clear explanation and rationale, which would help them motivate their crews to reliably report intrusions, Craig says. The success of the reporting system will depend not only on workers using it, he adds, but on a sustained dialogue between the users and the administrators of the system, adding that this engagement will help users feel “they’re in the process of improving safety culture.”

According to Craig, MnDOT staff are currently reviewing ways in which the intrusion reporting system could be integrated into the agency’s infrastructure.
Public Affairs and the project’s principal investigator. “This approach very often leads to better outcomes than non-participative decisions.”

Narváez collaborated with Professor Kathryn Quick, also with the Humphrey School, for the project. The research team collected and analyzed data about the general climate of stakeholder knowledge and attitudes toward road financing. Data were collected through media analysis, case studies, interviews, and surveys of county government leaders.

Survey responses indicated that the public generally agrees on the importance of well-maintained local roads but lacks an understanding of funding and financing mechanisms. “There is limited public engagement on these issues despite the use of a variety of outreach methods, and public attendance at hearings is often motivated by opposition to a project rather than a desire to learn about it,” Narváez says.

The researchers also examined public engagement efforts in four local jurisdictions: Chanhassen, Brooklyn Park, Mille Lacs County, and Beltrami County. The researchers collaborated with public works leaders from these jurisdictions on the design, implementation, and evaluation of methods used to engage stakeholders about local road system needs. Each case study reviewed the jurisdiction’s transportation system, outreach methods used to engage the public, policy outcomes, and relevant features of the area.

Based on their analysis of the survey responses and case studies, the research team recommends a number of actions:

- Organize community dialogue based on high-quality information, impartial analysis, and thoughtful explanations of policy options.
- Use multiple communication channels for targeted outreach. Traditional methods such as newspaper announcements are no longer sufficient; new approaches such as geotargeted communications, social media, and smartphone-compatible messaging formats are needed.
- Build resources to support stakeholder participation, including accessible information (e.g., infographics) and staff capacity to conduct outreach and communications.
- Employ an inclusive process and thoughtful, timely responsiveness from public managers.

“This research was successful in building public engagement to help smaller county agencies like ours work through a project,” says Bruce Hasbargen, county engineer in Beltrami County. “It’s great to be able to share this success with others.”

The project was sponsored by the Minnesota Local Road Research Board and MnDOT.

Case study: Brooklyn Park

**Policy issue.** City staff were interested in introducing a citywide franchise tax to provide a consistent funding stream and remove the burden of large, one-time assessments on adjacent property owners for individual road projects.

**Public process.** Facilitated small-group meetings were held in the most affected neighborhoods and in City Hall, incorporating Q&A and small-group dialogues, involving 120 people. There were several discussions with the city council and direct outreach explaining the recommendation for a franchise fee.

**Outcome.** The franchise fee was passed and implemented. Residents’ confidence in and acceptance of the fee option increased substantially through the community dialogue process, as evidenced by the researchers’ pre- and post-surveys.
This hybrid would require transit users to walk farther. In a new study, researchers at the Humphrey School of Public Affairs led by Professor Jason Cao studied how far park-and-ride users are willing to walk, which factors influence that willingness, and which factors are the most important to park-and-ride users’ decision to walk.

“Very little research has been conducted on how far park-and-ride lots can be located away from transitways while maximizing ridership and revenue—the ‘tolerance distance’ for park-and-ride users,” Cao explains. “In fact, no previous studies have explored how walking tolerance varies by the design of walking paths between park-and-ride lots and transit stations.”

Data for this study were collected using web-based surveys of park-and-ride users from lots serving a variety of transit modes and locations throughout the Twin Cities region. Respondents were asked how far they walked to a station; for the analysis, the minimum was set at two blocks and the maximum at five. Sections gathered information about respondents’ last park-and-ride trip, attitudes with respect to their daily travel habits, their behaviors if there were no park-and-ride stations, and preferred pedestrian environment.

The pedestrian environment portion of the survey further explored trade-offs among walking distance, intersection safety, pedestrian infrastructure, and building appearance. Respondents were asked to imagine walking through a shopping area from a park-and-ride lot in order to reach their bus stop or train station and presented with four scenarios. In each scenario, respondents were asked to consider three images and choose the one they would feel most comfortable walking through to reach their transit station or stop.

The surveys found that the average walking distance for all respondents was three city blocks. “Nearly 39 percent chose to walk two blocks, while at the other extreme, only 11 percent chose to walk five blocks,” Cao says.

The results also indicate that walking distance is much more important than intersection safety, pedestrian infrastructure, or building appearance in affecting park-and-riders’ choice. “However, if all three of these characteristics are adequate, it seems to offset distance, and park-and-ride users are willing to walk 1.8 blocks farther than they currently do,” he says.

Deeper analysis of the pedestrian trade-offs found that when determining how far they are willing to walk, park-and-riders value snow clearance, street lighting, and intersection safety. “In general, the quality of the sidewalk network connecting transit stops and park-and-ride facilities is the most important, followed by safety and security attributes associated with the walking environment,” Cao says. “The aesthetic quality seems to be the least important. Reaching the destination is the single most important goal.”

Jan Lucke, planning division director with the Washington County Public Works Department, says the research is critical to station area planning efforts under way for the Gold Line. “It will be instrumental to planners working to find the balance between development and walking distance to achieve the highest and best use for land adjacent to Gold Line stations,” she says.

The study was sponsored by MnDOT as part of the Transitway Impacts Research Program.
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