E-commerce is booming as consumers increasingly shop online for convenience, price, and availability. New trends and emerging technologies are driving consumer expectations for shortened, lower-cost, more flexible delivery options. But what do those expectations mean for the freight industry? What challenges does the industry face in meeting the demands of the new on-demand economy?

Participants at the annual Freight and Logistics Symposium in December focused on finding answers to these questions as they explored freight’s integral role in the on-demand revolution.
Given the many benefits of parks, there’s growing interest in whether these green spaces are distributed equitably in urban areas. When researchers study park accessibility, they typically assume that people will use active modes of transportation (biking and walking) to reach their destinations. Few studies have considered automobile and transit accessibility.

A new analysis from the U of M helps fill this gap. It applies a comprehensive measure of park accessibility to determine the differences across space and population groups for Minneapolis and Saint Paul neighborhoods. Kristin Carlson and Jacqueline Nowak conducted the assessment last year as part of their graduate coursework for Professor Jason Cao of the Humphrey School of Public Affairs.

“The main goal of our work was to determine whether areas with higher median household income would have greater park accessibility by automobile than their counterparts. ‘The difference may be due to the transportation links serving these populations,’ Carlson says. ‘These neighborhoods, which have lower incomes, are closer to freeways, and easy freeway access means faster paths to parks. This is advantageous for some types of park trips, but it may not be reasonable to expect residents to drive 20 minutes to a park, even if they have access to a vehicle.’”

The team also looked at the additional number of parks residents could reach in 10 minutes when using transit compared with walking. “We found disparities,” Nowak says. “Transit improved park accessibility and reduced the equity gap over walking alone, but only to a limited extent. Pedestrian park access for lower socioeconomic groups is highest at the greatest time threshold (30 minutes). In other words, these groups tend to live further from parks.”

The Minneapolis Park and Recreation Board has invited the researchers to present their findings. “Better understanding of how people access regional parks, both in terms of transportation mode and their actual ability to do so, will provide critical data as we implement park improvements with a lens on racial and economic equity,” says Adam Arvidson, director of strategic planning with the board. “This is information we do not currently have and would not be able to produce on our own.”

Nowak is a graduate student pursuing dual master’s degrees in civil engineering and urban and regional planning. Carlson completed her master’s degree in civil engineering in September and now is a researcher with the Accessibility Observatory (access.umn.edu).
Snow fences improve roadway safety and reduce the need for plowing and deicing. A Minnesota Department of Transportation (MnDOT) program offers landowners compensation for snow fences, including $1,000 or more for leaving corn rows standing at the edges of fields. However, there has been limited adoption of the program by landowners.

To increase participation, MnDOT turned to the U of M’s Center for Integrated Natural Resource and Agricultural Management (CINRAM) and U of M Extension to develop and test a snow-fence outreach program. The research team piloted it in one MnDOT district, then worked with MnDOT to prepare an outreach plan for remaining district offices.

“If we can implement our blowing-snow-control program more consistently, we can help improve the mobility of the public, reduce crash severities, and reduce operational costs,” says Dan Gullickson, Snow Control Program administrative coordinator with MnDOT’s Office of Environmental Stewardship.

To launch the project, researchers designed and conducted a survey of all 200 MnDOT District 8 staff. Results identified two relevant types of district personnel: maintenance staff involved in plowing and road care, and program delivery staff who design roadways and may be involved in acquiring land for snow fences. “We found that maintenance crews interact more with landowners than do program delivery staff,” says CINRAM director Dean Current, the principal investigator.

Using these findings, researchers developed separate training programs for each group, then trained District 8 staff in May 2016. In January 2017, the team surveyed trainees to evaluate the training and adjust it accordingly. “The second survey showed marked improvement in staff knowledge of the blowing-snow-control program and willingness to promote the program,” Current says.

Respondents also suggested potential improvements to the blowing-snow-control program. These included more program champions, outreach in spring and summer via community and farmer gatherings and local and state fairs, and clearer understanding of how program promotion fits within job responsibilities.

The training has already led to significant impacts in the field. Landowner participation in the district’s standing-corn-row program grew from 4 sites to 15 in the year after training, due mostly to maintenance staff. “We saw a 300 percent increase in the number of standing corn rows,” Current says.

One conclusion from the project, he notes, is that certain maintenance workers were very effective in promoting adoption of snow-control measures while others were not. “Identifying, supporting, and incentivizing individuals who have an interest and ability to promote snow-control measures will be important in the future success of the program.”

Other portions of the study analyzed successful landowner outreach programs around the country, assessed the market and non-market value of snow fences, and gauged interest in harvesting products from living snow fences.

The research team also included Gary Wyatt and Diomy Zamora of Agroforestry Extension and Karlyn Eckman of the Department of Forest Resources.

MnDOT has identified about 3,700 SITES on state and federal roads FOR SNOW FENCES.
Roadway overtopping—when floodwaters flow unimpeded across roads—can be dangerous and costly. In a recent project, U of M researchers studied erosion, flow, and shear stress to find new ways to protect roadways from this major safety concern.

“This project was a combination of basic and applied science, and is a great example of the University and MnDOT working together successfully to solve problems unique to our geography and climate,” says Jeff Marr, associate director of engineering and facilities with the U’s St. Anthony Falls Laboratory (SAFL). The project was funded by the Minnesota Local Road Research Board and the Minnesota Department of Transportation (MnDOT).

SAFL researchers focused their analysis on the Red River watershed in northwestern Minnesota; roads in the area are prone to flooding and overtopping. Downstream scour and erosion of roadway embankments can result in breach or washout of the entire roadway. “Frequent flood events in recent years reinforce the need to protect roadways where flooding is likely to occur,” Marr says.

Raising the roadway to prevent overtopping is not a feasible solution, he explains, as flood plain law does not allow moving the problem elsewhere by backing up the water. The most cost-effective option is to allow floodwaters to overtop roadways and to try to protect their embankments from scour. Developing cost-effective scour-prevention measures could greatly reduce the cost of repairs, as well as the time required to reopen the roadway after a flood event.

The goal of this project was to investigate the effectiveness of slope protection techniques to shield overtopped roadways and their downstream embankments from scour and erosion. A further goal was to use cost-effective methods that could be installed by local agencies instead of contractors, Marr says.

For the study, the research team developed a field-based program to collect data on the hydraulics associated with full-scale overtopping events. Researchers recorded flood stage at several locations near the Red River during overtopping events and evaluated the failure modes under natural conditions. Annual field monitoring occurred from 2013 through 2016.

Next, the research team conducted a series of experiments at SAFL to study the hydraulic and erosional processes associated with overtopping. With bare soil used as a control, three erosion protection techniques were investigated: geogrid over existing vegetation (armored sod), turf reinforcement mat, and flexible concrete geogrid mat. All three encourage vegetation to grow through a mat, helping to stabilize the soil and protect the embankment from scour and erosion.

The researchers were able to draw some conclusions from the laboratory experiments, including:

- Bare soil with no vegetative cover (the control) is highly susceptible to erosion and is the worst-case scenario. New installations should have established vegetation before the first overtopping event is expected.
- All three mitigation techniques reduced erosion, but the flexible concrete geogrid mat provided the best protection.

“This project developed a fairly complete matrix of useful erosion-protection measures that our own staff can implement—techniques that are less elaborate and more cost-effective than hiring contractors,” says J.T. Anderson, assistant district engineer with MnDOT District 2.
As culverts get longer to accommodate wider embankments, light levels within them are reduced—raising concerns that darkness may deter fish movement through a road-stream crossing. A new study by U of M researchers, however, was unable to demonstrate this effect with the endangered “Topeka Shiner.”

The need for this project first emerged in 2013, when MnDOT completed a culvert replacement project on U.S. Highway 75 over Poplar Creek. This southwestern Minnesota waterway serves as habitat to the federally endangered Topeka Shiner. Because the new culvert was significantly longer than the previous structure, the U.S. Fish and Wildlife Service required MnDOT to monitor the movement of the Topeka Shiner to ensure the new culvert did not inhibit fish passage.

“While previous studies identified ways that culverts can impede fish swimming, such as water depth and velocity, less obvious culvert attributes such as darkness had not been closely investigated,” says Jessica Kozarek, research associate at the U of M’s St. Anthony Falls Laboratory. “To ensure fish passage for the Poplar Creek installation and future culvert replacements, we saw the need to evaluate the impact of long culverts with low light levels on the movement of the Topeka Shiner and associated species.”

Scott Morgan, principal hydraulics engineer with MnDOT District 7 and the technical liaison for the MnDOT-funded study, says MnDOT has been extending culverts for safety reasons. “Wider embankments allow us to construct safe roadways without guardrail—and hitting guardrail is more hazardous for an errant vehicle than a driveable slope. Guardrail also conceals animals and catches snow.”

The study involved both a fish mark-and-recapture monitoring campaign and a set of laboratory experiments. In the field, researchers began by collecting light-level data in three long-box culverts. Next, they caught fish both upstream and downstream from culverts and control sections, marked them, and resampled them to see where the fish moved. They also determined whether the fish passed through culverts in similar numbers as through control sections of the same stream.

In the laboratory, researchers measured Topeka Shiner preference for light or dark channels using a 25-foot-long flume. Experiments allowed researchers to isolate the effect of light levels by running all experiments at the same depth and velocity. Fish could choose to swim along light or shaded lanes in this experiment.

Based on the field results, researchers concluded that light levels in large box culverts did not appear to deter movement of southwestern Minnesota fish communities. “The longest and darkest culvert did exhibit a difference in movement between the culvert and the control, but this variation could not be attributed to light levels alone. Fish—including Topeka Shiners—were able to pass through all three culverts,” Kozarek says.

This finding was supported by the laboratory experiments, she adds. Fish that could select either a shaded or lighted channel showed no avoidance of the shaded channel regardless of shading level.

“MnDOT expects that these findings—which showed no effect on the Topeka Shiner—will lower the cost and reduce the delay of box culvert replacement projects by eliminating the need for a fish passage study for each one,” Morgan says.

This is one of the first studies that has set out to evaluate fish behavior near dark culverts, Kozarek notes. More research is needed to quantify avoidance behaviors in darker culverts (smaller diameter) or for other species, especially in conjunction with other potential culvert barriers such as insufficient depth, excess velocity, or lack of appropriate habitat.
“Today we don’t just shop online. We buy online, and goods are delivered to their point of consumption—not to a point of purchase,” said David Wangler, president of Trimble Transportation Enterprise and the symposium’s keynote speaker.

In his presentation, Wangler explained how technology is leading a major and exponentially growing shift of consumer expectations. As a result, more pressure is put on carriers and logistics service providers to increase their own pace of change, adapt to new distribution and delivery models, and provide higher service levels that typically underutilize capacity.

But technology can also help providers respond to rising consumer expectations while facing the pressures of reducing cost and improving service. Examples include employing advanced routing and scheduling to help carriers as they establish local delivery operations and using predictive analytics to understand potential maintenance issues before vehicles break down.

Following the keynote, a panel presentation provided details about the new CN Duluth Intermodal Terminal, the first international intermodal container ramp in the Twin Ports of Duluth, Minnesota, and Superior, Wisconsin. Duluth Cargo Connect operates the ramp at the Clure Public Marine Terminal, which is served by Canadian National Railway Company (CN). With the new service, shippers gain the advantage of reaching the Pacific, Atlantic, and Gulf gateways from one facility.

The terminal offers businesses access to international markets, greater efficiencies, and reduced supply-chain costs and transit times. Moreover, it supports the growth and stability of the five-state area’s manufacturing, agricultural, and forest products markets by offering cost-effective logistics solutions and an opportunity to expand into markets they couldn’t otherwise reach.

The terminal also provides a variety of value-added services, including more than 40 acres of secure outdoor space for cargo storage, staging, and assembly; container stuffing and de-stuffing; and storage, warehousing, and distribution services.

“When you place an intermodal terminal in the middle of all those services, and you don’t have to move that container onto a public street, you have really hit a home run,” said Jonathan Lamb, president of Lake Superior Warehousing. “Now you are in a position to make the supply chain as seamless as possible for that customer.”

The symposium closed with a dialogue about preserving the Twin Cities metro highway system and prioritizing investments.

Keeping the system in good working order and operating safely are the highest priorities, said Brian Isaacson, director of metro planning, program management, and transit at the Minnesota Department of Transportation (MnDOT). But with most funding being used to preserve current assets, not much is available for mobility projects, he added.

In addition, the area’s projected growth, combined with funding gaps, almost ensures chronic congestion in the metro. “Consumers and freight are going to have a much harder time moving around in 2040 under the current scenario,” said Nick Thompson, transportation director for the Metropolitan Council.

However, a hierarchy of regional mobility investments supports the goal of maximizing funding to combat congestion. The hierarchy includes four layers: traffic management technologies, spot mobility improvements throughout the system, MnPASS, and strategic capacity.

The freight industry also has an opportunity to share its expertise as planners gather data to make decisions with limited resources, Thompson said. “If industry is saying, ‘There are these fundamental changes that you are not reflecting in your planning process,’ we need to know that. We rely on industry to tell us that.”

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.
TOD may not share a city’s or regional planning body’s goals for transit-oriented growth patterns and built forms.”

This fundamental difference in perspectives demands creativity from planners and regional policymakers. In a new study, Guthrie and Associate Professor Yingling Fan explore how the public sector can best overcome these obstacles and encourage TOD at a regional scale. “Previous research has focused primarily on the impacts and benefits of TOD, not on how to accomplish it in the real world,” Guthrie says. “Our project helps fill that need.”

The researchers began by conducting in-depth interviews with staff of TOD programs around the nation, as well as of larger transit agencies and organizations responsible for TOD. Then, they assessed program goals, structures, and outcomes; analyzed interview transcripts for recurring concepts and shared understandings; and created typologies of the TOD programs. Additionally, a set of case studies was developed to add context from regions with more experience in TOD creation.

Several common themes emerged from the interview analysis. First, the researchers found that changing lifestyle preferences, particularly among millennials, present new opportunities for TOD. They also learned that well-established mechanisms are important for regional coordination, and that clear goals are needed for TOD programs.

In addition, transit service type and quality are critical to TOD prospects and success. “Fixed guideway transit in general—and rail transit in particular—is seen as providing the strongest opportunity for TOD,” Guthrie says.

Finally, they discovered affordable housing could be a natural ally of TOD under the right circumstances. “For example,” he says, “in a station area not yet home to rapid growth, quality affordable housing can represent a publicly funded catalytic development—it guarantees occupancy and creates a functional transit-oriented community through high transit use rates.”

The greatest overarching conclusion? There are no silver bullets—no single strategy or simple set of strategies will make system-level TOD easy or quick to achieve. “If there is a single conclusion to be drawn from this research, it is the importance of persistence,” Fan says. “Regions with high degrees of success in system-wide TOD implementation have been at it for decades. They also have consistently funded TOD efforts, whether in terms of planning grants, supportive public infrastructure provision, or direct loan and grant financing.”

Beyond this, the researchers propose three key recommendations:

- Focus on public investments that attract private dollars.
- Maximize the effectiveness of constrained public resources by timing investments around new transit expansions.
- Build durable structures for interagency and interjurisdictional coordination.

“The recommendations are useful guidance to help the public sector be the most effective in achieving TOD goals,” says Lucy Galbraith, TOD director at Metro Transit. “Governments working collaboratively and making strategic investments in infrastructure within the region will, given enough demand, allow a region to grow great neighborhoods supported by transit.”

The project was funded by the Transitway Impacts Research Program.

DENVER created a regional TOD LOAN FUND initially capitalized with public funds.
Transit-oriented development requires persistence, coordination, and strategy.