Autonomous vehicles (AVs) may trigger wide-ranging changes in public transit and parking systems in coming years. As part of a recent project, U of M researchers held in-depth discussions with planning practitioners from the Minneapolis–Saint Paul metropolitan area to learn what they think the biggest challenges and opportunities will be. While opinions differed about the specifics, all the participants agreed that AVs will have significant impacts for the region and believe corresponding planning policies need to be developed.

RoadCoach app could help older drivers stay safe

An innovative driving support app designed by U of M researchers may be an effective tool to improve attention and reduce certain types of risky driving behaviors in older drivers, according to results of a new two-state field operational test.

“We wanted to investigate the impact of our RoadCoach driving support app on risky driving behaviors among older adults, because this group currently has the highest fatality rate per 100 million miles driven, and we expect a significant increase in the number of older drivers on the

Twin Cities planners predict transit, parking impacts of autonomous vehicles

Autonomous vehicles (AVs) may trigger wide-ranging changes in public transit and parking systems in coming years. As part of a recent project, U of M researchers held in-depth discussions with planning practitioners from the Minneapolis–Saint Paul metropolitan area to learn what they think the biggest challenges and opportunities will be. While opinions differed about the specifics, all the participants agreed that AVs will have significant impacts for the region and believe corresponding planning policies need to be developed.
Bluetooth technology may soon alert drivers to highway work zones

For several years, U of M researchers have been teaming up on an interdisciplinary effort to develop a Bluetooth-based system that can be placed in work zones to deliver warning messages to drivers. In a new project, field tests show that the system is capable of providing dynamic, location-based in-vehicle messages for motorists approaching a work zone.

“Providing drivers with tailored in-vehicle messages before they arrive at highway work zones has the potential to save lives and prevent many injuries,” says Chen-Fu Liao, a senior research associate with the Department of Mechanical Engineering. “In recent years, the challenges of work-zone safety and mobility have been exacerbated by the growing issue of distracted driving. Our research uses in-vehicle spoken messages to calibrate drivers’ understanding of the work zone and reduce risky behavior associated with distraction.”

The latest research takes the previously designed prototype system—which uses inexpensive Bluetooth tags placed in work zones to deliver non-distracting audio alert messages through a smartphone or vehicle infotainment system—and tests it in real-world situations.

The objective was to refine the previously developed in-vehicle message system to incorporate a sustainable power source design, implement results from earlier human factors studies to provide work-zone information to motorists, and evaluate the system’s performance. “We believe this approach could provide an alternative to automatic speed enforcement for changing driver behavior in work zones by providing dynamic and timely work zone information such as awareness of workers on-site, changing traffic conditions, or hazards in the environment,” Liao says.

To field test the work-zone warning system, researchers deployed several Bluetooth tags at three work zones in the Twin Cities metropolitan area. With the previously developed app, called WorkzoneAlert, running in the background on a smartphone, the research team drove a sedan and a minivan through each of the three work zones at different times of the day to evaluate the system’s performance under different traffic conditions. Bluetooth detection rate, range, and available reaction time were used as performance measures for system evaluation, and vehicle location and timing of each triggered message were logged for data analysis.

Results of the field test show that the WorkzoneAlert app is able to reliably detect the Bluetooth tag placed an average of 127 meters away on traffic signs or portable radar speed signs. In addition, researchers found the system was able to successfully announce the corresponding message associated with each Bluetooth beacon. At a posted work-zone speed limit of 35 to 45 mph, the system allowed five to nine seconds of reaction time prior to the motorists approaching the location where the beacons were installed.

In the future, researchers expect to use the results from this study to prepare for a field operational test to continue evaluating the system.

The project was sponsored by the Roadway Safety Institute.
Annual nationwide data from the Accessibility Observatory at the University of Minnesota measuring access to jobs by transit are now available.

The annual analysis, part of the Access Across America national pooled-fund study that began in 2013, ranks 49 of the 50 largest (by population) metropolitan areas in the United States for connecting workers with jobs via transit.

“The data have a range of uses and implications, especially when applied on a state and local level,” says Andrew Owen, director of the Observatory.

The new report—Access Across America: Transit 2018—presents detailed accessibility values for each of the 49 metropolitan areas, as well as detailed block-level color maps that illustrate the spatial patterns of accessibility within each area.

The rankings focus on accessibility, a measure that examines both land use and transportation systems. Accessibility measures how many destinations, such as jobs, can be reached in a given time.

Rankings of the top 10 metro areas for job accessibility by transit in 2018 changed only slightly from the previous year, with New York, San Francisco, and Chicago, respectively, again topping the list. One exception is the Washington, DC, metro area, which dropped to #6 from #4, likely due to the unavailability of census data on federal workers.

The Minneapolis–Saint Paul area ranked 13th, unchanged from 2017. The study reports that the average worker in the Minneapolis metro can reach 18,034 jobs within 30 minutes traveling by transit. Total employment in the metro area is 1.8 million jobs.

The report presents the fourth annual national evaluation. “In constantly evolving systems like these, it is critical to monitor changes over time,” Owen says. “This report continues the process of monitoring how accessibility in these metropolitan areas evolves in response to transportation investments and land-use decisions.”

Key factors affecting the rankings for any metro area include the number of jobs available and where they are located, the availability of transit service, and population size, density, and location.

“Better coordination of transit service with the location of jobs and housing will improve job accessibility by transit,” Owen says.

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 Accessibility Observatory at the University of Minnesota is the nation's leading resource for the research and application of accessibility-based transportation system evaluation. The Observatory is a program of CTS.

The Transit 2018 report and other Access Across America research reports for auto, transit, and biking are available at access.umn.edu.
The research team, led by Assistant Professor Jason Cao of the Humphrey School of Public Affairs, began with a literature review of the general effects of AVs as well as those related to transit and parking.

They found that the expected influences of AVs on transit are complicated: some researchers believe AVs would substantially decrease transit ridership, but others say AVs would attract riders by solving the first-mile, last-mile issue. Regarding parking, some researchers predict major decreases in demand—some even contend that the development of shared AVs will eliminate the need for parking entirely.

Based on these results, the team then organized two focus groups with representatives of different agencies and sub-regions of the metro area.

In the transit focus group, “almost all the participants agreed that AVs will decrease the cost and increase the efficiency of operating public transit, especially in suburban areas,” Cao says. Without drivers, service hours could be expanded.

Participants acknowledged the potential of AVs to serve people with disabilities but noted that technology cannot easily replace certain roles of transit drivers. “Merely having the AV technology is far less than enough to provide a proper ADA service due to the lack of human caregiving,” Cao says.

Other participants, however, pointed out that AVs could free drivers from their current driving tasks and allow them to focus on escorting and caregiving, which might be more beneficial to passengers.

Participants also noted how drivers provide a perception of safety and sense of community that cannot be offered easily by driverless transit. “So,” Cao says, “a tradeoff needs to be made between reducing numbers of drivers to decrease costs and maintaining the benefits of having human drivers.”

The most pressing transit issue identified by the transit focus group is the funding structure of transit, especially in Minnesota. If shared AVs become prevalent, the number of vehicles sold—and sales taxes—may decline, Cao says.

The parking focus group members differed on whether the demand for parking will decrease or increase. Most participants agreed that future demand depends on whether vehicles are owned or shared. If a vehicle is owned, it might be sent home or to a different location by its owner and return for pickups when needed. If a vehicle is shared, it would circulate among different users and only appear for pickups and drop-offs.

To cope with the potential increase in congestion, the focus group raised two possible solutions. The first one is imposing a congestion pricing mechanism that charges people when they send an empty car on the road. The other solution is to build peripheral parking near popular destinations but on lower-priced land.

Many participants of both groups said the perception of safety is essential and doubted whether people would be willing to give up control of the vehicle, Cao adds.

Other members of the research team were graduate student Xinyi Wu and co-investigator Frank Douma, director of the State and Local Policy Program. The project was funded by CTS.

New online course on professional ethics

Did you miss our in-person training on professional ethics last fall? Enroll in our new online version of the course and meet your ethics-related PDH requirements before June 30!

During the course, you’ll review 10 commonly encountered ethical dilemmas and their appropriate solutions. Cost is $65. For more information or to register, visit cts.umn.edu/education/ethicsonline.
roads as the Baby Boomer generation ages,” says Nichole Morris, director of the U of M’s HumanFIRST Laboratory and the project’s principal investigator. “This disproportionate fatality risk is linked to several factors and may manifest through measurable driving behaviors such as hard braking or failure to respond to speed limits. Our hope is that these issues could be partially mitigated by effective coaching in real time with an in-vehicle support system.”

Originally, the RoadCoach app was developed to improve safe driving behavior in teen drivers. HumanFIRST researchers then modified the app to support all drivers regardless of age; it was found to have high usability and user acceptance among older drivers through a series of focus groups, usability tests, and a controlled field test.

In a new study funded by the Roadway Safety Institute, researchers set out to investigate the impact of RoadCoach feedback on risky driving behaviors among older adults. The team also wanted to evaluate user acceptance of this technology over an extended period and measure the presence of short-term changes in driving behavior once feedback was removed. To do so, they conducted a 12-week field operational test that included a group of 28 drivers aged 65 and older in both Kansas and Minnesota.

The test period included three weeks of baseline driving behavior, six weeks of driving behavior with RoadCoach feedback, and three weeks of follow-up with no RoadCoach feedback. During this time, the app was loaded onto participants’ mobile phones, connected to their vehicles’ Bluetooth speakers, and set to record driving metrics such as hard braking, excessive accelerations, aggressive turning, stop-sign violations, speed warnings, speed violations, and distance traveled.

Results of the study show that RoadCoach had a largely positive effect on driving performance while the feedback was active. “We saw that risky behaviors such as speed warnings, speed violations, hard braking, and stop-sign violations showed either significant improvement or a trend toward improvement from the baseline to the feedback phase,” Morris says. “There also appeared to be some training effect with the RoadCoach app—we found that hard braking and stop-sign violations showed sustained improved performance in the final no-feedback phase.”

In addition, the app had high satisfaction and trust among users, with drivers reporting that the app helped improve their attention and focus on the task of driving.

“We’ve seen that some drivers are anxious about the potential loss of their driving independence and are open to the use of technology to help retain it,” Morris says. “In the future, we hope to examine the extent to which in-vehicle coaching could help prolong or even improve safe driving among older drivers.”

Reports summarize work of Transportation Policy and Economic Competitiveness Program

Two new reports summarize research and other activities of the Transportation Policy and Economic Competitiveness (TPEC) Program.

The 2017–2019 TPEC Progress Report shares highlights of projects in TPEC’s three research focus areas: finance, industry clusters and freight infrastructure, and technology. The report also includes TPEC’s engagement highlights, such as stakeholder meetings, presentations, and publications.

The second report is a summary of the TPEC Medical Industry Cluster Forum, which was held November 8, 2019, in Minneapolis. The forum brought together multisector leaders for a discussion of the importance of the medical industry cluster to Minnesota’s economy and its implications for infrastructure use and economic development.

Both reports are on the TPEC website: tpec.umn.edu/publications.
The developers of the Daynamica™ app received this year’s Robert C. Johns Research Partnership Award. A unique data-collection technology, Daynamica is a research-grade smartphone application that collects and processes activity and travel behavior data with minimal user burden.

By collecting rich data, the technology is capable of informing transportation planning and fostering more sustainable and healthier communities. It has been deployed in research studies involving more than 1,000 subjects, resulting in more than 120,000 person-hours of data. The studies range from travel behavior research in urban planning to physical activity and emotional well-being research in public health.

Daynamica is based on technology developed by a team of faculty and students at the University of Minnesota led by Professor Yingling Fan of the Humphrey School of Public Affairs. The technology has been used by researchers at Virginia Tech, Princeton University, Texas A&M University, Georgia Tech, Ohio State University, and seven Chinese universities.

Fan and her co-investigators—Julian Wolfson (School of Public Health), Gediminas Adomavicius (Carlson School of Management), and Chen-Fu Liao (Mechanical Engineering)—have also integrated Daynamica into teaching. This offers opportunities for students to use the technology and gives them exposure to cutting-edge approaches for gathering and analyzing urban data.

Daynamica-related work has generated a US patent and attracted more than $13 million in research funding, including significant contributions from the US Department of Transportation and National Science Foundation.

In January 2018, Fan and her co-investigators co-founded Daynamica, Inc., with the University of Minnesota Venture Center. Commercialized products include multiple mobile apps and the associated data analysis and visualization systems. To learn more, please see daynamica.com.

The Research Partnership Award is named in honor of former CTS director Robert Johns. The award is presented annually to a team of individuals who have collaboratively drawn on their diverse expertise to achieve significant impacts on transportation.

Team members
- University of Minnesota: Yingling Fan, Julian Wolfson, Gediminas Adomavicius, Chen-Fu Liao, Frank Douma (Humphrey School), Ying Song (Geography, Environment, and Society)
- Ohio State University: Huyen Le
- Virginia Tech: Steve Hankey
- Princeton University: Anu Ramaswami
- Texas A&M University: Chanam Lee
- Northwest University, Xi’an, China: Jing Zhu
- Shenzhen Urban Transportation Planning Center: Yuan Shao, Xiaochun Zhang
- USDOT Volpe Center: Matt Cuddy
- Metro Transit: Theresa Cain
- Minnesota Department of Transportation: Lisa Austin

Transportation summer camp scheduled for July 20–31

This summer, CTS will once again host the National Summer Transportation Institute (NSTI) for students entering grades 7–9. The free, two-week program introduces campers to transportation topics and aims to spark their interest in science, engineering, and transportation careers.

Attendees will participate in classroom and lab sessions with transportation experts, go on field trips to facilities around the Twin Cities, and participate in a group project.

Know any students who would like to attend? Applications are due March 18. Visit cts.umn.edu/summercamp for more information.
Leaders, students recognized at CTS Awards Luncheon

CTS presented the following awards at its Annual Meeting and Awards Ceremony on February 19.

Richard P. Braun Distinguished Service Award
(outstanding leadership in research and innovation)
Carol Shield, College of Science and Engineering Distinguished Professor, Department of Civil, Environmental, and Geo-Engineering

Ray L. Lappegaard Distinguished Service Award
(outstanding leadership, mentorship, and support for the profession)
Bernie Arseneau, Highways and Roads Director, HDR, and former MnDOT deputy commissioner and chief engineer

William K. Smith Distinguished Service Award
(leadership, mentorship, and education of future leaders in private-sector freight transportation)
Bruce Abbe, CEO, Abbe Communications and Management Services, and former president & CEO of the Midwest Shippers Association

Distinguished Public Leadership Award
(public leaders who have influenced innovative transportation policy directions)
Rep. Frank Hornstein, Chair, Minnesota House Transportation Finance and Policy Division

Education Awards

Matthew J. Huber Award (students in engineering, science, and technology fields)
Pengyue Wang: Doctorate, mechanical engineering; advisor: Will Northrop
Benjamin Tomhave: Master’s, civil engineering; advisor: Alireza Khani

John S. Adams Award (students in policy and planning fields)
Yunlei Qi: Doctorate, public affairs, urban planning track; advisor: Greg Lindsey
Shannon Engstrom: Master’s, urban and regional planning; advisor: Frank Douma

Richard P. Braun Scholarship (undergraduates pursuing transportation-related degrees)
Erick Sipila: Bachelor’s, industrial and systems engineering; advisor: David Orser

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