To improve safety at often-dangerous rural road intersections, U of M researchers have investigated drivers’ ability to judge traffic speed and gaps between cars at varying sight distances. Using a state-of-the-art driving simulator, the researchers showed that 1,000 feet of sight distance allows drivers to make better crossing decisions.

“We’ve known that sight distances were factors in rural intersection crashes,” says Tracey von Intersections continued on page 5
Sleep apnea treatment reduces medical insurance costs for truck drivers

A research team led by the University of Minnesota Morris found that a trucking firm that mandated treatment for its drivers with obstructive sleep apnea (OSA) saved significantly on non-OSA-program medical insurance costs.

OSA is a condition in which a person’s airway closes repeatedly while sleeping, causing the individual to partially wake up each time, though not enough to be aware of what is happening. Sufferers do not get fully restful sleep, which negatively affects many other medical conditions.

Despite evidence that untreated OSA is associated with significantly higher rates of serious preventable truck crashes, the U.S. Department of Transportation (USDOT) dropped an inquiry about requiring screening commercial vehicle operators for this disease in 2017. Part of the reason was motor carrier concern about cost.

In new research published in the medical journal Sleep, the U of M Morris-led research team addressed this concern by identifying the savings on the costs of other medical conditions that result from treating OSA.

Researchers analyzed the medical insurance claims of drivers enrolled in the study firm’s sleep apnea screening, diagnosis, and treatment program. To estimate the savings in claims for an individual driver receiving treatment, the research team used a multivariate model to compare the costs of drivers accepting treatment and those refusing it. After excluding claims related to the program itself, they found a savings of $441 per driver per month for the typical driver who accepted treatment.

To estimate the aggregate savings for 100 drivers who were diagnosed and treated, the researchers compared them to 100 “screen-positive” controls (drivers screened as likely to have OSA who had not yet been diagnosed). The cases and screen-positive controls were matched on characteristics (e.g., job tenure) that affected their likelihood of entering the study. The researchers found a savings of $153,000 for 100 drivers over 18 months. Additional savings came from increased employee retention among treated drivers.

“The individual saving of $441 per driver per month due to the effective treatment of this disease is very substantial and deserves attention from everyone who is concerned about high medical insurance costs,” says Steve Burks, a professor of economics and management and principal investigator of the Truckers & Turnover Project at the U of M Morris. “The aggregate savings for 100 drivers, along with higher retention of treated drivers, were sufficient to offset much of the cost to the study firm of operating an OSA program.”

The statistical analysis was performed at the U of M Morris, where 11 U of M Morris students and 3 faculty members were co-authors. Co-authors at Harvard Medical School and Virginia Tech Transportation Institute also contributed to the work.

This research was funded by the Roadway Safety Institute, the U of M Morris, the study firm, Harvard University, and Virginia Tech Transportation Institute.

(Reprinted from a U of M press release, Oct. 25, 2019.)
‘Aerotropolis’ model may offer key to economic growth in Twin Cities and beyond

An increasingly fast-paced and globally connected economy is changing the rules of industrial competition and business location as we know it, making major airports key nodes in global production and enterprise systems. At the luncheon presentation of the 2019 CTS Transportation Research Conference, John Kasarda described the Twin Cities’ potential to leverage the aerotropolis model and deliver competitive advantages to firms and municipalities in the region and state.

“The aerotropolis is an urban form where cities are built around airports, speedily connecting time-sensitive suppliers, manufacturers, distributors, and business people to distant customers, clients, and marketplaces,” said Kasarda, director of the Center for Air Commerce at the University of North Carolina’s Kenan-Flagler Business School and CEO of Aerotropolis Business Concepts LLC.

The new business environment at the center of the aerotropolis model is built around speed. “Economies of speed now supersede economies of scale and scope,” Kasarda added. “It’s no longer the big eating the small, but the fast eating the slow.” Factors feeding into this new fast-paced reality include the global sourcing and sales of products and services, just-in-time manufacturing and delivery, miniaturization and digitization of medical devices and smart electronics, and market turbulence and uncertainty.

The aerotropolis moves a region up the commercial and industrial value chain by recognizing that time is not just a cost, but also a currency for many business people and businesses. This is especially true in the rapidly growing medical sector, where speed is especially important for biologics, vaccines, and other highly perishable specialty medicines as well as surgical implants and other medical devices for which time-definite delivery to distant sites is critical.

According to Kasarda, the Twin Cities region currently faces four challenges in this new business environment. First, the area needs continued growth in the life sciences, medical device, and medical technology sectors as well as corporate headquarters and other high-value business services sectors. Additionally, these new economy sectors must be able to effectively compete with other metro areas in the decades ahead, and job creation goals must be met.

“Finally, development around and outward from the Minneapolis–Saint Paul International Airport must be economically efficient, attractive, and environmentally sustainable in order to present a positive first and last impression of the city while becoming an enduring magnet for new-economy workplaces and workers,” Kasarda said. “How these interwoven challenges are met will go a long way in determining the economic future of the region and the entire state.”

The Twin Cities region possesses all the ingredients needed to develop a world-class aerotropolis, Kasarda said. These include a major international airport hub between Asia and Europe, a high concentration of corporate headquarters, excellent universities and transportation research centers, aviation-oriented healthcare services and medical device companies, plans to improve multimodal airport access and regional surface transportation systems, and world-famous medical and retail tourism draws.

“The bottom line is that the fastest, best-connected firms and places will win in the decades ahead,” Kasarda said. “Minnesota and the Twin Cities are currently at an economic crossroads in which strategic planning and development initiatives will determine the direction it will go in terms of business mix, investment, growth, job creation, and overall economic prosperity—and creating a world-class Minneapolis–Saint Paul aerotropolis would provide a strong competitive advantage.”
Repairing cracked asphalt is essential for maintaining performance—it keeps water from seeping into the pavement and creating bigger problems (like potholes) in the future. Road crews use two main methods for repairing asphalt cracks: clean-and-seal and rout-and-seal. In a new study, researchers compared these two methods to determine which had the cost-benefit advantage. Survey results, construction data, and field evaluations of repair performance over two years gave rout-and-seal a slight edge over clean-and-seal.

“There had never been any research done that compared the costs and benefits of these two methods,” says Manik Barman, an assistant professor in the University of Minnesota Duluth’s Department of Civil Engineering. “As a result, transportation agencies did not have guidelines or uniform procedures for selecting the most cost-effective crack-sealing method for a specific job. We aimed to provide a solution to this problem by determining which of the two repair methods offers the better value over time.”

For most crack repairs, road crews clean the crack and apply an asphalt filler or sealant. With clean-and-seal, workers use compressed air to remove debris from the crack before applying a sealant. With rout-and-seal, a saw or router is used to grind a shallow trench over the crack; the routed reservoir is then filled with sealant.

“Some agencies favor clean-and-seal because it is less expensive, reduces the time crews are on the road, and frees more time to maintain other cracks,” says Barman. However, we knew if rout-and-seal delivered a longer-lasting repair, it might be more cost-effective than clean-and-seal in terms of life-cycle cost.”

Researchers began by reviewing literature to see how agencies around the country approach asphalt crack repair. Next, they surveyed Minnesota road agencies to see which repair method they prefer and how long repairs typically last. To determine crack sealing performance, researchers evaluated Minnesota Department of Transportation (MnDOT) construction logs of old repair sites and visited 11 new repair sites. They then revisited the new repair sites 2, 6, 8, 12, and 18 months following the repair, calculated performance levels for each repair method at each site, and gathered cost data. Finally, the research team created decision trees to provide clear guidance for transportation planners and maintenance crews.

“To help select an appropriate crack repair method, we developed two decision trees,” Barman says. “The first is detailed, and the second is simple with only three variables—crack size, traffic level, and the number of times a crack has been sealed.”

Results of the study give rout-and-seal methods a slight advantage over clean-and-seal. Analysis of old and new projects showed that at an average performance index level, rout-and-seal repairs last about four years and clean-and-seal last about three. Because the difference is slight, factors such as treatment cost, life expectancy, ease of operation, traffic level, and crew manager opinion may guide selection of sealing strategies.

“This study provided very useful information,” says Dan Knaepk, assistant county engineer with Sherburne County Public Works. “The rout-and-seal has a better cost-benefit over the life of the pavement than clean-and-seal; however, they are relatively close. Agencies will need to decide if they have the manpower or resources to perform one over the other.”

The project was funded by the Minnesota Local Road Research Board.
Bargen, county engineer for Grant County, Minnesota. “This study gave us the hard data showing how long sight distances should be to allow drivers sufficient time and space at rural thru-stop intersections.” (Thru-stop intersections are those at which a highway crosses a minor road controlled by a stop sign.)

The need for this project was pressing because four-way intersections carry inherent safety risks for drivers. From 2008 to 2012, nearly 42 percent of severe crashes occurring at Minnesota intersections resulted in serious injuries and fatalities, and crashes are often most severe at unsignalized rural intersections.

“Drivers on minor roads seeking to cross must determine when traffic gaps are sufficient to cross and can misjudge the time-to-collision,” says Nichole Morris, director of the U of M’s HumanFIRST Laboratory. “Limited visibility has been associated with drivers choosing insufficient gaps, so we wanted to determine the optimal sight distance at four-way intersections. This will maximize driver safety, reduce injuries, and save lives while potentially reducing unnecessary clearing of trees and brush at intersections.”

The driving simulator at the HumanFIRST Lab was an essential part of this study. The Realtime Technologies simulator consists of a 2013 Ford Fusion cab with realistic controls and the latest-generation simulation software and projection hardware, making it possible to generate complex environments that engage the driver’s senses to create a realistic simulated experience.

Researchers began by developing nine simulations of prototypical Minnesota rural roads that incorporated wooded areas and shoulders to examine drivers’ time-to-collision judgments for crossing. In addition, they developed a 19-mile mainline roadway with 18 minor thru-stop intersections. The simulations were then rigorously tested for validity by state, county, and research engineers familiar with rural intersections.

Next, 36 drivers were selected to participate in the simulated driving trials. For the time-to-collision trial, drivers waited at nine simulated intersections with varying sight distances and speeds of crossing vehicles and were asked to press the gas pedal when they determined it was safe to cross. For the mainline trial, participants drove the 19-mile mainline road segments and were presented with cars at minor road thru-stops with variable sight distances; the cars either stopped or intruded into the intersection. After the trials, participants reported on their perceived cognitive demand at the crossings.

Study results show that 400- and 600-foot sight distances are insufficient for drivers to make good crossing decisions. The 1,000-foot sight distance and slower speeds (55 mph) allowed drivers to judge time-to-collision more effectively and respond to cars at minor thru-stops intruding into the mainline. “This means that drivers could effectively respond to a car running a stop sign—often a catastrophic crash scenario,” Morris says.

Finally, researchers discovered that when mainline drivers noticed a thru-stop car waiting closer to the intersection, they reduced speed more than for a car stopped farther back. Therefore, moving the stop bar on minor roads closer to the intersection could both increase the sight distance for the waiting driver and slow driver speeds on the mainline—an inexpensive change with potentially significant benefits.

“Agencies could use the 1,000-foot sight distance and our other findings for guidance,” Morris says. The project was funded by the Minnesota Local Road Research Board.

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emerging digital layers of the public realm.

“You can think of information platforms in much the same way you think about cities, because at the core they are about connectivity and how things are linked together,” Webb said. “The changes we’ve seen in the last decade are really about the role that connectivity plays.”

Webb explained that there are three ways to think about connectivity. First, connectivity is a technology that changes the way we experience proximity. “Modern cities could be considered a technology because they allow us to build social and economic systems through proximity,” Webb said. “Today, new technologies are lessening our dependence on spatial proximity.”

Connectivity can also be a business that enables us to do more—such as railroads, airlines, ride-sharing services, and even Amazon.

Businesses that operate infrastructure raise unique questions that point to the final way to think about connectivity: as a public good. These questions include: “How do we decide who operates the infrastructure?” and “How do we ensure it serves the public good?”

“As we build something transformative, it’s important to consider the ways we can make it work for the public purpose,” Webb said. “We saw that in the past with railroads and then roads, but today it is less about the actual physical infrastructure and more about the information layers on top of that. For example, ride-sharing services such as Uber are building data infrastructure on top of the road network.”

The good news, according to Webb, is that the challenges we face today in ensuring connectivity serves the public good aren’t new: long before the emergence of digital communication technologies, cities faced questions about how to regulate private-sector innovation in providing public services.

“The risk is that we miss the forest for the trees by treating this challenge as a technical problem or a mobility technology problem and failing to address it as the structural problem it is by using the already-existing structural interventions we have used in the past,” Webb added.

These existing leverage points fall into three main categories. Physical infrastructure interventions include capital investment, street and curb regulations, and pricing and subsidies for infrastructure use. People, vehicle, and goods interventions include driver and vehicle licensing and operating subsidies for services. Market and business interventions include pricing and utility regulations, labor and consumer protections, antitrust measures, and public investments. Of these three tools, Webb believes business and market interventions using proven measures such as innovative pricing regulation, dynamic infrastructure regulation, innovation in governance, labor protection, and privacy regulations are the most promising but underutilized tools for addressing these new and emerging challenges.

Using market and business interventions as a leverage point connects with the objective of SharedStreets—to preserve privacy while empowering cities, companies, and citizens with the digital tools and data needed to build future cities. At its core, SharedStreets is working to build an open-access modern map that is at the heart of emerging forms of urban connectivity and coordination—a data infrastructure that is part discovery infrastructure (like yellow pages), part information coordination infrastructure (social media), and part distribution infrastructure (the marketplace).

“We need to create new kinds of public utilities and define a right to collective agency and action through shared information,” Webb said. “We need to make bold public investments that commodify this core infrastructure to ensure it remains as a building block for others—preventing capture so that everyone can participate.”

University of Minnesota reception at TRB

The University of Minnesota is hosting a reception for friends and alumni during the Transportation Research Board 99th Annual Meeting in Washington, DC. The reception will be held at the Anthem Restaurant in the Marriott Marquis on Sunday, January 12, from 5:30 to 7:00 p.m.

Details are available at cts.umn.edu/events/trbreception.
Minnesota leaders weigh in on digital data and new mobility

In the opening presentation of the 2019 CTS Transportation Research Conference, SharedStreets co-director Kevin Webb examined how the emerging “digital layers” of the public realm are affecting transportation and urban governance. Immediately following his presentation, a panel of Minnesota leaders and experts shared their perspectives on managing digital data and new mobility in today’s complex transportation industry.

Steve Elkins, Representative, Minnesota House of Representatives

“In an era of shared mobility services, governments will need data to manage the demand on street grids and curbs. What happens when everyone is summoning a shared vehicle to drop them off at the front door of the company headquarters at the same time? The curb will be hugely important, and if every vehicle drops off and then starts circulating downtown waiting for its next ride, the streets will be gridlocked. We are going to need data on where vehicles are dropping off, where they are accumulating, and have some kind of pricing mechanism to regulate these flows and spread them out. This will require some very granular, real-time data to enable cities or regional governments to manage these flows.”

Robin Hutcheson, Director of Public Works, City of Minneapolis

“Our engineers investigated how much of the City of Minneapolis is actually within the right-of-way, and we learned that the right-of-way makes up 22 percent of the city. When you look at the definition of right-of-way, it is ‘land that we hold in trust for the public.’ The biggest risk I see in this technological transportation boom is having that slip away from us. In order to protect our right-of-way and ensure it benefits the public, our city needs to reshape, reframe, and reskill ourselves to address this risk.”

Andrew Owen, Director and Research Fellow, Accessibility Observatory, University of Minnesota

“The risk generator underneath all this is that urban transportation is typically a low-margin or money-losing business, and therefore companies that operate urban transportation need to find ways to be profitable. However, the methods they use to make a profit often run counter to the public good. For example, they can dump supply onto the system and cause competitors to drop out, practice supply discrimination and cause certain users to wait longer for trips, or practice price discrimination by charging users different prices for the same service. The challenge for governments is to regulate in a way that ensures there is some profit left to allow companies to provide the service without destroying our cities in the process.”

Russ Stark, Chief Resilience Officer, City of Saint Paul

“From a city perspective, but also from a resident and community perspective, there is a risk of services popping up and then disappearing after people have become reliant on those services, and in some cases even organized their lives around them. As local governments, at least initially, we’ve been unable to react at the speed of the private sector to these changes, and to determine the best approach to achieve the public good. I believe we have an obligation in the public sector to set expectations for services to work for our communities and, if we value them, ensure that they be sustained over time.”

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