As part of the Minnesota Bicycle and Pedestrian Counting Initiative, researchers from the Humphrey School of Public Affairs are continuing to work with the Minnesota Department of Transportation (MnDOT) to count and monitor bike and pedestrian traffic in Minnesota.

In the latest phase of the initiative, the team is encouraging cities, counties, and other local agencies to get involved in counting efforts.

Counting nonmotorized traffic can produce a wide variety of benefits for both communities and MnDOT, says Jasna Hadzic, MnDOT bicycle/pedestrian planner. “Data on bicycle and
New radar detection stations help evaluate safety improvements on rural roads

Although they carry far fewer vehicles than roads in urban areas, rural roadways continue to be the site of a significant portion of our nation’s fatal crashes. While a number of factors contribute to higher rural road crash rates, one cause for many crashes is excessive speed on horizontal and vertical curves. “Even for rural highways with otherwise good visibility, vertical curves such as hills and valleys are often difficult for drivers to assess,” says John Hourdos, director of the Minnesota Traffic Observatory (MTO) at the U of M. “It’s not uncommon to see drivers traveling at 55 miles per hour or more on vertical curves that are only safe at reduced speeds. This can lead to poor visibility of driveways and intersections, which can result in dangerous high-speed, right-angle crashes.”

Though several effective countermeasures have been developed for twists and turns on flat terrain, such as LED flashing chevrons, vertical curves do not yet have such treatments. Existing signage solutions, such as Blind Approach signs, have not sufficiently improved safety. To fill this void, a new approach using chevron warning signs is being considered in Washington County, Minnesota.

“To conduct a thorough assessment of the effectiveness of roadway safety treatments, it’s important to know not only the vehicle speed, but also the location at which drivers react to the safety treatment, and to what degree,” says Joe Gustafson, Washington County traffic engineer. “In the case of vertical curves, if a driver decelerates only after they recognize the limited sight distance, they are already too late.”

One method of determining if a new treatment is effective is to conduct a before-and-after study at one or more vertical curve locations. But to accurately capture speeds of vehicles on vertical curves for such a study, a new data collection technology was needed.

To address this need, researchers at the MTO set out to develop a new radar-based data collection system. The system they created uses radar detectors along with custom recording equipment mounted within weatherized cases to quickly and easily collect vehicle trajectory data for analysis. For this CTS-funded project, two unique stations were developed: a primary station that contains the recording computer and a satellite station that sends data to the primary station for recording.

The researchers then conducted field tests of the newly designed Portable Vehicle Tracking Station on a vertical curve in Washington County.

Results indicate the new technology is a reliable tool for collecting vehicle speed and position across a vertical curve. The stations were found to have an active range of between 700 and 1,200 feet, which can cover a curve’s critical range. “With costly requirements for sign maintenance and minimum reflectivity, it’s more important than ever to know which signs are effective at modifying driver behavior,” Gustafson says. “This technology is potentially useful not only for the evaluation of new and experimental safety strategies, but also to evaluate the effectiveness of signs or other treatments that have been used for decades.”

READ CATALYST ONLINE
for links to research reports and other resources.
Rail mass transit systems are designed in one of two ways: barrier systems that use turnstiles or other methods to restrict access to fare-paying passengers, or barrier-free systems that require patrons to carry proof of payment.

In the Minneapolis–St. Paul metropolitan area, Metro Transit uses a proof-of-payment system with barrier-free stations. Metro Transit police officers enforce compliance by riding select trains and checking proof of payment.

In a new study, a University of Minnesota research team analyzed current data to provide new insights into fare compliance on the Blue Line (Hiawatha) light-rail transit corridor and other proof-of-payment transit systems. The study was led by Department of Industrial and Systems Engineering professor Diwakar Gupta and sponsored by Metro Transit.

“Accurate measurement of fare compliance is important for many reasons,” says Gupta. “For example, it can help assess the effectiveness of different rates of inspection and citations, and potentially improve the effectiveness of future data collection and fare compliance estimation efforts.”

After employing a suite of statistical methodologies, researchers made some important discoveries. As expected, they found that ridership rates varied by travel direction, station, time of day, and day of the week. Connected with these findings, the team also found that the rate of fare evasion varied within weekdays by time of day, direction, and station. They were also different on weekends and holidays.

Overall, researchers determined that the rate of fare evasion is quite low: about 0.55 percent for weekdays and 0.7 percent for weekends. Interestingly, they also discovered that the evasion rate for those using Go-To passes and other magnetic cards is much greater than the overall evasion rate, in the range of 4.36 percent to 5.52 percent.

Based on their findings, the researchers offered strategies for improving fare compliance. “We found that if Metro Transit police shift some of their enforcement efforts from the weekdays to the weekends, the system could achieve better fare compliance on the weekends without negatively impacting weekday fare compliance,” says Gupta.

Finally, the study provided insight into improvements for future data collection and fare compliance estimation improvements and offered a cost-saving strategy.

“Metro Transit could use ticket sales and card-use data, which is automated, to estimate ridership with appropriate inflation factors to account for riders who transfer from buses and those who are non-compliant,” Gupta says. This could allow Metro Transit to substantially reduce the frequency of manual counts, which could then be used mainly to verify that the relationships between manual and automated data remain accurate.

“The work by the University of Minnesota on the fare compliance project has helped Metro Transit develop a separate and repeatable process to verify compliance rates,” says Nicholas Eull, senior manager of revenue operations at Metro Transit. “The results of this project will benefit Metro Transit for years to come in monitoring fare compliance throughout the system.”
Minnesota winters reduce durability of recycled asphalt pavement

Old asphalt pavements are increasingly being recycled into new paving projects as a way to save money, materials, and the environment.

In fact, more than 68.3 million tons of reclaimed asphalt pavement, or RAP, and 1.86 million tons of recycled asphalt shingles were put to use during the 2012 construction season in new pavements across the country, saving taxpayers more than $2.2 billion, according to the National Asphalt Pavement Association.

Asphalt typically contains a petroleum-based binder mixed with aggregate particles and other additives. When asphalt is reclaimed, the binder in the recycled material is reactivated, reducing the need for virgin asphalt binder. The process also reduces the need for virgin aggregate.

But using recycled asphalt in Minnesota entails special challenges because of the cold climate. Asphalt binder ages over time due to oxidation, making the glue stiffer and more brittle. As a result, RAP can crack more easily at lower temperatures.

“Thermal cracking” is the primary distress in asphalt pavements, not only in Minnesota but in all northern U.S. states and in Canada. Extreme temperature variations that include severe lows, combined with frequent application of deicing salt and repeated freeze-thaw cycles, are the main contributors to distress in our asphalt pavements.

As part of a recent MnDOT project studying the performance of recycled asphalt and high-RAP asphalt mixtures on Minnesota county roads, University of Minnesota researchers performed lab testing and analysis on several asphalt mixtures with various percentages of RAP to determine cracking resistance at low temperatures. The goal was to develop better design guidelines for asphalt pavement mixtures using large amounts of RAP.

U of M civil, environmental, and geo-engineering professor Mihai Marasteanu, who led the testing and analysis, said they found that, in general, asphalt mixtures with more RAP cracked more easily.

“What we found out was that when you add RAP, your stiffness increases, which may negatively affect cracking,” he says. “Why? Because you accumulate higher thermal stresses.”

The research team used three different test methods at two temperatures on two different grades of asphalt mixture with four levels of RAP. The grade is established by the temperature range in which the material performs reasonably well. Samples that perform well in colder temperatures are higher quality and more expensive. Regardless of the quality, however, pavements with reclaimed asphalt materials tend to crack sooner (at higher temperatures). Moreover, the highest RAP content appeared to be the most detrimental.

Marasteanu explained that the results of the testing validated what they already knew. But he hopes the research also will help develop tools to improve the process for recycling asphalt pavement materials as well as standards for defining RAP.

“The first thing that we have to do is to come up with a RAP control management program,” he says. “The main problem, in my opinion, is if you don’t know what [RAP] contains. When you say RAP, what exactly do you mean?”

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CTS Fall Luncheon: Will rising trip productivity change travel choices?

When deciding how to get from point a to point b, minimizing travel time is often the biggest factor. But what if being able to multitask while traveling alters that choice? Commuters might pick transit over an automobile—even if the transit alternative takes longer—if it allows them to use their travel time more productively. What’s more, recent advances in automated vehicle technology are poised to revolutionize how travel time is used and perceived, further blurring the role of travel as a crisp transition between activities.

At the CTS Fall Luncheon, Patricia Mokhtarian, professor of civil and environmental engineering at the Georgia Institute of Technology, will discuss a mode-choice model that accounts for the impact of multitasking attitudes and behavior on the utility of various modes. The model shows that engaging in productive activities—such as using a smartphone or tablet—significantly influences the utility of travel, and could account for a small but non-trivial portion of the current mode shares.

These changing behaviors could have big implications for transportation planning and policies: more people might choose longer commutes and gain access to more jobs, for example, but also consume more land and fuel.

The luncheon will be held December 8 in Minneapolis. Details are available at cts.umn.edu/events/luncheons.
Self-driving vehicles: challenges and opportunities for Minnesota

Whether you call them self-driving, driverless, automated, or autonomous, these vehicles are on the move. GM, for example, announced on September 7 that it will introduce a Cadillac model in two years that can travel on the highway without the driver steering or putting a foot on a pedal.

What are the implications of such disruptive change? A new U of M report examines the current status of the technology and the implications for road safety, capacity, travel behavior, and cost. Published by the Transportation Policy and Economic Competitiveness (TPEC) program, the report also considers the regulatory framework and policy challenges this technology may face, with particular focus on Minnesota.

The report is available at tpec.umn.edu. Self-driving vehicles are also the topic of a TPEC forum coming up on October 31 in Minneapolis. More information is on the TPEC website.

Keep reading for a sampling of the complicated future of self-driving vehicles.

Some experts predict limited availability of driverless cars by 2020 and wide availability by 2040.

Driver mistakes cause close to 90 percent of U.S. crashes.

Traffic congestion costs Americans $100 billion in lost time annually.

Miles traveled could increase: the elderly, disabled, and even children may have more mobility.

MPG could rise with programmed speeds and smoother travel.

Ownership and parking costs could fall: self-driving vehicles could be shared instead of sitting idle for hours.

Legal, policy, and insurance issues need clarity. Minnesota statutes may need to be modified.

Google’s prototypes have not been tested in all weather conditions, including snow-covered roads. If its statutes were revised, Minnesota could become a testing ground for innovations to handle inclement weather.
Accessibility is the ease of reaching valued destinations. It can be measured for various transportation modes, to different types of destinations, at different times of day. There are a variety of ways to define accessibility, Owen explains, but the number of destinations reachable within a given travel time is the most comprehensible and transparent, as well as the most directly comparable across cities.

For the study, rankings were determined by a weighted average of accessibility, giving a higher weight to closer jobs. Jobs reachable within 10 minutes were weighted most heavily; jobs were given decreasing weight as travel time increases up to 60 minutes. Travel times were calculated using full transit schedules for the 7:00 to 9:00 a.m. period. The calculations include all components of a transit journey, including “last mile” access and egress walking segments and transfers.

The report—Access Across America: Transit 2014—presents detailed accessibility values for each metro area, as well as detailed block-level maps that illustrate the spatial patterns of accessibility within each area.

The findings have a range of uses and implications. State departments of transportation, metropolitan planning organizations, and transit agencies can apply the evaluations to performance goals related to congestion, reliability, and sustainability. Detailed accessibility evaluation can help in selecting between project alternatives and prioritizing investments. “It can also help reveal how the costs and benefits of transportation investments are distributed over space and society,” Owen says.

In the future, the Observatory will also use data collected for this study to analyze more detailed aspects of transit accessibility to jobs. Upcoming reports, published periodically as part of the Access Across America series, will explore accessibility to jobs of different wage levels and a comparison with accessibility by car.

In addition to Owen, the research team included David Levinson, RP Braun-CTS Chair of Transportation Engineering, Department of Department of Civil, Environmental, and Geo-Engineering (CEGE); and Brendan Murphy, CEGE graduate research assistant.

The research was sponsored by CTS. To view reports and accessibility maps from the study or to subscribe to updates from the Observatory, please visit access.umn.edu/research/america.

Top 10 metro areas: job accessibility by transit (January 2014)

1. New York
2. San Francisco
3. Los Angeles
4. Washington
5. Chicago
6. Boston
7. Philadelphia
8. Seattle
9. Denver
10. San Jose

Four metropolitan areas were excluded because of a lack of available employment and/or transit schedule data: Memphis, Jacksonville, Oklahoma City, and Richmond.

Case Study: Minneapolis–St. Paul

The Minneapolis–St. Paul metropolitan area ranked 13th in the study, which used data collected prior to the launch of Green Line light-rail transit service between St. Paul and Minneapolis. In an upcoming report, Observatory researchers will analyze the changes in job accessibility associated with the new rail line and supporting adjustments to connecting bus services.

“When light rail replaced bus service along the corridor, travel times by transit became more reliable,” explains Andrew Owen, Observatory director. “Bus service in a large portion of St. Paul north and south of the corridor was rescheduled or realigned to link with the Green Line. We expect to find that the entire Green Line project has created job accessibility benefits throughout the region, not just along the light-rail corridor.”
pedestrian traffic can help us understand trends, determine crash rates, assess safety, measure effects of road designs and traffic controls, project the use of new facilities, and inform investment decisions.”

As part of the project, the team selected several locations in Minneapolis, Hennepin County, Eagan, Rochester, Duluth, and Grand Marais to install permanent and semi-permanent automated bicycle and pedestrian counters that give the team continuous counts of nonmotorized traffic. In addition, the project includes lending portable counting equipment to cities and counties to assist them with nonmotorized projects.

The goal is to measure bicycle and pedestrian traffic on a variety of facilities in both urban and rural locations. At the same time, the project is testing and evaluating the use of five different counting technologies, including inductive loop, passive infrared, microwave, and pneumatic tube counters.

“If local agencies deploy these counters, we want them to know how accurate they are,” Hadzic says.

In addition to evaluating accuracy, the researchers are working to determine which counters are best for different locations—from shoulders to bike lanes to off-street trails.

The team has already partnered with Hennepin County to deploy portable pneumatic tube counters—the same type of technology used to count vehicles—in more than 20 locations. The research team is still working on methods for analyzing the collected data to get accurate counts for bicycle traffic, but initial findings are promising.

“Counting bikes with tubes presents exciting opportunities,” says Greg Lindsey, professor at the Humphrey School and the project’s principal investigator. “If we can adapt the devices that state and local agencies already use, we can move ahead in a cost-effective way. We’re already counting the vehicles, and this technology could let us see how many bikes are traveling with that traffic.”

The team expects to work with MnDOT district staff across the state to further demonstrate the use of pneumatic tubes for bike counting in the summer of 2015.

Next steps for the project include testing the new counting technologies in more cities across Minnesota. Future test sites will include additional locations in Duluth, Rochester, Bemidji, and more. The team is also working with local agencies such as Hennepin County and the Three Rivers Park District to develop comprehensive plans for monitoring nonmotorized traffic.

Bike and pedestrian safety research highlighted in D.C.

The Roadway Safety Institute was recently invited to showcase its research at a bicycle and pedestrian safety workshop held at the headquarters of the United States Department of Transportation in Washington, D.C.

The Institute, the Region 5 University Transportation Center (UTC) led by the U of M, was one of only seven UTCs invited to attend the September 29 workshop. Institute director Max Donath and Humphrey School professor Greg Lindsey represented the Institute at the event. Donath and Lindsey discussed how work by researchers at the Institute is reducing the high risks faced by pedestrians and bicyclists through approaches that target all aspects of the journey—from better planning for routes and facilities to developing technologies and countermeasures for preventing crashes.

Workshop attendees included representatives from the Federal Highway Administration, National Highway Traffic Safety Administration, and the Office of the Assistant Secretary for Research and Technology.
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Minneapolis
CITIES AND COUNTIES
get involved with
BIKE AND PEDESTRIAN COUNTING.
page 1

New radar detection stations
help evaluate
SAFETY IMPROVEMENTS
on rural roads.
page 2

Study offers insights into
TRANSIT FARE COMPLIANCE.
page 3

Accessibility Observatory
report illustrates access to jobs by transit.
page 1