

**May 2003 - Vol. 1 No. 2**

CTS Research E-News brings you the latest research project milestones, published reports, and seminar coverage.

In this issue:**Policy & Planning**

- ◆ [New study suggests ways to address congestion and sprawl](#)
- ◆ [Mapping the dynamics of growth and decline around Minnesota's regional centers](#)
- ◆ [Transit-friendly development for suburbs](#)

Intelligent Transportation Systems

- ◆ [Tilting vehicles - the "anti-SUV"](#)
- ◆ [ITS Lab develops immersive 3D visualization capability](#)

Transit & Alternative Modes

- ◆ [National Transit News](#)
- ◆ [TCRP research publications available online](#)
- ◆ [Transit Security Newsletter](#)
- ◆ [National Transit Institute Training Catalog Online](#)
- ◆ [Journal of Public Transportation](#)
- ◆ [Research problem statements invited](#)

Transportation Infrastructure

- ◆ [U researchers delve into concrete bridge girder cracks](#)

Transportation & the Environment

- ◆ [U research into snowdrift control wins CTS Research Partnership Award](#)

Policy & Planning**New study suggests ways to address congestion and sprawl**

The recently published synthesis of the [Transportation and Regional Growth](#) study will help frame the debate surrounding transportation and land development in Minnesota and offer guidelines for addressing congestion and sprawl. The findings are contained in a report titled [Market Choices and Fair Prices](#), which the *Star Tribune* says "ought to constitute a breakthrough in this state's long struggle over transportation."

The [Minnesota Department of Transportation](#) and the [Metropolitan Council](#) sponsored the five-year study, [Transportation and Regional Growth](#), which comprises 16 separate reports designed to offer policy-makers sensible choices to address the state's transportation and land-development issues.

The study is the most comprehensive ever done on transportation and regional growth issues in Minnesota. Its key findings are:

- ◆ Minnesota's current metropolitan development patterns and policies have reached their limits and are costing more than people may be willing to pay.
- ◆ The single greatest factor contributing to the Twin Cities' current situation is state and regional policy encouraging low-density, sprawling development.
- ◆ Neither of the most discussed options--building more roads and traffic lanes, and increasing mass transit--is, by itself, effective and affordable.
- ◆ Congestion is not the problem, but a symptom of larger transportation and regional growth issues, including a system that encourages spread-out growth coupled with nearly total dependence on personal vehicles.
- ◆ Mass transit has a limited impact on congestion, but it does effectively serve activity-rich destinations--such as downtown areas and the University of Minnesota--regardless of where transit users live.
- ◆ Current development patterns have negative environmental impacts, including endangering water resources.
- ◆ Minnesota policy-makers need to think of the Twin Cities metro area as comprising 19 to 24 counties, not seven.

The study does not offer silver bullet solutions to the state's transportation challenges. Instead, it offers two options for further debate: "honest pricing" and "more market choices."

Honest pricing lets the market work, leading to better decisions and more efficient use of resources. Honest pricing exposes potential home buyers, commercial developers and automobile owners to the true costs of transportation and land development--most of which are currently hidden in state aids to local governments, local property taxes and motor-vehicle registration taxes.

Gearing policies to accommodate trends already evident in the marketplace is the best way to see faster and more durable results. More market choices means more market-oriented planning and zoning to create destinations that would welcome a mixture of employers, services and amenities. These would be better served by a combination of improved roads, an expanded bus system and carefully implanted commuter and light rail lines. The synthesis report is available in PDF and printed formats. For more information on the study, including detailed findings, go to www.cts.umn.edu/trg.

Mapping the dynamics of growth and decline around Minnesota's regional centers

Low-density development patterns have become common around the Twin Cities in recent years, sparking debate over the role of the transportation system in encouraging or discouraging urban sprawl in the metro area. Outside the Twin Cities, Minnesota's regional population centers are also experiencing shifts in development patterns in response to economic and demographic forces.

A new report from the [Transportation and Regional Growth](#) study examines the changes underway in land use and travel behavior around the state. Led by Professor **John Adams**, researchers in the University of Minnesota [Department of Geography](#) have published a new report, [Urbanization of the Minnesota Countryside](#), which traces population change and land development in the towns and townships surrounding 20 regional centers during each decade since 1970.

In most of the areas studied, the researchers discovered a similar pattern of development: where low-density suburban-style development was occurring near the regional center, population increases fastest (or decreases least) in commuter areas near the center. But the researchers found several areas that appear to be bucking this trend, due to unique local circumstances such as overlapping commuter areas or lakeshore property development.

Traffic volumes and travel patterns around the state have been affected by changes in regional centers. While traffic volumes increased during the 1980s and 1990s on all major highways examined, some highway segments did show evidence of reduced travel demand and lower volumes. Some of these reductions can be traced to the development of new, less congested parallel routes; in other areas (particularly the southwestern and western areas of the state), the change may be due to farm consolidations.

Researchers in the University of Minnesota Department of Geography have published several research reports in the [Transportation and Regional Growth](#) series. All reports are available as PDF documents on the TRG Study web site, www.cts.umn.edu/trg.

Transit-friendly development for suburbs

Development principles that support transit can be successfully adapted to suburban settings, and doing so improves land-use mixes and walkability. That and other findings are discussed in [Urban Design, Transportation, Environment and Urban Growth: Transit-Supportive Urban Design Impacts on Suburban Land Use and Transportation Planning](#). The recently published report, by **Carol Swenson**, formerly of the Design Center for American Urban Landscape at the University of Minnesota, and **Frederick Dock** of Meyer, Mohaddes Associates, Inc., is the eleventh in a series of the [Transportation and Regional Growth](#) Study.

Many metropolitan areas, including the Twin Cities, are exploring transit-supportive development as a strategy for balancing growth and sustainability. However, region-wide implementation of transit-supportive principles will require coordination of land use decision-making at the local level with transportation infrastructure planning and transit service decision-making at the county and regional levels.

In order to support that coordination, the regional transportation model must be enhanced to allow for estimating travel behavior at both neighborhood and subregional scales, say the report's authors. This report summarizes their work on enhancements to measure both the individual and accumulative impacts of transit-supportive urban design strategies.

The report consists of three sections. The first documents the researchers' urban design analysis of four transit-supportive development proposals. Two scales of sites were studied: those that were moderate in both land area and development intensity, and those that were either large in land area or planned to be intensively developed.

Transit-supportive principles of mixed use, organization, and connectivity were used to measure and enhance current proposals for each site. Enhancements included modifying block size, increasing the number of full intersections, relocating mixed-use areas closer to probable transit routes, and modifying single land uses. Results of this phase of the study showed that transit-supportive development could work comfortably in existing suburban conditions and within different scales and types of suburban sites.

The second section of the report discusses the researchers' development of model enhancements in the form of a subarea model. These enhancements were designed to allow better evaluation of transit-supportive urban design and to address the relationships between land-use density and type, vehicle trip-reduction and transit usage, shorter-distance tripmaking, pedestrian activity, and proximity to transit.

The researchers found that the subarea transportation model proved sensitive enough to detect changes in tripmaking patterns at both the site and subregional scales. Two types of tripmaking contributed to these changes: short-distance trips between transit-supportive developments and walking or bicycle trips within developments.

The last section of the report uses the subarea model developed by the authors to analyze a subregional transit-supportive growth scenario, results of which clearly demonstrate the benefits of transit-supportive development strategies, the authors say. For example, transit-supportive developments were shown to positively affect the jobs/housing balance in the subregion. If the entire region were modeled, the authors would expect to see even more benefits.

Other conclusions drawn by Swenson and Dock are that transit-supportive development requires interjurisdictional planning and shows its greatest potential when it is planned and implemented in the aggregate. Additionally, to realize the benefits of transit-supportive development, suburban communities need to plan cooperatively for it.

Intelligent Transportation Systems

Tilting vehicles - the "anti-SUV"

Imagine putting twice as many cars on the road, without increasing traffic congestion or air pollution. A new class of vehicles, half as wide as today's automobiles and designed to carry a single occupant, could make this scenario a reality if technological hurdles can be overcome, according to mechanical engineering research fellow **Lee Alexander**.

Already under development in the research labs of several automobile manufacturers, including BMW, Mercedes, and Renault, narrow vehicles reduce the wasted space taken up by empty seats in a typical commuter's car today. But if these vehicles are to operate at freeway speeds, they must be able to negotiate curves like a conventional wide car, without tipping over due to lateral acceleration.

Alexander described these vehicles as "anti-SUVs," noting that the typical sport utility vehicle carries a payload of just four percent of total vehicle weight, contributing to poor mileage and high emissions.

For motorcycles, stability in turns is accomplished by leaning the vehicle into the turn, thereby balancing the vehicle's center of gravity against the centripetal force of turning. But for a vehicle with more than two wheels, leaning becomes a challenge. Alexander and his team are designing a novel suspension system that leans a three-wheeled vehicle in response to steering wheel movements.

Alexander reported that designing a dynamic model of the steering system was a challenging task because the dynamics of the narrow vehicles were found to be more complex than a four-wheel automobile. However, a solid model was an essential tool to develop the tilting system and the software to control it.

The researchers have now constructed a reduced-scale model of their vehicle, which zooms around their testing ground under remote control. At an Advanced Transportation Technologies Seminar Series presentation in November 2002, Alexander showed a brief video of the test vehicle looping through figure-eight turns, but noted that the control algorithms were far from completely reliable. Continued testing and refinement are needed to improve the stability of the system before building a larger prototype.

ITS Lab develops immersive 3D visualization capability

According to **Ted Morris**, the ITS Laboratory's director, "Our goal is to provide a means for researchers to test really new, 'out there' types of strategies." A new visualization tool under development by Morris and senior systems engineer **Chen-fu Liao** is keeping the [ITS Laboratory](#) on the cutting edge.

The lab is a dedicated facility supporting intelligent transportation systems research at the University of Minnesota. The lab's mission is to develop or provide state-of-the-art resources to researchers, students, and collaborators in other ITS research programs.

Focused on supporting research in surveillance, monitoring, and management of traffic systems, the [ITS Laboratory](#) works in partnership with the [HumanFIRST Program](#) (human factors research and driving simulation) and the [Intelligent Vehicles Laboratory](#) (vehicle control and driver-assistive systems) to enable a full spectrum of ITS research.

ITS Institute Director **Dr. Max Donath** described the ITS Laboratory's role: "The ITS Laboratory gives researchers the tools they need to develop new traffic management strategies that make more efficient use of our existing roadways--reducing congestion without additional construction."

Transit & Alternative Modes

National Transit News

TCRP research publications available online

The federal [Transit Cooperative Research Program](#), administered by the [Transportation Research Board](#), provides practical transit research to address technical and operational issues. TCRP emphasizes putting research results into the hands of organizations and individuals that can use them to solve problems. TCRP publications may be viewed at www4.trb.org/trb/crp.nsf.

Here are recent TCRP publications, with associated reference information and summary from the TRB Web site:

- ◆ [Improving Public Transit Options for Older Persons](#) (TCRP Report 82) Two-volume report that describes exemplary transportation services and innovative transportation alternatives designed to enable older persons to maintain independence and describes future transportation challenges generated by an increasingly older population.
- ◆ [Diversity Training Initiatives: A Synthesis of Transit Practice](#) (TCRP Synthesis 46) describes the diversity initiatives currently underway in transit agencies.
- ◆ [Developing a Recommended Standard for Automated Fare Collection for Transit: Scoping Study - Regional Fare Management Manual](#) (TCRP Research Results Digest 57) describes how best to apply automated fare collection in multi-agency, regional environments.
- ◆ [Design-Build Transit Infrastructure Projects in Asia and Australia](#) (TCRP Research Results Digest 53) describes transportation information on the cities and facilities visited, lessons learned, and discussions of policies and practices that could be applied in the United States.
- ◆ [Emerging Trends in European Public Transport](#) (TCRP Research Results Digest 54) describes transportation information on the cities and facilities visited, lessons learned, and discussions of policies and practices that could be applied in the United States.
- ◆ [Using the Internet for Transit Training and Certification](#) (TCRP Report 84) describes web-based training as a means of providing effective, high-quality training to the transit industry.

Transit Security Newsletter

The Federal Transit Administration's Office of Safety and Security publishes a monthly **Transit Security Newsletter**. The March 2003 issue, *Ensuring the Safety and Security of the Nation's Public Transportation Systems*, is available at [transit-](#)

National Transit Institute Training Catalog Online

The National Transit Institute's 2003 course catalog is available at www.ntionline.com.

Journal of Public Transportation

The *Journal of Public Transportation*, Volume 6, No. 1, 2003, published by the [Center for Urban Transportation Research](http://www.cutr.usf.edu/index2.htm) at the University of South Florida, includes these articles, available at www.cutr.usf.edu/index2.htm:

- ◆ Facing Societal Challenges: The Need for New Paradigms in Rural Transit Service
- ◆ What's Wrong With the Railways?
- ◆ The Effects of High-Speed Rail on the Reduction of Air Traffic Congestion
- ◆ Optimization of Bus Route Planning in Urban Commuter Networks
- ◆ A Multiobjective Optimization Model for Flexroute Transit Service Design

Research problem statements invited

The Transit Cooperative Research Program welcomes your submission of potential research topics. Submitting a research problem statement is easy. Instructions and the necessary forms may be found at: www.tcrponline.org/whatistcrp_howparticipate.htm. Research problem statements for FY2004 are due June 15, 2003. New projects will be selected in October 2003.

Transportation Infrastructure

U researchers delve into concrete bridge girder cracks



According to a recently completed University research study led by civil engineering professors **Catherine French** and **Carol Shield**, heavily reinforced long-span concrete bridge girders are susceptible to vertical restraint cracks prior to release from their casting beds. Because of the combined effects of prestressing force and the girder's own weight, those same cracks typically close completely when the reinforcing strands are released and the girder is removed from its casting bed.

Nevertheless, those cracks, though no longer visible, may eventually cause the girders to tolerate less stress and thus lead to earlier-than-expected cracking due to bending. In turn, the "bending" cracks may result in potential fatigue and corrosion problems in the steel strand reinforcement running through the girders.

The "prestressing" process used to make some high-strength concrete bridge girders, where reinforcing steel strands are drawn tightly through the casting form before concrete is added, causes the resulting girder to flex or arch slightly. Prestressing puts compression into the bottom of the beams so that they can carry more superimposed loads before cracking in bending.

French presented her findings February 24, 2003, during a lunchtime gathering at the [Minnesota Department of Transportation](http://www.mn.gov/transportation) Bridge Office in Oakdale and as part of the CTS research seminar series. The research project, titled "Experimental Investigation of the Effect of Vertical Pre-Release Cracks in Prestressed Bridge Girders," was sponsored by [Mn/DOT](http://www.mn.gov/dot) and the Minnesota Precast/Prestress Association.

Transportation & the Environment

U research into snowdrift control wins CTS Research Partnership Award

During a typical winter, roads and highways in many areas of the Upper Midwest are covered with blowing and drifting snow. The result is often reduced driver safety, degraded road quality (from scraping and water infiltration), and significant snow removal costs, not to mention secondary costs such as shipping delays, reduced commerce, and lost salaries and taxes.

To address this expensive and dangerous problem, a team of researchers and practitioners conducted a project titled *Implementation of Climatological Summaries for Blowing Snow Control: Design, Training, and Website Development*. Their successful work was honored at the CTS Annual Meeting and Awards Luncheon on April 15, where the team received the **2003 CTS Research Partnership Award**.

In the project, University researchers joined practitioners from the [Minnesota Department of Transportation \(Mn/DOT\)](http://www.mn.gov/transportation), the [Minnesota State Climatology Office](http://www.mn.gov/climate), and other agencies to develop snowdrift mitigation strategies.

The trigger for the study was the snowy winter of 1996-97, said Professor **Mark Seeley** of the University's [Department of Soil, Water, and Climate](http://www.umn.edu/soil_water_and_climate), at the awards luncheon. That anomalous winter cost \$215 million for snow control, soaring from approximately \$100 million in an average year. Seeking a better approach, **Dan Gullickson** of Mn/DOT's [Office of Environmental Services](http://www.mn.gov/environmental_services) initiated the project with a phone call to Seeley; the two then put together the team to address the issue, Seeley said.

In the project's first stage, researchers investigated several climatological factors such as snowfall season (onset and end date), snowfall amount and density, and wind frequency distributions. Data were analyzed using a database containing the climatic history of 370 locations, some dating back to the 1850s. The team used these values to develop a model to determine proper mitigation strategies, including appropriate living snow fence design.

With this information they made a Web-based, interactive snow-control design module that allows users to obtain necessary climatological attributes for road and snow fence design (see www.climate.umn.edu/snow_fence). For example, users can learn about the success of living snow fence planted in southern Minnesota. During the near record-setting winter of 2000-01, three types of fence (strips of standing corn, twin-row honeysuckle, and single-row honeysuckle/red cedar) performed exceptionally well, storing 50 percent of their theoretical capacity. (These were just three of the numerous living snow fence designs available to landowners through negotiations with Mn/DOT.)

The success of the team, Seeley said, was a function of the members' ability, dedication and focus, connectedness to the communities with which they interacted, and "first and foremost," to team leadership—with particular credit going to **Martha Shulski**, formerly with his department and now with the Alaska Climate Research Center.

"Together," Gullickson concluded at the ceremony, "everyone achieves more."

Project partners were:

- ◆ **Dan Gullickson, Lou Barrett, Ed Fleege, Elizabeth Hobbs, and Jim Klessig** (Mn/DOT)
- ◆ **Mark Seeley, Amy Baker, and Dave Ruschy** (University of Minnesota Department of Soil, Water, and Climate)
- ◆ **John Doan** (Minnesota Dept. of Finance, formerly with Mn/DOT)
- ◆ **Martha Shulski** (Alaska Climate Research Center, formerly with the Department of Soil, Water, and Climate)
- ◆ **Paul Flynn** (USDA Natural Resources Conservation Service)
- ◆ **Lee Klossner** (University of Minnesota Southwest Research and Outreach Center at Lamberton, Minn.)
- ◆ **Kenny Blumenfield** (University of Minnesota Department of Geography)
- ◆ **Pete Boulay, Greg Spoden, and Jim Zandlo** (Minnesota DNR State Climatology Office)

The CTS Research Partnership award is designed to recognize research projects within the CTS research program that significantly improve transportation, and to reward teams of individuals who have drawn on the strengths of their diverse partnerships to implement those results in the field.

Two additional projects also received special partnership recognition. The first was "Employment of the Traffic Management Laboratory (TRAMLAB) for Evaluating Ramp Control Strategies in the Twin Cities." Its purpose was to develop a scientifically sound procedure for determining the effectiveness of Mn/DOT's ramp control strategy and to provide a platform for testing future strategic changes.

In the second project, "A Survey of Segmental Concrete Block Retaining Walls Along Roads," researchers from the Department of Civil Engineering worked with professionals at Mn/DOT to assess the nature and extent of premature deterioration of segmental concrete block retaining walls along roadways in the Minneapolis-St. Paul area.
