Policy & Planning

Understanding transportation impacts of land use scenarios

The interrelated nature of transportation and land use are well known to planners and policymakers. But understanding how these complex relationships will play out on a regional stage is a challenge that has inspired considerable research at the University of Minnesota. This month sees the publication of a new report by researcher Gary Barnes of the State and Local Policy Program of the University's Humphrey Institute of Public Affairs, exploring the impacts of various development scenarios on transportation-related issues like congestion, pollution, and accessibility.

Barnes' previous research on travel patterns appeared in two reports from the interdisciplinary Transportation and Regional Growth study, coordinated by CTS. In the new report, published by the Minnesota Department of Transportation (Mn/DOT), Barnes continues to take a regional view of land use and travel demand, rather than focusing on a specific district or neighborhood.

The report presents an analysis of six hypothetical land-use scenarios for the Minneapolis-St. Paul area, including three different population distributions and four distributions of jobs. Barnes began with a demographic picture of the seven-county Twin Cities area in the year 2000. The six development scenarios implemented combinations of low- and high-density housing and employment projected to the year 2020.

The resulting patterns of housing and employment were then analyzed using a simplified version of the standard four-step traffic forecasting model. Barnes notes that the research in this report was not designed to yield the kind of local accuracy needed for detailed forecasting; instead, his objective was to "isolate and exaggerate the types of impacts that would be likely to result from different land-use philosophies."

Barnes' analysis suggests that land-use policies can affect the development of transportation-related problems, though he warns that land use alone cannot "turn back the clock." The report offers planners and policymakers an interesting new perspective on development across an entire metropolitan region.

Transportation-related Impacts of Different Regional Land-use Scenarios (Mn/DOT 2004-03) is available from Mn/DOT at www.lrrb.gem.mn.us/pdf/200403.pdf (1.1 MB).

Report probes impact of communications technologies on travel behavior

Advances in telecommunications technology continue to exert profound influences on our social behavior—consider the explosive growth of retail Web sites and cell phone networks. Transportation researchers are now delving into the impacts of new technologies on travel behavior, in areas such as telecommuting, transit, and emergency services.

With support from the Minnesota Department of Transportation, Frank Douma of the Humphrey Institute's State and Local Policy Program has been leading a research effort to study the impacts of several advanced telecommunications technologies in Minnesota. His forthcoming report, titled Telecommunications for Sustainable Transportation, focuses on how technologies such as high-speed Internet access, the Global Positioning System, and wireless voice and data networks could improve access to transportation and increase efficiency.

Other contributors to the report include visiting scholar Thomas Horan of the Claremont Graduate University, professor emeritus Richard...
According to Professor Nikolaos Papanikolopoulos, simply won't be feasible for human operators to monitor and evaluate it all. As video cameras are increasingly used at vulnerable areas—bridges, seaports, and potentially on airplanes—the volume of video data generated will be enormous. It will be of interest to policymakers and transportation agencies involved in planning for transportation needs outside metropolitan areas, both in Minnesota and around the nation.

The surveillance of public spaces has taken on greater importance and urgency. As video cameras are increasingly used at vulnerable areas—bridges, seaports, and potentially on airplanes—the volume of video data generated will be enormous. It is simply won't be feasible for human operators to monitor and evaluate it all. The report authors and their collaborators bring a wide range of research methods to bear on these broad and complex issues. Their findings will address technical and operational issues. TCRP emphasizes putting research results into the hands of organizations and individuals that can use them to solve problems.

### Intelligent Transportation Systems

**Using a computer to monitor activity in public places**

*Editor's Note: a more detailed version of this article appeared in the Spring 2004 Sensor, a newsletter of the Intelligent Transportation Systems Institute.*

Since the events of September 11, the surveillance of public spaces has taken on greater importance and urgency. As video cameras are increasingly used at vulnerable areas—bridges, seaports, and potentially on airplanes—the volume of video data generated will be enormous. It is simply won't be feasible for human operators to monitor and evaluate it all. According to Professor Nikolaos Papanikolopoulos, of the University’s Department of Computer Science & Engineering, autonomous vision-based systems are ideal for monitoring human activities in public places because they are more “attentive” than a human. A computer system could be used to first screen data, then highlight significant cases for human operators to evaluate.

Papanikolopoulos and research associate Osama Masoud developed a project to test the feasibility of this type of computerized monitoring. The project is aimed at helping Metro Transit, the Twin Cities transit bus operator, recognize drug dealing and other suspicious activity at bus stops. Because drug dealing is characterized by individuals loitering for long periods at bus stops, it offered a good target behavior for the system to look for.

Drawing on his and Masoud’s earlier work on human detection and crowd monitoring, Papanikolopoulos, along with graduate students Guillaume Gasser and Nathaniel Bird, developed such a system. Across the street from a busy bus stop on the University of Minnesota campus, the researchers installed a video camera to watch people come and go at their test site.

### The system in action

The system uses standard equipment: an off-the-shelf video camera and a personal computer. The monitoring process itself is divided into three distinct phases: background subtraction, object tracking, and human recognition.

- **Background subtraction** involves separating the background scene supplied by the video feed from the foreground. By comparing each new frame in a video sequence to a background model of the scene (without activity), the system can detect moving objects.
- **Object tracking.** To enable the system to track objects in real time—here, people as they walk around a bus stop—the researchers developed algorithms to recognize pre-specified actions.
- **Human recognition.** For the purposes of the bus stop monitoring project, the researchers chose a short-term biometric technique—clothing color.

Results of the researchers’ test showed that the system could successfully track individuals in sparsely-populated outdoor scenes, with limited occlusion, in near real time. The system was also robust in handling image size changes due to differences in perspective as an individual walked across the scene, Papanikolopoulos says.

Defining what constitutes a threat, or threatening behavior, may be the toughest issue, Papanikolopoulos admits. "For me, this is one critical question that we need to answer. Can we learn suspicious activity?" he says.

If the potential uses for a system like this are numerous, so are the issues raised, Papanikolopoulos says. "As long as we have video feeds, someone is going to exploit this information and extract data," he says. "Where we draw the line is a critical question for our society."

### 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](http://www4.trb.org/trb/crp.nsf).

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

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**Bolan of the Humphrey Institute**, as well as researchers and assistants in several university departments.

The report deals with three major topic areas:

- **Telecommunications and travel behavior.** How is travel behavior affected by telecommuting, on-line shopping, and broadband Internet access?
- **GPS and paratransit.** Can Global Positioning System technology be integrated into on-demand, flexible-route transit services, making these services a more viable transportation option for the general public?
- **ITS and emergency response.** What are the effects of incorporating wireless communications technologies into emergency response systems?

The report authors and their collaborators bring a wide range of research methods to bear on these broad and complex issues. Their findings will be of interest to policymakers and transportation agencies involved in planning for transportation needs outside metropolitan areas, both in Minnesota and around the nation.

*Telecommunications for Sustainable Transportation* will be published online shortly by Mn/DOT’s Research Services Section. Preprints are available from the CTS Library at: mathi032@umn.edu or call 612-624-3646.

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**Transit Cooperative Research Program**, administered by the [Transportation Research Board](http://www.transportation.org), 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](http://www4.trb.org/trb/crp.nsf).

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TCRP Problem Statement Submittal
Research problem statements for the FY 2005 Transit Cooperative Research Program are due on June 15, 2004. The solicitation and instructions for submittal are available online at www4.trb.org/trb/crp.nsf.

Journal of Public Transportation
The Journal of Public Transportation, Vol. 7, No. 1, 2004, published by the National Center for Transit Research at the University of South Florida, includes these articles, available at www.nctr.usf.edu:

- Estimation of Bus Arrival Times Using APC Data
- Determinants of Bus Dwell Time
- Prediction Model of Bus Arrival and Departure Times Using AVL and APC Data
- Transit Network Optimization—Minimizing Transfers and Optimizing Route Directness
- Vehicle Selection for BRT: Issues and Options

Transportation Infrastructure
Freeze-thaw testing of pavement aggregates using the Hydraulic Fracture Test
In northern climates, freeze-thaw cracking of portland cement concrete pavements is a major maintenance issue. Transportation agencies are understandably eager to know how a particular pavement will hold up under repeated freeze-thaw cycles. A new durability test could make it easier and less expensive to find out.

The Washington Hydraulic Fracture Test (WHFT) was originally developed by Donald Janssen of the University of Washington and Mark Snyder, then at the Michigan State University, under the auspices of the Strategic Highway Research Program (SHRP). Snyder and co-author Rebecca Embacher (now at Mn/DOT) carried out further research at the University of Minnesota's Civil Engineering department. Their findings are documented in a new report, Refinement and Validation of the Hydraulic Fracture Test, published by Mn/DOT.

Freeze-thaw cracking occurs when water that has seeped into porous aggregate material freezes and expands, creating immense pressures within the aggregate. Repeated freeze-thaw cycles-occurring when temperatures hover around freezing-break down the material, leading to pavement damage commonly experienced as "spring potholes."

Using the most widely accepted methods, testing aggregate durability under controlled conditions has been time-consuming, difficult, and expensive. Freeze-thaw testing of concrete beams containing the aggregate may take months, and require skilled technicians. This problem is made more acute by the natural variation in aggregate qualities, which makes periodic testing of new samples necessary.

The hydraulic fracture test uses liquid water at high pressure to simulate the effects of freeze-thaw cycling at room temperature. An aggregate sample is placed in a water-filled pressure vessel, and water is forced into the aggregate's pore structure using a pressurized nitrogen source. Rapidly releasing the pressure in the vessel "allows compressed air trapped within the aggregate pores to expand, expelling water from the aggregate and creating internal stresses similar to those produced by the formation of ice or salt crystals, or the movement of absorbed water ahead of a freezing front," in the words of the report authors.

Previous research established that results obtained with the hydraulic fracture test correlate closely with the results of accepted freeze-thaw test methods. Using the new test, the authors assert that a single laboratory technician should be able to rapidly assess the durability of several aggregate samples in little as seven days.

The new report focuses on refining the test and validating its accuracy against other test methods. The researchers implemented several improvements, including a larger test chamber and equipment modifications. Results were compared to those of standard freeze-thaw testing and magnesium sulfate (mass loss) testing. Details of the researchers' methodology and findings are contained in the report. Refinement and Validation of the Hydraulic Fracture Test (Mn/DOT 2003-28) is available from the Mn/DOT Web site at www.research.dot.state.mn.us/detail.asp?productID=1904.

Upcoming Events
Visit the CTS Web site www.cts.umn.edu for more comprehensive event information.

May 4-5, 2004
15th Annual CTS Transportation Research Conference, RiverCentre, St. Paul. To learn more, please visit www.cts.umn.edu/events/rescon. You may also call Heather Dorr at 612-625-5267 for more information.

May 5, 2004