

**March 2004 - Vol. 2 No. 3**

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

**In this issue:****Policy & Planning**

- ◆ [Research examines tax strategies for road funding](#)

**Transit and Alternative Modes**

- ◆ [Improving transportation for disadvantaged populations](#)
- ◆ [National transit news](#)

**Transportation Infrastructure**

- ◆ [New federal regulations prompt retaining wall research](#)

**Transportation & the Environment**

- ◆ [New tool to help officials set biodiesel policies](#)

**Upcoming Events****Policy & Planning****Research examines tax strategies for road funding**

Minnesota state and local roads cost taxpayers \$2.6 billion a year, yet few understand how these tax dollars are raised or spent. The public's lack of knowledge hinders the road tax policy debate and could eventually hurt Minnesota's economy. A new study, *Paying for Minnesota Roads*, addresses this problem with a set of baseline information about Minnesota roads and road taxes from both the government and taxpayer perspectives.

In their report, research fellow **Barry Ryan** and associate professor **Thomas Stinson** of the University of Minnesota [Department of Applied Economics](#) evaluate the household budget impact of current road tax policy and three policy alternatives on a set of representative households.

According to the researchers, state and local roads generate 52 billion vehicle miles of travel (VMT) annually in Minnesota, which translates to five cents per VMT on average. But simple statistics can be misleading, since the cost of service on low-volume local road networks can far exceed the statewide average. State road aid to counties and cities helps offset these local cost disparities, saving taxpayers in many communities from higher road-related property taxes or lower levels of local road service.

Derived from three statewide taxes-motor fuels excise taxes, motor vehicle registration taxes, and starting in 2003, a portion (30 percent) of the motor vehicle sales tax-Minnesota road aid accounts for nearly a third of the \$1.5 billion in total local road spending annually. The remaining two-thirds comes from local government general funds, primarily property taxes and state property tax relief, also known as general-purpose aid. State roads, on the other hand, cost about \$1 billion annually, and are funded with the same three taxes that support local road aid, along with additional federal highway grants. These federal dollars result largely from the federal tax on motor fuels, and reflect the state's responsibility for federal interstate highways in Minnesota.

For more on the transportation-related implications of tax policy, read Ryan's article in the [Winter 2004 issue of the LTAP Exchange](#) newsletter: "Understanding road taxes from both the government and taxpayer perspectives."

Ryan and Stinson's report, *Paying for Minnesota Roads: A Tax Policy Assessment (Mn/DOT 2004-04)* is available from the Minnesota Department of Transportation Web site at [www.research.dot.state.mn.us/detail.asp?productID=1902](http://www.research.dot.state.mn.us/detail.asp?productID=1902).

**Transit & Alternative Modes****Improving transportation for disadvantaged populations**

The challenge of providing transportation services to groups who cannot routinely use automobiles is the subject of a new report, published by the [State and Local Policy Program \(SLPP\) of the University at Minnesota's Humphrey Institute of Public Affairs](#). Report author **Gary Barnes** took a broad view of the many overlapping systems used by disadvantaged populations, with an eye toward developing a framework for understanding the issues involved as well as identifying sources of inefficiency.

Community based transportation is a subject of ongoing research at the [Center for Transportation Studies](#), which has organized two one-day community based transportation conferences at the University of Minnesota to bring together representatives of government, researchers, non-profit organizations, and the private sector.

In the report, Barnes notes that "...many of the commonly cited problems have been around for a long time, despite the apparent desire of everyone involved to solve them, and despite the existence of examples of how to solve them. We concluded from this that there must be significant barriers preventing solutions from being implemented; barriers that are not being systematically addressed or perhaps even acknowledged."

One reason for this, Barnes suggests, is the general lack of objective information on the problems faced by community based transportation providers and users. Identifying and defining these problems would be an important first step towards developing solutions.

Attempting to gain an overview of this complex issue, researchers studied a number of community based transportation systems across America, including Pittsburgh, Minneapolis, St. Paul, and the states of Florida and New Mexico. Although the case studies provide valuable examples of different implementation strategies, the researchers note that local circumstances often vary so much that transplanting a successful system from one area to another is extremely difficult.

*Improving Transportation Services for Disadvantaged Populations* is available for download from the Humphrey Institute web site, [www.hhh.umn.edu/centers/slp/cbt.htm](http://www.hhh.umn.edu/centers/slp/cbt.htm). The report includes complete proceedings from the Second Conference on Community Based Transportation, hosted by CTS in October, 2003.

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## 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:

- ◆ [A New Vision of Mobility: Guidance to Foster Collaborative Multimodal Decision Making](#) (Research Results Digest TCRP 65/NCHRP 288)
  - ◆ [Uses of Archived AVL-APC Data to Improve Transit Performance and Management: Review and Potential](#) (TCRP Web Document 23 - Project H-28)
  - ◆ [Public Agency Guidance on Employer-Based TDM Programs and Employer Technical Memorandum Characteristics of Effective TDM Programs](#) (TCRP Web Document 22 - Project B-4)
  - ◆ [Public Transit System Policy Boards: Organization and Characteristics](#) (TCRP Web Document 21 - Project H-24)
  - ◆ [Advanced Public Transportation Systems for Rural Areas: Where Do We Start? How Far Should We Go?](#) (TCRP Web Document 20 - Project B-17)
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## Transportation Infrastructure

### New federal regulations prompt retaining wall research

Bridges and tunnels may grab the headlines, but retaining walls have engineering challenges, too. In response to a change in federal requirements for retaining wall design, researchers from the [Department of Civil Engineering](#) have been working with the [Minnesota Department of Transportation \(Mn/DOT\)](#) to develop a better understanding of earth pressure behind retaining walls. Researcher **Joseph Labuz** presented the research at a meeting of the CTS Research Council on Transportation Infrastructure Feb. 24.

The research was prompted by a federal switch to a different specification for measuring earth pressure, developed by the [American Association of State Highway and Transportation Officials \(AASHTO\)](#). Mn/DOT anticipates that using the new method will significantly increase the estimated earth pressures used to design retaining walls.

As part of the research project, the researchers developed a special device for determining the sensitivity of earth pressure cells (EPCs), which are standard instruments used to measure earth pressure on structures.

To measure the effects of earth pressure on an actual structure, the researchers instrumented a typical concrete retaining wall constructed alongside a Minneapolis freeway. The more than 60 sensors used included earth pressure cells, extensometers, inclinometers, tiltmeters, strain gages, and temperature probes.

Using this wide array of instruments, the researchers were able to not only measure the soil pressure, but monitor effects on the wall including tilt and displacement.

A final report on the research project is expected to be published by Mn/DOT later this year, and will be available on the Web.

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## Transportation & the Environment

### New tool to help officials set biodiesel policies

In recent years policymakers have shown growing interest in the use of biodiesel fuels. In 2002, Minnesota passed a mandate to use two percent biodiesel for most vehicles, and at the federal level, several programs are encouraging use of biodiesel as one approach for reducing emissions, enhancing energy security, and utilizing renewable fuels. But questions remain: How much biodiesel usage is feasible? Is it too costly? Are some uses more suitable than others? University of Minnesota researcher **Doug Tiffany** is investigating current usage patterns of diesel and fuel oil in Minnesota and developing a tool that policymakers can use to aid in their decisions.

Tiffany, a research fellow in the [Department of Applied Economics](#), discussed his work on February 24 as part of a CTS Environment Council meeting. Approximately 30 people attended, including representatives from the [American Lung Association](#) and the [Minnesota Trucking Association](#), and numerous U of M faculty involved in public health and environmental issues.

Biodiesel can be made from vegetable oil or animal fat. It has a fairly simple chemistry, Tiffany said, and is much simpler to make than ethanol. It takes 7.6 pounds of fats/oils to make 1 gallon of biodiesel. Any diesel engine can use the fuel, and trials under Minnesota's winter conditions show minimal operational differences with biodiesel blends ranging from 2 to 20 percent.

Biodiesel has several advantages over petrodiesel. It has greater lubricity, so it reduces wear between contacting metal engine parts. This attribute will be of greater importance as the levels of sulfur in diesel fuel are lowered from 500 ppm to 15 ppm in 2006, according to EPA regulations. All diesel engines will need lubricity-enhancing agents, and biodiesel is a proven choice in this regard. Also, biodiesel's higher cetane content gives it a higher flash point and greater resistance to premature ignition—a plus for many applications.

Perhaps most important, though, is that pure biodiesel reduces sulfates by 100 percent, carbon dioxide lifecycle emissions by 78 percent, and carbon monoxide by 44 percent, due to the higher oxygen level in the fuel. It also reduces particulate emissions by 40–80 percent and cuts unburned hydrocarbons by 68 percent. However, it may increase nitrous oxide compounds slightly, Tiffany said.

Its sustainability aspects are favorable: Production of an acre of Minnesota soybeans requires 7.4 gallons of diesel (plus 0.9 gallon of gasoline for general farm use), yet can yield 70 gallons of biodiesel. These factors give biodiesel a positive energy balance of 3.24 units of fuel energy produced for every unit of fossil fuel consumed in its life cycle. In comparison, petrodiesel yields 0.83 units, and ethanol yields 1.34 units.

However, biodiesel is more expensive than petrodiesel—often costing twice as much—despite the favorable energy balance. In part this is due to a more volatile market for vegetable oils, Tiffany said. Using recycled cooking greases and animal fats results in cheaper biodiesel than those derived from vegetable oils at this time. Provisions of the federal energy bill, if enacted, would reduce costs of biodiesel by reducing federal diesel excise taxes one cent for each percent of biodiesel included in a blend.

Tiffany's project is determining the seasonal and geographic patterns of usage in diesel fuel and fuel oil in Minnesota. In particular, he will suggest where biodiesel use could lead to favorable emission reductions near population centers. One such application could be in transit and school buses to reduce the emissions of particulates and volatile organic compounds that seep into buildings and persist along streets. Another application is to reduce the same emissions by using biodiesel in diesel-powered generators that produce electricity at times of peak usage and under emergency situation.

For his research, Tiffany is gathering data from various sources (for example, U.S. Department of Energy and Minnesota Departments of Commerce, Agriculture, Education, and Transportation). The usage patterns will be calculated by county and month, and by engine or burner type (e.g., farm, school bus, furnace). The goal is to estimate the quantities used for different areas of the state.

The new policy tool he is developing is a workbook consisting of many spreadsheets with categories including numbers of vehicles using diesel, estimated diesel gallons used, and annual fuel needed. A menu page permits the user to set biodiesel usage for school buses at 20 percent, farm usage at 2 percent, and 10 percent in the case of fuel oil in order to derive the number of gallons of biodiesel needed in each county.

The tool is intended to give policymakers objective data to use in their decision making. Intended users include state policymakers, city officials, and private fuel distributors. Paired with data from the Minnesota Pollution Control Agency, the tool could also be used to develop mitigation plans if that becomes necessary based on federal control of local air quality standards.

Can biodiesel make Minnesota energy-independent and solve all our serious pollution concerns? Unfortunately, no. There is simply not enough feedstock to replace substantial amounts of petrodiesel, Tiffany said. If all the soybeans in Minnesota were crushed for biodiesel fuel, we could replace 50 percent of the diesel used in the state. More complicated questions also remain, such as identifying the situations where usage of biodiesel can have the greatest impact on reducing emissions that harm human health. However, biodiesel does have lubricity benefits and may be well suited for certain areas and applications, he concluded, and existing diesel engines are able to use this renewable fuel.

For more about his project, e-mail Tiffany at [dtiffany@dept.apec.umn.edu](mailto:dtiffany@dept.apec.umn.edu).

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## Upcoming Events

Visit the CTS Web site [www.cts.umn.edu](http://www.cts.umn.edu) for more comprehensive event information.

### May 4, 2004

**CTS Spring Luncheon: "A Quiet Revolution in Transportation Finance,"** RiverCentre, St. Paul (in conjunction with Transportation Research Conference). View [details](#).

### May 4-5, 2004

**15th Annual CTS Transportation Research Conference,** RiverCentre, St. Paul. To learn more, please visit [www.cts.umn.edu/events/rescon](http://www.cts.umn.edu/events/rescon). You may also call Heather Dorr at 612-625-5267 for more information.

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