



UNIVERSITY OF VERMONT
TRANSPORTATION RESEARCH CENTER

ANNUAL REPORT | 2008-2009

TRANSPORTATION RESEARCH CENTER



Message from the Director

With the close of the '08-'09 academic year, we've reached the halfway point of our six years as a National University Transportation Center of the US Department of Transportation (US DOT). Our careful center-building has laid a solid foundation for research, education and outreach that is still growing. Our interdisciplinary work on sustainable transportation system solutions places us as an important cross-campus hub for transportation planning, environmental issues and public health.

I'm particularly grateful to our founding external advisory board members, who completed their three-year term this spring. As a group and as subgroups they helped guide us in selecting our signature focus areas, peer-reviewed proposals and reports. I want to especially acknowledge the dedicated involvement of UVM alumnus Paul Toussaint as he retires as University of Kentucky Transportation

Center Director. We're also in debt to TRC advisor and Resource Systems Group, Inc. (RSG) president Dr. Thomas Adler, for his endless support in a second year of recruiting and interviewing faculty candidates. Finally, the support and guidance of outgoing UVM Provost John M. Hughes have advanced the goals of the TRC immensely.

For me, the year's highlights were the times we filled the UVM Davis Center ballrooms with researchers, students and citizens—all eager to discuss transportation funding, transportation and climate change, alternative energy and many other timely topics. It is during these events that I can see how critical the full cycle of research, data collection, student education and public debate of transportation is to our quality of life and economy. It's an exciting opportunity for the TRC to serve this vital role for Vermont.

Sincerely,

Lisa M. Aultman-Hall, Ph.D.
Professor and Director

TRC'S WORKFORCE DEVELOPMENT PROGRAMS

US DOT funding makes these multi-state efforts possible:

- The Transportation Systems Academy provides hands-on training to community and technical high schools.
- The National Transportation and Community College Summit explores the role of these colleges in preparing students for transportation careers.
- The Transportation Systems Institute with Vermont Technical College focuses on maintaining or recruiting DOT workforces.
- The Second Careers in Transportation Program with AARP examines issues in attracting older talent to the transportation industry.
- The Summer Transportation Institute reaches out to high school students.



GRADUATE & UNDERGRADUATE STUDIES

The TRC is focused on building and supporting student research in transportation at both the graduate and undergraduate levels. In the '08-'09 academic year, 32 graduate students participated actively in research projects ranging from measuring tailpipe emissions to examining the transportation patterns of refugees in Vermont. Keeping with the Center's mission to promote interdisciplinary research, our students are enrolled in engineering, mathematics, health care, environment, natural resources, community development and public administration programs.

New Summer Program Supports Undergraduate Research

In summer '09 the TRC created a program to encourage undergraduate research, funding proposals and academic papers by providing up to \$5,000 to students working with faculty researchers. Seven students took on projects as varied as an analysis of the mobility patterns and needs of young people to developing a photo archive of the construction of Interstate 89.

Transportation Planning Class Examines the Societal Impact of Automobiles

How and why has the US become the most auto-dependent society on earth? Answering these questions was the task of the undergraduate transportation planning class taught last spring by Dr. Richard Watts, TRC Research Director. By examining the impact of the automobile on society and how the personal vehicle has become our primary mobility tool, students gained a better understanding of the concept of sustainable transportation.

Student Teams Tackle 21st Century Transportation Problems

Today's transportation issues require interdisciplinary teams to design innovative solutions. "Critical Issues in 21st Century Transportation," required of all TRC students, explores how transportation policies and programs impact our environment, energy, culture, mobility and overall quality of life. Last fall, led by Dr. Watts, students worked in teams to examine air quality requirements from the trucking industry perspective, city street regulations from an urban pedestrian viewpoint, and mobility in rural areas from the perspective of older Vermonters.



Student Spotlight: Jonathan Dowds

Jonathan Dowds is a first-year master's student at the Rubenstein School of the Environment and Natural Resources (RSENr) studying the energy impacts of plug-in-hybrid electric vehicles (PHEVs). Last summer he presented his paper, "Inefficiencies and Perverse Incentives in Greenhouse Gas Cap-and-Trade Schemes: The Case of Electric Sector Caps and Electric Vehicles", at the Ecological Economics Conference in Washington, DC.

Student Spotlight: Karen Sentoff

Karen Sentoff is a second year master's student in the Environmental Engineering program at UVM. Karen is working closely with Dr. Britt Holmén and several other graduate students to measure the tailpipe emissions from on-road vehicle testing.



ASSESSING ENERGY EFFICIENCY

Energy efficiency—defined as providing equal or better quality service with less energy use—is a core value in society. To understand energy efficiency in the transportation sector, the TRC takes an expansive view that encompasses vehicle and individual travel behavior, the impact of land use patterns on access, as well as the construction, maintenance, and operation of the transportation system. Several research projects are underway on topics related to transportation energy efficiency.

Driver Efficiency Project

Research suggests that vehicle drivers respond to higher gas prices by combining and reducing automobile trips when possible and by driving more efficiently. Driving style and vehicle operation could therefore be effective targets for policies and educational efforts to improve transportation efficiency.

The TRC Driver Efficiency Project is testing the impact of continuous miles per gallon (MPG) feedback on driving behavior and fuel efficiency in gas-powered cars. In the 3-month trial, 60 volunteers who commuted more than 20 minutes each way to work had a small computer device mounted in their cars that monitored MPG over daily driving intervals. The devices displayed continuous MPG feedback in one phase of the study, and were masked in others; participants and controls also received a brief tip sheet on fuel-efficient driving behaviors.

Maine Smart-Growth Project

This study evaluated the environmental effects of proposed smart-growth development strategies in two Maine towns, Lisbon and Sanford, by examining the potential reductions in average trip lengths, daily vehicle miles traveled (VMT), and daily greenhouse gas emissions from on-road automobiles. Using a series of model runs, TRC researchers found that the potential for smart-growth scenarios to reduce VMT would be greatly limited without additional transportation system changes to complement the proposed dense, mixed-use developments.



At the Richmond, VT Park-and-Ride lot, a commuter loads his bike onto CCTA's 7:40 a.m. commuter bus to Montpelier. Photo by Andy Duback.

FINANCES

Plug-in Hybrid Electric Vehicles (PHEV) Project

PHEVs, which recharge from a standard electric outlet, can potentially reduce driving costs and air pollution by substituting off-peak electricity for gasoline. What could this mean for Vermont and New England? To help predict the impacts of large-scale PHEV deployment, the TRC is gathering data from a prototype PHEV and developing data-based energy-use models. Based on PHEV usage and energy assumptions from other studies, TRC research found that the Vermont grid can support up to 50,000 new PHEVs without any changes to the existing electricity infrastructure—and as many as 100,000 to 200,000 PHEVs with some intelligent control over the timing of PHEV charging.

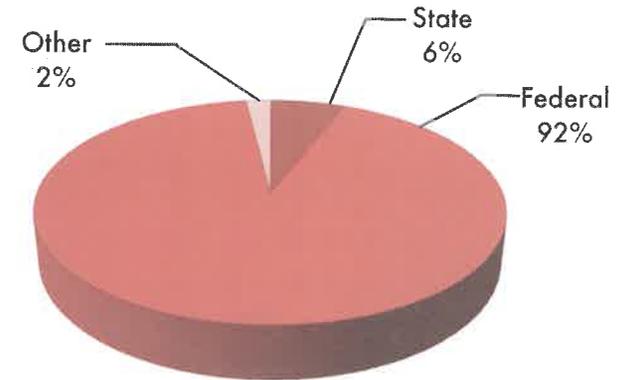


Optimal Transit System Project

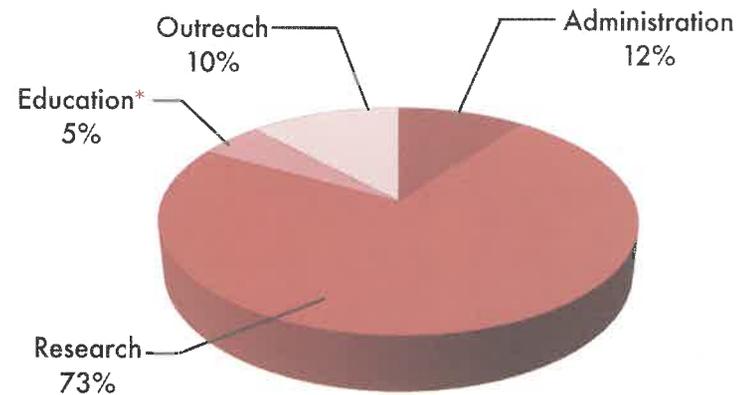
By reducing the need for personal automobile use, public transit can increase the efficiency of the transportation system. However, efficient transit service using larger vehicles is challenging in Vermont's sparsely settled landscape; paradoxically, efficiency declines when large transit vehicles service few passengers. In this analysis, TRC researchers examined the density of Vermont settlement areas to establish the most transit-serviceable areas.

Using household and building locations from the Vermont Emergency 911 database and Geographic Information System ArcGIS mapping to determine population density, investigators were able to identify central, denser "hub" areas within towns that could potentially support transit. In the Vermont analysis, TRC researchers found few places that have the density to support fixed-route public transit systems, suggesting other mobility solutions are needed.

External Funding by source (FY09)



Expenditures by category (FY09) Total: \$3,350,343



*Scholarships and Courses

UNDERSTANDING TAILPIPE EMISSIONS

Emissions from our vehicles' tailpipes are an important piece of how transportation impacts the environment. We study both the carbon emissions that have global impacts, as well as ultra-fine particle emissions which create local public health challenges. We investigate gases already regulated by the Environmental Protection Agency (EPA) as well as those air toxics that are not currently regulated. As our scientists and engineers collect and analyze real-world data, our social scientists study how citizens can participate in tailpipe emission solutions.

Transportation Air Quality Lab Opens Spring 2009

In May, after a year of planning and design, graduate and undergraduate students moved into the new Transportation Air Quality Lab in the Perkins Building on Main campus. A joint endeavor of the TRC and the UVM School of Engineering, this exciting new facility features a conventional light-duty gasoline vehicle, a plug-in hybrid vehicle (PHEV), as well as a leased hybrid vehicle. All will soon be in the field with Dr. Britt Holmén's team.

Mobile lab equipment measures second-by-second tailpipe emissions while volunteers drive in the real-world network. Students are studying how road curvature and grade, traffic control, and driving style interact to affect engine load and vehicle speed along with emissions levels. Dr. Holmén is also partnering with Dr. Robert Jenkins to run a new diesel engine dynamometer—a lab-based engine that runs on different types of diesel—while researchers collect and characterize pollutants in relation to fuel source.

Individual Knowledge of Tailpipe Emissions

Sociology professor and TRC researcher Dr. Tom Macias is part of a team examining the public's understanding of tailpipe emissions. Dr. Macias believes the more socially networked people are, and the more social capital they have—the more likely they are to be active citizens in society.

In a series of focus groups, Dr. Macias found that many citizens don't think about tailpipe emissions or their own behavior in causing them. When asked how they could reduce emissions, most suggested carpooling, walking, and biking; however, knowledge did not translate to behavioral change. The research continues in an effort to understand how social capital affects people's motivations and barriers to behavioral change related to tailpipe emissions.

Karen Sentoff, a TRC graduate student, adjusts the diesel dynamometer in the Transportation Air Quality Lab. Photo by Andy Duback.

INTEGRATED LAND USE & TRANSPORTATION MODELING

The Integrated Land Use and Transportation Carbon Calculator

Scientist Dr. Jennifer Jenkins and graduate student Anna Mika have added an important dimension to transportation research at the TRC and its partners at the Resource Systems Group Inc (RSG). The TRC and RSG traditionally use measures such as vehicle speed and total miles traveled to estimate tailpipe emissions. But Dr. Jenkins and Mika note that different land use development and land cover represent very different carbon sources and sinks—and that land use planning and decision-making models must also take into account the way we develop land, and which land-use conversions we make. The carbon estimator model they are developing will incorporate this information.

UrbanSim: Modeling Land Use Decades at a Time

UVM hosts one of the most disaggregate and comprehensive land use models in the nation. The study area of Chittenden County, home to the City of Burlington, is modeled in the software platform UrbanSim—which allows home location, household composition, travel patterns and activities to be represented with more detailed environmental metrics than in traditional travel demand models. Team leader Dr. Austin Troy is partnering with RSG and Dr. Adel Sadek of the University of Buffalo to model how the county changes over a 20-year study period. The team is able to address accuracy and sensitivity questions in their research that are beyond the reach of traditional practice.

The NRI: Determining Critical Links in a Transportation Network

This year, the interdisciplinary team led by Dr. Aultman-Hall and Dr. David Novak made fundamental advances in developing a Network Robustness Index (NRI). After outstanding work on the project, graduate student James Sullivan joined the TRC team as a full-time researcher.

The NRI is based on the premise that transportation planners and policy makers cannot always assume the busiest road link is the most important to the overall system's reliability and ability to function in emergencies. In fact, TRC's research found that when you consider the whole network, the location of origins and destinations, and the availability of alternative routes, the most critical links may be very different than those identified using traditional analyses.



Jim Sullivan, TRC Research Engineer, works with the NRI. Photo by Andy Duback.

SEASONAL VARIATION IN MOBILITY

Travel choices change with the season and with weather, as do our quality of life and environmental impacts. In this area, TRC researchers focus on understanding what causes seasonal changes in driving, biking and walking so that we can design programs and policies to lengthen the biking and walking season and address the isolation caused by winter travel barriers, particularly in rural areas.

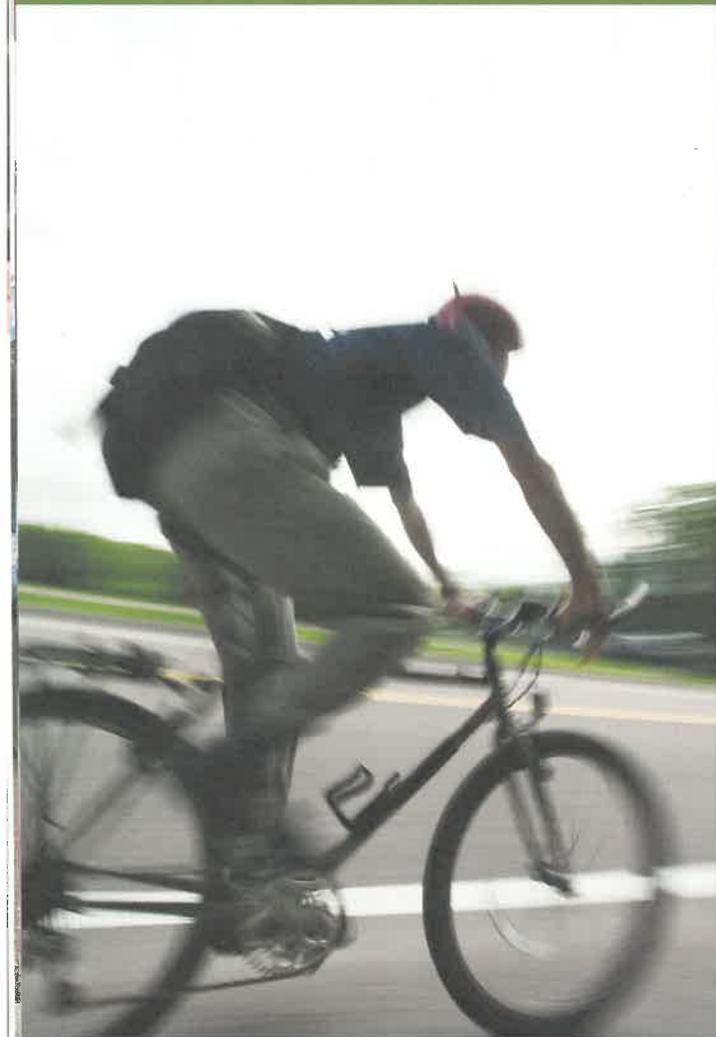
Diverse Research Groups Join Forces in a Strong Coalition

Drs. Brian Flynn and Jane Kolodinsky did not know each other before the TRC was created at UVM. Their research groups at the Office of Health Promotion and Research (OHPR) and the Center for Rural Studies (CRS), respectively, worked on important public health and rural quality of life issues. Now, with support from Dr. Aultman-Hall and her colleagues at the New England Transportation Institute (NETI), both groups are applying their research experience to the complex problems of our rural northern transportation system.

During the fall of '08, Dr. Kolodinsky's group conducted focus groups with rural residents to probe how their travel options affected their quality of life, accessibility and isolation. That winter, Dr. Flynn's group met with commuter bicyclists to understand when they stopped cycling due to weather. Both groups are now embarking on large web- and phone-based surveys that will be repeated over one year to measure seasonal effects. The interdisciplinary focus and diverse research approach makes these quantitative surveys much stronger.

Assessing the Impact of Weather and Season on Pedestrian Traffic

A TRC team has used data gathered by the Vermont Agency of Transportation's automated hourly pedestrian counters from a sidewalk in downtown Montpelier, Vermont to determine if temperature, relative humidity, precipitation and wind affect the number of walkers. This study was unique in that a large amount of data was collected over an extreme range of weather conditions for a single location. The researchers found that after adjusting for time of day and day of week, weather and seasonal variables explained 30 percent of the variations in pedestrian volume—and that bad weather such as cold temperature or precipitation consistently affected walking traffic, but by only a moderate amount (less than 20 percent).



TOURISM TRAVEL

Leisure and recreational travel take place over long and short distances and use diverse modes: buses, planes, trains, automobiles and bikes. Despite the importance of tourism travel to our economy and quality of life, research is lacking in this field. The TRC seeks to contribute innovative data—not only to enrich Vermont’s tourism economy, but also to advance policies that minimize the environmental consequences of our leisure travel.



Simulated images of Acadia National Park Loop Road.

Using Innovative Methods to Measure Travel Sustainability

Dr. Bob Manning of the RSENR and his team of student and staff researchers continue their partnership with the TRC to study travel on paths, roads and transit systems in tourist areas, including national parks. The group conducts surveys to assess if and when users experience crowding and congestion, while also tracking the impact of travel behavior on the natural environments and their carrying capacity. The results will help inform traffic management policies and program design in parks and other areas.

The innovative user survey technique developed by the Manning group uses photos to represent traffic levels and congestion to the research participants. In the example shown (left), volume increases over a series of pictures. While this is similar to the traditional “level of service” approach used in traffic engineering since the 1950s, the UVM method incorporates new variables such as user perception, comfort and enjoyment.

Can Eco-labeling Motorcoaches Encourage Greener Travel?

Dr. Lisa Chase of the Vermont Tourism Data Center, a research partner with the TRC, contends that with their lower energy and emissions outputs per passenger mile, motorcoaches are a greatly underutilized mode in our transportation system. In partnership with UVM Extension, the American Bus Association and the United Motorcoach Association, Dr. Chase’s team is testing the hypothesis that consumers need information, potentially through eco-labels, to be able to make choices that minimize their transportation-related environmental footprints. A nationwide web-based survey, as well as a pilot eco-labeling program are currently underway. Researchers were in the field last spring to assess the impacts of the eco-labeling program on the attitudes and behaviors of motorcoach operators and travelers.



A look back: 2008-2009 at a glance

July

7/1/08 Approximately 100 participants from across the state of Vermont come to learn about restoring and rehabilitating failing bridges at the Bridge Preservation and Maintenance Conference



August

8/18-8/20/08 The TRC joins with the Center for Clinical and Translational Science to host the Honors College Seminar, "Transportation, Environment and Public Health"



8/29/08 The summer's final "brown bag" discussion—our popular conversational seminar series dealing with hot topics in transportation

September

9/2/08 Staff and students of the TRC come together to welcome our new group of incoming graduate students from seven colleges across campus

9/6/08 Staff from the TRC convene the kick-off meeting of the Transportation Education Development Pilot Program (TEDPP) grant in Concord, NH. Representatives from VT, NH and ME DOTs, Federal Highway Administration (FHWA), AARP, Vermont Technical College and VT and NH Local & Tribal Technical Assistance Programs (LTAP) attend



October

10/1/08 Chen Zhang, Ph.D. and Andrew Weeks, two new research analysts, begin work as part of the team at the TRC



November

11/14/08 University of Maine economist Jonathan Rubin delivers a lecture at the TRC about CAFE credits and the Energy Act of 2007



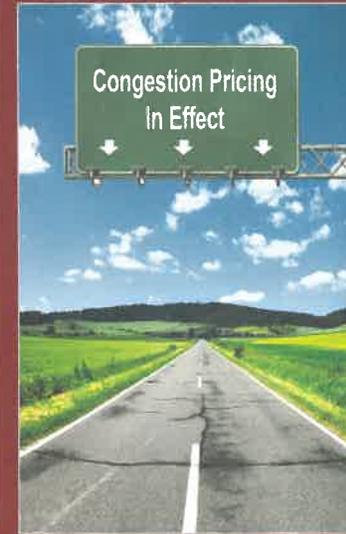
December

12/8/08 Transportation Funding Summit brings lawmakers and transportation experts together to discuss finance and funding options for rural America



TRC "by the numbers"

Graduate students funded	32
Faculty on TRC projects	41
Colleges involved in TRC projects	7
Attendees at outreach events	1,123
New staff hired	3
Transportation research papers presented at conferences	15



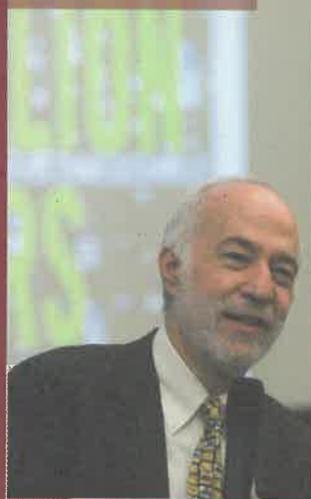
January

1/11-1/14/09 Twelve TRC researchers, grad students and associated faculty attend the 88th TRB Annual Meeting in Washington, D.C.

1/13/09 James Sullivan honored as the TRC Outstanding Student of the Year at the CUTC Annual Awards Banquet

1/15/09 Transportation expert and author Daniel Sperling addresses a standing-room-only crowd on the environmental impact of the rapidly increasing number of automobiles. Sperling spoke as part of the UVM Burack Distinguished Lecture series

1/28-1/31/09 Karen Glitman, TRC Program Manager, with representatives from FHWA, presents the TEDPP workforce development project to the American Association of Community Colleges (AACC) at their annual Workforce Development Institute



February

2/12/09 Jill Hough, Program Director of the Small Urban and Rural Transit Center (SURTC), travels from North Dakota to present her research at the TRC: "Aging in Rural and Small Urban Environments: Are Travel Needs Being Met?"

March

3/2-3/4/09 Richard Watts and Andrew Weeks travel to Maine to present Smart Growth Study to the Maine DOT and community partners

3/9/09 Lisa Aultman-Hall, TRC Director, serves on a "Climate Change Roundtable" with Congressman Peter Welch



3/23/09 Cassandra Gekas, a TRC graduate scholar, receives the Edith D. Hendley Award from the UVM Women's Center at the Women's Awards Banquet

April



4/3/09 TRC hosts its external advisors for their spring meeting (pictured above, back row: Leon Heyward, Bob Penniman, Glenn McRae, Dan Brand, Thomas Adler, Richard Tetreault. Front row: Lisa Aultman-Hall, Harold Garabedian, Cindy Burbank, Peter Plumeau)



May

5/1/09 Richard Watts, TRC Research Director, speaks at the Connecticut Energy Advisory Board about the future of PHEVs in New England

5/6/09 The TRC welcomes the public to an exposition of its projects and studies at the Second Annual TRC Research Expo, featuring 36 poster presentations

5/27/09 Vermont Clean Cities Coalition presents "The Case for Natural Gas Vehicles" workshop

June

6/9/09 The TRC releases two research reports addressing the future of funding transportation in rural areas

6/29/09 Nineteen high school students gather for the annual Summer Transportation Institute, presented in coordination with Upward Bound





The University of Vermont Transportation Research Center

(UVM TRC), located in Farrell Hall, is a hub for research, education and outreach related to sustainable transportation. The TRC serves as the host of the National University Transportation Center (UTC), funded by the US Department of Transportation, as well as the Vermont Clean Cities Coalition, funded by the US Department of Energy and the Vermont Department of Public Service.

UVM's goals with the TRC:

- To build graduate research,
- To build an interdisciplinary team of transportation researchers that contribute solutions to critical transportation problems, thereby improving our health and our environment.
- To have a sustainable, diversely funded Center at the end of the grant period.

Left: the staff of the TRC; bottom left, Terence Barrett, a TRC graduate student; below, Farrell Hall; right, bike commuters on Riverside Ave., Burlington, VT

www.uvm.edu/trc



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