

focus on RESEARCH

How Do Varying Road Types and Road Densities Impact Water Quality?

This summer marked the third and final season of field work for the storm water component of the TRC's Signature Project #1, "Integrated Land-Use, Transportation, and Environmental Modeling." Led by Dean Mary Watzin, the storm water study examines how various road types and road densities affect water quality, stream integrity, and pollutant loads.

The project is just one example of the

growing synergy between the Rubenstein School of Environmental and Natural Resources (RSENR) and the TRC. "I've always been very excited about the TRC's emphasis on bringing together natural scientists, social scientists, engineers, and modelers to work on complex systems and complicated problems," Dean Watzin explains. "Philosophically, it is exactly consistent with the focus of the Rubenstein School, which is to create teams of researchers and find practical solutions to real world problems."

Beyond a shared philosophy, Dean Watzin points out, RSENR and the TRC also work in complimentary research areas. "There are so many ways to work together. Issues relating to protected land, habitat fragmentation, wildness, quality of life, tourism, and how people



experience the natural world," citing a number of Rubenstein research priorities, "are all tied into the design and use of the transportation system."

Helping people to understand the ramifications of the choices they make, Dean Watzin believes, is a vital step in moving toward a more sustainable future. Collaborative research efforts, such as those seeded by the TRC with USDOT funding, provide the scientific underpinning necessary to achieve that objective.



INTEGRATED LAND-USE, TRANSPORTATION, AND ENVIRONMENTAL MODELING: STORM WATER

Principal Investigator: Dr. Mary Watzin (Rubenstein School of Environment and Natural Resources)
Funding Agency: US DOT

The TRC Graduate Research Scholar Program Builds on its Success

Developing sustainable transportation systems presents challenges that cut across disciplines, requiring insights from a broad range of fields, including engineering, economics, community development, public health, and natural resources. The fundamentally interdisciplinary nature of transportation research is the motivation behind TRC's Graduate Research Scholar (GRS) program. Now in its fifth year, the GRS program provides on average \$28,000 in annual research assistantships. Together, the GRS and TRC research programs have funded 76 graduate students from six different colleges, including eight new scholars for the 2010-2011 year, three of whom are featured below.



Tiyasha De Pinto (College of Agriculture and Life Sciences), is pursuing a Masters in Public Administration, studying the funding and governance structures of Metropolitan Planning Organizations (MPOs). MPOs function as the linchpin for coordinating local, state and federal policy makers; soliciting public input, maintaining long-range transportation plans and developing transportation improvement plans. In conjunction with Dr. Asim Zia, De Pinto is researching the relationship between the ways in which MPOs are funded and the projects that they undertake, as well as examining how the organizations are held accountable for their decision-making.



Mark Suozzo (College of Engineering and Mathematical Sciences) is a 2009 UVM graduate and currently a Masters student in Civil Engineering. He joined the GRS program to work with Dr. Mandar Dewoolkar, researching methods for adapting porous concrete pavement to withstand northern winters. Porous concrete is not widely used in cold climates since natural freeze/thaw cycles along with winter sanding, salting, and plowing can reduce the concrete's permeability and longevity. Working in conjunction with VTrans, the city of Burlington, and Heritage Flight, Suozzo is field testing three porous concrete pavement parking lots and working in the lab to test alternative concrete compositions.



Prior to coming to UVM to pursue a Masters degree in Natural Resources, **Aaron Witham** (RSENR) worked as the Sustainability Coordinator at Unity College. Witham found it difficult to improve transportation sustainability at the college as many aspects of the transportation system are interdependent; making it difficult to make significant environmental improvements without systemic changes. In his current research with Dr. Richard Watts and Dr. Tao Sun, Witham is using social network analysis to examine communication patterns among sustainable transportation advocacy organizations. Ultimately, this information could lead to more effective collaborations between organizations and an increased emphasis on transportation sustainability in the policy arena.



UNIVERSITY OF VERMONT

TRANSPORTATION RESEARCH CENTER

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Complex Systems in Transportation: How to Influence Vehicle Purchase Decisions

In complex systems, dynamic, nonlinear interactions among entities lead to higher level patterns that are difficult to predict. "Complex systems research takes a philosophical approach, which recognizes that systems have emergent properties and that a reductionist approach, which focuses only on individual components of the system, may not be sufficient for understanding system-level behaviors," explains Dr. Maggie Eppstein of the UVM Complex Systems Center (CSC). "There are many potential complex systems applications in the transportation sector; everything from interactions between drivers on the road to crisis response and evacuation planning can be studied using complex systems methodologies."

Promoting collaborative, interdisciplinary complex systems research across UVM is central to the CSC mission and contributes to a natural partnership with the Transportation Research Center. "One of the things that makes the complex systems approach so powerful is that it can work in many different domains and

the insights gained in one domain can transfer to very different domains," states Dr. Eppstein. "We want to continue to integrate and synergize with UVM's unique areas of strength, such as the TRC."

The value of that collaboration is evident in TRC's Signature Project #5, "Multi-Scale Model of the U.S. Transportation Energy Market for Policy Assessment." For this project, Dr. Eppstein and her colleagues are using agent-based modeling to explore factors that could influence sales of plug-in hybrid electric vehicles (PHEVs). By examining model sensitivities to potential leverage points, the research team can identify policies and procedures that could be most effective in promoting PHEV market penetration.



Results indicate that unless agents can estimate and make known differences in lifetime fuel costs across vehicle types, PHEVs are not likely to significantly penetrate the market. "If policymakers want PHEVs to catch on, they need to find a way to make this comparison easy for consumers, such as through information required on vehicle stickers," Dr. Eppstein concludes. This work was presented at the 2nd Annual Complexity in Business Conference in November and is currently in journal peer review.



TRC Leads Two National Conferences

The Transportation Research Center played a central role in two recent, very successful national conferences. Dr. Lisa Aultman-Hall chaired the conference committee for the "Research Perspectives on Transportation Systems for Livable Communities" conference organized

by the Transportation Research Board and funded the USDOT UTC. The two-day conference at the National Academies Keck Center examined the challenges of incorporating measures of livability into transportation planning. In addition, Karen Glitman chaired

the host committee for "The 19th National Conference on Rural Public and Intercity Bus Transportation," which brought together about 300 planners, operators, and researchers in Burlington, VT to share best practice and current research relating to rural and intercity bus systems.



TRC Updates the Statewide Travel Demand Model

The Vermont Statewide Travel Demand Model is an essential tool for transportation planning in Vermont. The model includes thousands of miles of roadways and is used to project future travel patterns and assess the impact of specific infrastructure projects. Since 2008, the TRC has hosted and operated the statewide model in response to the needs of towns, counties, metropolitan planning organizations, and the state.

the survey period. Because the statewide model relies on statistical estimations of the desirability of different destinations, making sure that information about how, why, and where people travel is as up-to-date as possible is essential for optimal model performance. In the past, because the NHTS is conducted nationally, few Vermonters were included in the sample.

For the 2009 survey, however, the TRC partnered with the Vermont Agency of Transportation and the Chittenden County Metropolitan Planning Organization to purchase an "add-on" to the survey, ensuring that more than 1,600 Vermont households were included in the sample. "The NHTS add-on data is a real asset for the state," Sullivan says. "We never had this kind of Vermont-specific data before.

Instead, we've had to rely on national-level data with some basic demographic adjustments. Having the add-on is a true upgrade."

"Modeling is never perfect, but we're always striving to improve performance of the statewide model," Sullivan asserts. "The better the information we can provide to the state, towns, and counties of Vermont, the better decisions they can make."



Jim Sullivan, a TRC Research Analyst, is currently working to update the statewide model with new data from the 2009 National Household Transportation Survey (NHTS). The NHTS, conducted by the Federal Highway Administration, is the most comprehensive assessment of travel patterns in the United States. It includes data about the number, purpose, and length of trips taken by members of household during

Vermont Clean Cities Coalition News

Find out more about these Clean Cities programs, or schedule a workshop, by contacting Tom McGrath at tmcgrath@uvm.edu or call 802-656-9864.



ECO-DRIVING WORKSHOPS provide hands-on training in proven energy-reduction strategies by encouraging more fuel-efficient driving and less idling. Eco-driving...

- saves local governments and individual drivers money;
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Workshop participants will learn dozens of methods for cutting back on fuel consumption—reducing their carbon footprint, and saving money at the same time. Small changes in driving habits—such as avoiding "jackrabbit" starts and stops, keeping tires properly inflated, and removing excess weight from a vehicle—can greatly decrease the amount of fuel used. When more drivers follow eco-driving practices, roads are safer and less stressful.



ECO DRIVING WORKSHOPS ARE AIMED AT THREE TARGET AUDIENCES:

companies with large fleets who are looking to reduce their fuel consumption; town energy committees who can spread the word throughout their communities; and driver's education programs who will educate new drivers. Just in the past three months, Eco-Driving seminars have reached over 200 Central Vermont Public Service employees; three town energy committees, and three driver's education programs.

MEET OUR NEW RESEARCH STAFF...



George Lu

In August 2010, George Lu joined the TRC as a Research Analyst after completing a post-doctoral session at the Traffic Operations and Safety Lab of the University of Wisconsin at Madison. He was drawn to the TRC by its focus on sustainable transportation. "The importance of developing sustainable transportation systems is becoming more and more apparent all over the globe" says Lu. "I aspire to expand my research endeavor in this exciting horizon and the TRC has given me the good opportunity to do that."

Encouraging non-motorized travel is essential to improving transportation sustainability, Lu believes, and promoting walking activities is key to that effort. Lu's first project at the TRC is to investigate the relationship between pedestrian volume at intersections and surrounding land use patterns. Lu will examine a spectrum of factors in the built environment that contribute to pedestrian flows, including the type and density of buildings surrounding an intersection, the presence of major pedestrian-trip-generating sites (such as schools and parks), and the availability of sidewalks and other pedestrian-related infrastructure elements.

Pedestrian safety at intersections was also a major focus of Lu's past transportation research. While at the UW-Madison, Lu developed a prototype traffic

signal system to improve pedestrian safety at signalized intersections. The system used pedestrian detection technology to dynamically adjust the duration of walk signals to ensure that the signal did not end while pedestrians were still in the crosswalk.

"More walkable communities are widely believed to be beneficial for the public. Therefore, boosting multifaceted advances in technology and infrastructure improvements to support these types of communities is critically important for the key theme, transportation sustainability, in current practice and in the research domain." Lu believes.

George Lu received his PhD in Transportation Engineering from the Univ

Justine Sears

Justine Sears joined the TRC staff as a Research Specialist in April 2010. "The breadth of research that the TRC conducts, as well as the center's focus on sustainability in all of its facets really appealed to me," Sears says. "It's exciting because we're providing high quality, highly relevant research that serves the state of Vermont and all Vermonters."

Sears's first summer at the TRC has been a busy one. She recently completed a report on Vermont transportation energy

use, a young-driver safety study for VTTrans, and is currently looking at the relationship between travel patterns and electric vehicle charging.

The Vermont Transportation Energy Report presents an overview of trends in Vermont fuel sales, vehicle efficiency, vehicle miles traveled, travel behavior, and the policies and initiatives that affect these trends. The report provides a foundation for data-driven policymaking to reduce fuel consumption and is issued annually by TRC in its capacity as host to the Vermont Clean Cities Coalition.

For VTTrans, Sears analyzed factors that contribute to crashes involving young drivers. "Many of the factors are those that you would expect," explains Sears. "Speed is a big factor, as are horizontal curves. Another important finding is that young drivers struggle with distractions, so having other young people as passengers in the car is a contributing factor as well. These findings support the state's graduate license program."

Sears is currently working with faculty in the School of Engineering and CDAE to analyze data from the National Household Travel Survey to better understand travel patterns in Vermont and determine what these patterns mean for electric vehicle charging. This research will provide improved projections of both the timing and spatial distribution of vehicle charging, factors that have important implications for grid infrastructure maintenance and charging station construction needs. Sears earned her MS at the University of Alaska Fairbanks.



JOIN US: *Critical Issues Expert Panel*

The Transportation Research Center Graduate Student Scholars will host an expert panel on "Critical Issues in Transportation." The panel will feature Maren Outwater, a Director at RSG; David Dill, the Vermont State Secretary of Transportation; and Matthew Coogan, the Director of New England Transportation Institute. The panel will be held in Farrell Hall on December 2nd at 4:00 PM and is free and open to the public. For more information, contact Julia Kirby at (802) 656-1312.

TRC RESEARCH REPORTS

Download these and many other reports from our website—www.uvm.edu/trc—click on **Publications** then **Research Reports**.

- The Vermont Transportation Energy Report (Justine Sears, Karen Glitman)
- Increasing Carpooling in Vermont: Opportunities and Obstacles (Richard Watts)
- Application of the Network Robustness Index to Identifying Critical Road-Network Links in Chittenden County, Vermont (Jim Sullivan, Lisa Aultman-Hall, David Novak)

