

University Transportation Center for Federal Region X at the University of Washington

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*Transportation Northwest
Regional Center
Newsletter*

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The Transportation Northwest
Newsletter is published
triannually by the
TransNow Regional Center
to inform readers about its
research, educational,
professional, and service
activities.

Opinions expressed by the
authors do not necessarily imply
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Minimizing Road Failure: Infrastructure Research at TransNow

Newspaper reporters like to compare traffic to water flowing in a pipe. Although vehicles behave much differently than water molecules, one aspect of the analogy that does work is the similarity between transportation infrastructure and plumbing: no one notices either until it breaks or needs replacement. Several TransNow supported researchers are working to ensure that transportation infrastructure doesn't break, or if it does, it is easily repaired. Professors John Stanton, Marc Eberhard, Dawn Lehman, Charles Roeder, and Jeff Berman at the University of Washington (UW) and David Pollock at Washington State University (WSU) are the principal investigators on a diverse group of projects that involve transportation infrastructure. The premise behind all of these projects is that if engineers can keep the infrastructure from prematurely deteriorating—either from corrosion, fatigue, or seismic demands—or if they can use more rapid construction techniques, then they can keep traffic flowing and preserve mobility.

At the UW, two research teams are investigating methods to improve the rapid construction of bridges in highly seismic regions. Although accelerated bridge construction is utilized in other areas of the country, the techniques are not directly applicable to western Washington without consideration of the area's level of seismicity. Professors Stanton and Eberhard are investigating the use of precast components. Precast concrete offers off-site construction and quality control, whereas on-site construction disrupts traffic, increases labor costs, and imposes unacceptable indirect costs on the traveling public. To take advantage of the benefits of using precast components in bridges, it is necessary to develop precast concrete systems that can be constructed quickly and to develop connections that will withstand seismic demands. A pilot study at the UW worked with contractors, fabricators, and WSDOT engineers to develop prototype structural concepts and evaluated their seismic response through analysis. These results, in combination with precast moment-resisting connection designs developed at the UW to make building frames more seismically sound, led to a bridge bent that dissipates energy through yielding dowels and re-centers after an earthquake. This connection minimizes damage, thereby allowing traffic to more quickly return after a seismic event. Experimental and analytical simulations are ongoing to further develop this bridge bent system. To read a recent report on their research findings, visit www.transnow.org/publication/final-reports/documents/Final_EarthquakeResistentBridges_61-5915.pdf.

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New Manager Joins TransNow



Deborah Harper

TransNow welcomes Deborah Harper as the new Program Manager. She comes with significant administrative experience and promises to be a great addition to the organization. Read more about Deborah below.

Deborah Harper has held a variety of interesting positions at the UW and in the private sector. She was responsible for raising funding and awareness for educational and research needs in the School of Medicine and the Department of Economics at the UW. In these positions she secured funding for research, student support and projects from individuals, foundations, government entities, and businesses. She was also responsible for marketing various programs to the community via press releases,

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Infrastructure Research

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In a related study, Professors Lehman and Roeder, working with Katherine Kuder of Seattle University, are investigating the use of concrete filled tubes (CFT) for piers in bridge construction. Steel CFTs offer high strength, stiffness, and deformability, and they do not require separate column reinforcement or formwork, which reduces labor, costs, construction time, and traffic disruptions. The concrete, which is being developed and tested by Professor Kuder, will contain a high percentage of cement replacement, utilizing recycled materials such as fly ash and slag. Using such materials should improve the environmental sustainability and decrease the cost of bridge construction. The researchers will also develop a connection for the CFT columns to the bridge deck, which will allow fewer materials, less formwork, and simpler geometries than conventional reinforced concrete. In addition, the system will improve the seismic performance of reinforced concrete bridges, thereby reducing damage under moderate levels of seismic demand and improving bridge functionality after an earthquake. For detailed information about this project, visit http://depts.washington.edu/struct/Project%20Websites/Rapid_CFT_caltrans.htm.

UW Professor Berman and WSU Professor Pollock are working to minimize traffic disruptions due to infrastructure failure. WSDOT has become concerned over the potential for failure of luminaires and traffic signal poles, some of which are approaching their 25-year design life. In response, Professor Berman is investigating pole fatigue, studying methods to calculate the remaining fatigue life of critical pole details, and making recommendations about the need for a testing program. Professor Pollock is looking at tieback rods in sheet piling systems that are commonly used in retaining walls, which either support roadways or hold back roadside slopes. These rods are subject to corrosion, and the common inspection technique involves excavating to the location of a few tieback rods and visually inspecting them. The process is labor intensive and expensive, which limits the number of rods that can be inspected. Pollock is testing the use of ultrasonic waves to detect cracks and fractures in the rods. He is also investigating whether ultrasound inspection can measure the rod's cross-section to determine whether it has been reduced through corrosion to an unacceptable level. Using this technique, every tieback rod could be assessed. Professor Berman's project is ongoing until 2010, however, Professor Pollock's research report is available at www.transnow.org/publication/final-reports/documents/TNW2009-07.pdf.

This is just a sample of the infrastructure research occurring at the TransNow universities, much of it funded by TransNow with matching funds from WSDOT or other transportation agencies. Travelers and traffic engineers will continue to be indebted to these researchers for the work they are doing to control costs, improve sustainability, and preserve or repair our transportation infrastructure while simultaneously keeping traffic flowing.

Deborah Harper

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newsletters, working papers, and television. She held similar positions at MultiCare Inc. and Virginia Mason Medical Center. As you might expect from these experiences she enjoys the grant submission process, watching projects and research come to fruition, and helping researchers administer their grants and promote their research.

Deborah left the development arena to work as a consultant on a three-year technology transfer project, The Tri-Cities Commercialization Partnership. This project, funded by NASA, was aimed at transferring technologies created in the federal laboratories at Hanford to the private sector. Technologies included waste water treatment, waste acid treatment, vitrification, and robotics. She worked with technologists; the Department of Energy; government contractors; city, county, and port governments; tribal communities and local higher educational institutions. In this role she also taught Small Business Research Funding classes and consulted for Kennewick General Hospital, Tri-Cities Cancer Center, and Kadlec Medical Center helping them improve their development efforts.

Deborah is a Washington State native. Her grandparents homesteaded land near Gig Harbor and she lived there until coming to the UW for her bachelor's degree. Deb also attended the Evans School of Public Affairs. She met her husband while working at the UW and they live within walking distance of campus. She jokes about knowing campus like the back of her hand. She also believes some of her most rewarding professional and personal experiences have happened here.



Alaska



Idaho



Oregon



Washington

Regional News

OTREC Director Appointed Deputy Administrator of RITA

Rob Bertini, PSU Professor and OTREC Director, was appointed to the post of Deputy Administrator for the Research and Innovative Technology Administration (RITA) in August 2009. Rob made a significant impact at PSU as he created the ITS Lab, launched a transportation seminar series available to anyone over the internet, and helped establish OTREC, a consortium of Oregon universities that generate research and provide education support to transportation engineering students and professionals. Best wishes to him as he begins this new career!



Rob Bertini

Region X Student Conference

On November 13, students from Alaska, Oregon, Idaho, and Washington consortium universities gathered at the University of Oregon in Eugene for the annual Region X Student Conference. Graduate students interested in transportation issues shared research and heard from industry professionals. This year's conference was titled "Moving People" and featured a keynote address from James Whitty, Manager of the Office of Innovative Partnerships and Alternative Funding for the Oregon DOT. TransNow provided travel support to UW and WSU students attending the conference.

Jennifer Dill is the New Director of OTREC

Karen Den Braven is the New Director of NIATT

Karen Den Braven replaces Michael Kyte as the Director of NIATT at the University of Idaho. Karen is a Professor of Mechanical Engineering and the Director of the Center for Clean Vehicle Technology. She will also join TransNow's Advisory Committee and collaborate on research and education efforts.



Karen Den Braven



Jennifer Dill

PSU Associate Professor Jennifer Dill is the new Director of OTREC. Jennifer joins as an experienced PI and collaborator with other Region X universities. She has a background in city and regional planning and has published numerous articles on bicycle and pedestrian innovation. Jennifer will also join TransNow's Advisory Committee and collaborate on research and education efforts.

The Impact of Gas Prices on Transit Ridership & Vehicle Miles Traveled

By Victor Stover, Graduate Student, SDOT Intern/TransNow Fellow



Victor Stover

Fuel prices in the United States have been extremely volatile in recent years. According to the Bureau of Labor Statistics, unleaded gas in the Seattle area rose to a price of \$4.29 per gallon in June 2008 and then dropped to \$1.81 in December. Prices rose again and averaged \$2.91 per gallon in September of this year. The fluctuations in gas prices have appeared to affect people's travel decisions, with many travelers choosing to drive less and take transit more as gasoline prices increase. When gasoline prices reached record levels last summer, transit agencies such as King County Metro experienced large increases in ridership, while state departments of transportation such as WSDOT reported decreases in automobile vehicle miles traveled (VMT). While this anecdotal evidence suggests that increasing gas prices are associated with increasing transit ridership and decreasing VMT, statistical analysis is needed to be more certain.

My master's thesis focuses on the relationship between gas prices, transit ridership, and VMT. I collected data for transit ridership, VMT, and other relevant variables for the 11 largest counties in Washington from 2004-2008. With this data I used econometrics, which is the use of statistical methods to study economic principles, to measure the relationship between the variables. In most counties I found statistically significant relationships between gas prices and transit ridership and gas prices and VMT. In King County, holding other factors constant, a 1 percent increase in gasoline prices led to a 0.09 percent increase in transit ridership and a 0.09 percent decrease in VMT. Both results were statistically significant at a 90 percent confidence level. This evidence suggests that some people are willing to change travel behavior when gas prices increase. They might choose to switch from driving alone to transit, or they might simply choose to drive less. These findings are significant to transportation professionals, who must be prepared for changes in travel behavior due to fluctuations in gas prices.

Victor is in a concurrent degree program and will earn a Master of Urban Planning and a Master of Science with a specialization in Transportation Engineering. He also has two internships: one with the Seattle Department of Transportation, where he performs travel demand modeling-related tasks, and one with NelsonNygaard Consulting Associates, where he contributes research, writing, and statistical and GIS analysis to a variety of transportation projects. He will graduate in December 2009 and will be seeking full-time employment in transportation engineering or planning at that time.

TransNews

Visiting Scholar Joins TransNow



Chris Hunter

Chris Hunter, a former TransNow student who received his MS and PhD degrees at the UW, returns as a Visiting Associate Professor for the 2009-2010 academic year.

He is here on sabbatical from his position as an Associate Professor in the CEE Department at the University of Rhode Island. His primary research interests are in traffic and transit system operations and traffic safety. While here, he will be primarily involved in the preparation of traffic data sets and in the development of VISSIM simulation models of freeway traffic flow for research and laboratory demonstrations of managed traffic lanes, as well as other traffic research.

TCC Room Broadcasts Webinars

The TransNow Communication Center is an excellent tool for broadcasting meetings. TransNow is fostering learning opportunities for our faculty and students by broadcasting various webinars on research and legislation. We hope to foster greater use of the room by faculty, students, and research partners. For information on reserving the room, visit www.transnow.org/about/tcc/.

TRB Meeting and Region X Reception

The 89th Annual TRB Meeting is January 10-14, 2010 in Washington, DC. TransNow faculty and students will travel to present their research.

Please join TransNow, NIATT, OTREC, and AUTC at the Region X Reception for refreshments held in conjunction with the TRB meeting. Visit www.transnow.org for an update on the date and location.

Jennifer Sheldon Says Farewell



Jennifer Sheldon

After serving as TransNow's Program Manager for over three years, Jennifer Sheldon resigned from her post to join the Department of Microbiology at the UW. She is responsible for pre and post award research support for the Department as Grants Manager. TransNow wishes all the best to Jennifer in her new job.

Transportation Student Party

On October 23, TransNow hosted a coffee and pastry reception to welcome new and returning students to the UW's transportation program in the CEE Department. The reception allowed students to get acquainted with each other, faculty, and staff.