

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

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## TransNow Enters its 22nd Research Year

Members of the TransNow Board of Directors (pictured at right) met in May to review TransNow's research program plan for the 2009-2010 year. TransNow received 23 new research proposals and 18 were selected for funding.



*TransNow Board of Directors (clockwise from top left row): John Stanton, Mark Hallenbeck, Pete Briglia, Dave McLean, Jerry Lenzi, Nancy Nihan, and Megan Hall. Also pictured: Jennifer Sheldon (Program Manager). Not pictured: G. Scott Rutherford and Ken Casavant.*

New this year to TransNow's research program is a focus on green transportation construction and operations. This year's RFP emphasized the high priority that would be given to such proposals, and, as a result, all of the new proposals received and the subsequent new projects selected addressed this concern. For example, new TransNow PI, Jennifer Adams, will conduct research that develops a method to better design sustainable stormwater infrastructure by evaluating existing hydrology data from the Region X area.

Below is a listing of the titles and short descriptions of the selected new projects followed by a listing of titles of continuing projects in their second year.

### *New Research:*

***Accelerating Bridge Construction to Reduce Congestion:*** This research involves the study of a specially designed system of precast components which can be used to construct bridges rapidly and thereby reduce congestion. The study will assess the benefits of the new technology in relation to other key aspects of bridge construction. **Contact:** Marc Eberhard, UW, eberhard@u.washington.edu

***Climate Change Impacts on Runoff Generation for the Design of Sustainable Stormwater Infrastructure:*** This project will identify the hydrological impacts of projected climate change for Region X and will use this information to evaluate existing Region X infrastructure and practices. The expected project outcome is the development of a method that can generate the hydrology data needed to design sustainable infrastructure. **Contact:** Jennifer Adam, WSU, jcadam@wsu.edu

***An Environmentally-Conscious Structural System to Achieve Accelerated Bridge Construction in High Seismic Zones:*** This research will develop a method for using concrete-filled tube piers to accelerate bridge construction in seismic zones. The research will result in improvements in engineering performance and in the reductions in the construction time and the carbon footprint of the bridge system. **Contact:** Dawn Lehman, UW, delehman@u.washington.edu

***Error Modeling and Analysis for Travel Time Data Obtained from Bluetooth MAC Address Matching:*** Bluetooth Media Access Control (MAC) address matching technologies have been recently developed for travel time data collection. However, both detection time and limited

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Opinions expressed by the authors do not necessarily imply endorsement by the University of Washington or Washington State University, a TransNow Consortium partner.

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## New Research FY10

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range can severely affect the accuracy of such travel time data. The magnitude of error depends on vehicle speed and the antenna used for scanning Bluetooth MAC addresses. This research would create a scientific model based on a stochastic process to estimate the error associated with this new travel time data collection technology. **Contact:** Yin Hai Wang, UW, yinhai@u.washington.edu

**Evaluate High Percentage Recycled Asphalt Pavement as Base Materials:** The incorporation of recycled asphalt pavement (RAP) in hot mix asphalt and base materials is increasing and this may result in substantial cost savings and a reduction in energy consumption and greenhouse gas emissions. This research will evaluate the structural and drainage performance of RAP in regards to long-term flexible and rigid pavement structural performance. The research will develop a specification for application. **Contact:** Haifang Wen, WSU, haifang\_wen@wsu.edu

**Evaluate Recycled Concrete as Hot Mix Asphalt Aggregate:** Concrete debris is generated from the demolition of roads, runways, buildings and other structures. The incorporation of recycled concrete as hot mix asphalt (HMA) aggregate could result in substantial cost savings, reduced energy consumption, and reduced greenhouse gas emissions. This research will assess the performance of recycled concrete as HMA aggregates and compare it with conventional HMA aggregates. **Contact:** Haifang Wen, WSU, haifang\_wen@wsu.edu

**Evaluating and Optimizing Recycled Concrete Fines in PCC Mixtures Containing Supplementary Cementitious Materials:** This research will develop a procedure that evaluates the effectiveness of a specific recycled concrete fines source. It will also determine the PCC mixture proportions that utilize the recycled concrete fines to offset reduced strength-gain effects associated with the use of these materials as cement replacement. The goal is to develop a procedure that is rapid and inexpensive so that ready-mix concrete producers could easily perform the procedure whenever a new recycled concrete fines source is obtained. **Contact:** Don Janssen, UW, dnjan@msn.com

**Evaluating Emissions Reductions and Tradeoffs in Urban Pick-up and Delivery Systems:** As urbanization grows, it becomes increasingly important to reduce the negative impact of transportation and increase livability in cities. This research considers the relationship between urban pick-up and delivery system operations and vehicle emissions. The tools developed will evaluate the trade-offs between resource (truck and driver) utilization, emissions, and service quality in order to reduce emissions from urban pick-up and delivery systems. The project will formulate a model that can optimize fleet routes and schedules with respect to emissions rather than financial cost. **Contact:** Anne Goodchild UW, annegood@u.washington.edu

**Exploring Terrestrial LIDAR for Roadside and Corridor Surveys:** Light Detection and Ranging (LIDAR) uses laser pulses to collect information to create quick, accurate, digital models of the topography and vertical structures. A WSDOT funded project, conducted by researchers at the University of California, Davis, will evaluate commercially available LIDAR systems. This research, done in coordination with the WSDOT project, will determine how to fuse the LIDAR data into existing WSDOT data systems. **Contact:** Ed McCormack, UW, edm@u.washington.edu

**Greenroads: Application and Evaluation:** As the Greenroads rating system (version 1.0) nears completion, the next phase of this project is to investigate its use and impact on actual roadway projects. This involves partnering with agencies and consultants to select "pilot projects" to pursue Greenroads rating certification and actively use the rating system to influence the design and construction phases of a roadway project. Detailed Greenroads information can be found at: [www.greenroads.us](http://www.greenroads.us). **Contact:** Steve Muench, UW, stmuench@u.washington.edu

**Low Impact Development (LID) and Transportation Stormwater Practices:** The project will develop a design decision tool that can be used by Region X transportation designers and other researchers to deal with current and future climate change stormwater impacts. The intent is to compile these practices and provide guidance on how they fit into the

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Low Impact Development (LID) philosophy of mimicking natural hydrological processes in situ and how they might be applied to the most critical infrastructure needs. **Contact:** Liv Haselbach, WSU, haselbach@wsu.edu

**Multi-Modal Measurement and Evaluation of Travel Time Reliability:** This research will focus on understanding travel time reliability and how it influences mode choice. The goal is to obtain vehicle location data from King County Metro Transit, Sound Transit, Tri-met and other agencies and investigate schedule adherence, a key measure of travel time reliability. These data will be used to characterize which aspects of routes (exclusive lanes, CBD, monthly pass use) make them more or less reliable. **Contact:** G. Scott Rutherford, UW, scottrut@u.washington.edu

**Partnering on the Development and Testing of a Green Freight Calculation Tool:** This project will partner with SINTEF, Norway's largest independent research organization, to provide TransNow researchers access to SINTEF's calculation tool for green freight transportation. This tool is used to calculate the environmental cost of the movement of freight along the supply chain. This collaboration will provide a new location (North America) to test the transferability of the resulting environmental calculator. **Contact:** Ed McCormack, UW, edm@u.washington.edu

**Rapid Construction of Bridges Using Concrete-Filled Fiber Reinforced Polymer Tubes:** The research will build on a previous investigation of the seismic behavior of ten single-column and two-column bents constructed using precast, post-tensioned, concrete-filled, fiber-reinforced polymer tubes. This research will produce design recommendations to improve the capabilities of the single column bent under monotonic lateral loads. **Contact:** Mohamed ElGawady, WSU, melgawady@wsu.edu

**Seismic Performance and Smart Health Monitoring of Concrete with Recycled Aggregate:** The objectives of the study are twofold: (1) to evaluate the seismic performance of recycled aggregate concrete (RAC) structures, and (2) to assess the condition and detect damage in RAC using embedded smart piezoelectric sensors/actuators. A combined experimental, theoretical and numerical approach will be considered to evaluate the seismic performance of RAC and develop the condition assessment and damage detection strategy using smart materials. **Contact:** Pizhong Qiao, WSU, qiao@wsu.edu

**Identifying High Risk Locations of Animal-Vehicle Collisions for Future Road Ecology:** This research will attempt to better understand the cause of highway animal vehicle collisions (AVCs) by combining reported AVC data and carcass pick-up data. The goal is to incorporate preventative measures in transportation planning. Deliverables of this study include a map of AVC hot spots, a set of roadway factors associated with AVCs, and a calibrated risk model for identifying causal factors of AVCs. **Contact:** Yinhai Wang, UW, yinhai@u.washington.edu

**Understanding Pacific Highway Commercial Vehicle Operations to Support Emissions Reduction Programs:** In an effort to recommend regionally comprehensive border management solutions that will simultaneously reduce the cost to carriers and vehicle emissions, researchers will work with the International Mobility and Trade Corridor Project (IMTC), a cross-border planning coalition, to design a robust data collection effort focused on commercial vehicles at the three freight crossings between Canada and the US in Washington State. While the data collection will be done by Western Washington University students, this study will analyze the data to develop ways to reduce truck idling and emissions. **Contact:** Anne Goodchild UW, annegood@u.washington.edu

## **Continuing Research:**

Six projects were awarded second year funding including: Design Choice of Aggregate Gradation for Hot Mix Asphalt Mixtures (PI: Shihui Shen), Developing a Truck Trip Generation Tool (PI: Ed McCormack), Fatigue Testing of a Critical WSDOT Luminaire and Traffic Pole Details (PI: Jeff Berman), A Microscopic Approach for Quantifying Recurrent and Non-Recurrent Delays on Freeways (PI: Yinhai Wang), Real-Time Travel Time Prediction on an Urban Traffic Network (PI: Yinhai Wang), and School Based Travel: A Mobility Assessment (PI: Anne Vernez Moudon). For more information on these projects, view the project descriptions at [www.transnow.org/research/research-project-descriptions/documents/Year21ResearchProjectDescriptions.pdf](http://www.transnow.org/research/research-project-descriptions/documents/Year21ResearchProjectDescriptions.pdf).

# Student Research: Variable Speed Limits on I-90

By *Basma Aziz Makari, WSDOT/TransNow Fellow*



*Basma Aziz Makari*

Approximately 50 percent of delay is caused by incidents. Blocking incidents impose large inconveniences and unreliability to drivers as they cause unexpected and significant delays. Incidents can cause backups several-miles in length, like the one shown below.

The largest proportion of incidents is due to rear-end and sideswipe collisions, which not only cause significant backups, but can cause severe injuries and expenses to those involved. Many rear-end and sideswipe collisions are caused by drivers driving 60 miles per hour or more as they approach highly congested traffic. If those vehicles drove slower as they approached a congested section of roadway, the chances of serious collisions would be reduced. Moreover, having drivers slow down as they approach a bottleneck can even alleviate the impacts of stop-and-go traffic.

These are the goals of the I-90 Two Way Transit project. On Interstate 90 westbound between I-5 and I-405, variable speed limits have been in operation since April 28, 2009. As the roadway becomes congested, an algorithm calculates a speed limit for each segment of roadway, which is posted on a variable speed sign like the one depicted below. Speed limits can vary from 30 to 60 miles per hour.



As this is the first application of algorithm-based variable speed limits in Washington State, the Washington State Department of Transportation and the UW will closely monitor the performance, effectiveness, and congestion through several studies over the next few months. These include:

- **Algorithm Tuning:** WSDOT traffic office. The WSDOT traffic office monitors the speeds computed by the algorithm, the frequency and variation of speed limit change, and the duration of reduced speeds. The algorithm is tuned as needed to effectively represent congestion conditions.
- **Posted Speeds and Congestion:** WSDOT traffic office. During the first few weeks of variable speed operations, the traffic office tracks roadway congestion levels and corresponding speed limits in a daily summary report.
- **Safety Analysis:** WSDOT traffic office. Safety impacts on I-90 will be assessed after the first six months of collision data during variable speed operations is available.
- **Measuring Driver Compliance:** Basma Makari, WSDOT and UW. In order for variable speed limits to be effective, it is essential for drivers to comply with the posted speed limits. Thus, driver compliance will be measured through the first few weeks of variable speed operations.
- **Headway Patterns Analysis:** Runze Yu, UW. Runze Yu, a student at UW, is performing research on I-90 to assess how vehicle headways fluctuate during congested conditions.



*Variable Speed Sign*

*Basma Aziz Makari is an engineer at the WSDOT. During the 2008-2009 year, she attended the UW as part of the WSDOT /TransNow Fellowship Program. TransNow provided a full tuition fellowship and WSDOT provided a fellowship that covered her salary and books.*



Alaska



Idaho



Oregon



Washington

## Regional News

### *Transportation Education Conference in Portland*

On June 22-24, 2009, transportation faculty from around the region gathered in Portland for the Transportation Education Conference. The conference addressed possible improvements to transportation curriculum and instruction in universities. Sponsors of the program included the four Region X UTCs, the Institute of Transportation Engineers (ITE) and the Council of University Transportation Centers (CUTC). TransNow supported Professor Yin Hai Wang and PhD students Kelly Pitera and Kari Watkins to attend the conference. TransNow PI and Professor Joe Mahoney also attended the conference.

### *NIATT Sponsors Winners of Snowmobile Challenge*

The University of Idaho's NIATT-sponsored Clean Snowmobile Challenge team took Third Place in the 10th Annual SAE sponsored Clean Snowmobile competition held in Houghton, Michigan in March 2009. The team modified a semi-direct injected, two-stroke snowmobile to run on flex-

fuel; any combination of 10-85 percent ethanol plus gasoline. The team also received awards for Best Fuel Economy, Best Acceleration, Best Value, Cold Start, and Endurance.

### *PSU Professor Awarded WTS Portland Woman of the Year*

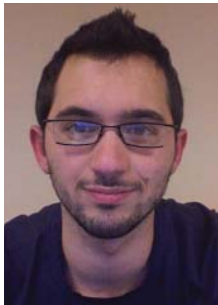
Congratulations to PSU Professor Jennifer Dill for earning the 2009 Woman of the Year award from the WTS Portland Chapter. Professor Dill was honored along with other award recipients at a banquet on May 14th. The *Journal of Public Health Policy* also honored Dill's work by publishing her article, "Bicycling for Transportation and Health: The Role of Infrastructure".



Jennifer Dill

## Technical Communication: Critical for Professional Development

By Adam Parast, *Transpo Group/TransNow Fellow*



Adam Parast

I would not say that I love to write, but I have recognized how important strong writing skills are for my professional development. The technical communication courses offered through the UW CEE Department helped improve my writing and made me a more marketable engineer.

I realized this while taking TC 231: Introductory Technical Communication, a requirement for undergraduates. I quickly found my technical communication textbook as the most important reference book I owned; it remains so to this day.

It is easy to find papers and presentations whose audience is wrongly identified. Through TC 231 I learned how to create papers and presentations for specific audiences and purposes. Having a well-defined purpose ensures the audience walks away with the knowledge the author intended them to have. I remember this during the annual ITE student night competition (students from UW and Seattle University compete to solve local transportation problems), as I am able to focus on questions that practicing transportation engineers will have. When I think thoroughly about the problem at hand I improve my odds of winning the competition.

I have learned that having clear and organized content ensures that nothing is forgotten. No matter how long or well researched a document is, forgetting an important topic can mean the difference between appearing credible or not.

This became painfully evident while taking CEE 582: ITS. After receiving a low grade on my first assignment I realized that although I worked many hours on the project, I had omitted obvious yet very important information. Determined not to make the same mistake on my final project, I created an extensive outline and received one of the highest grades in the class. If this had happened while competing for an engineering project for a job, my bid would have been unsuccessful.

Being able to identify the audience and purpose of a project as well as creating a thorough outline are just a few of the many indispensable communication tools. Because of technical communication courses, I am now well practiced in these skills and a better engineer because of it.

*During the 2008-2009 academic year, Adam was an intern at the Transpo Group and a TransNow fellow within the CEE graduate program. Next year, he is continuing his Master's program in Scandinavia through the Valle exchange program offered through the UW CEE Department.*

## TransNews

### *UW Students Win ITE Awards*

UW Students Elyse Hanson (U) and Erica Wygonik (G) were honored by the Washington State Section of ITE. Hanson, a TransNow scholar and Parsons Brinckerhoff intern, won a \$1500 undergraduate scholarship. Wygonik, an Urban Design and Planning student and RA for Prof. Goodchild, won a \$2000 graduate scholarship. As part of the partnership with the Washington State Section of ITE, TransNow funded part of the awards.

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### *TransNow Advisory Committee Meets*

The TransNow Advisory Committee gathered on June 11 at the UW. The committee examined currently successful partnerships and possibilities for new collaborative efforts with TransNow's various public and private partners, focusing on the three center components of Education and Training, Research and Outreach.

### *UW CEE Professor Speaks at Henry Roy Berg Endowed Lecture*

On May 11, Professor Joe Mahoney was the guest speaker for the annual Henry Roy Berg Endowed Lecture. He examined the evolution of transportation infrastructure with emphasis on the Puget Sound Region.

Professor Mahoney's research focuses on transportation and construction. His primary areas of expertise are highway and airfield pavements, pavement materials, pavement management systems, and industry-related environmental regulations and compliance.

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### *2009 CUTC Summer Meeting*

TransNow Associate Director, Scott Rutherford and Program Manager, Jennifer Sheldon attended the summer CUTC meeting held on the campus of the University of Massachusetts - Amherst from June 30-July 2, 2009.

### *WSU/UW Students Awarded Coral Sales Scholarships*

WSU and UW Students were awarded Coral Sales Scholarships to celebrate their academic achievement. TransNow matched their awards with an additional 60 percent for a total of \$1600 for each student. WSU recipients were Stephanie Schlatter and Andrew Fegan. UW recipients were Celeste Hoffman and Ryan Mak. Below is a thank you note from Celeste Hoffman:

*Dear TransNow,*

*I wanted to send my sincerest thanks for matching the Coral Sales Company scholarship! I am very honored to have come to your attention.*

*Thanks,  
Celeste Hoffman*