PACTRANS
UNIVERSITY TRANSPORTATION CENTER NEWSLETTER

Safe and Sustainable Solutions for the Diverse Transportation Needs of the Pacific Northwest

Issue #4, November 2013

November 2013

IN THIS ISSUE

Get in Touch with PacTrans:
University of Washington
More Hall Room 112
Website: http://www.pactrans.org
email: PacTrans@uw.edu
Phone: (206) 685-0395
Find us On Twitter!
@PacTransUTC

PacTrans Interns Produce New Seattle Bus Buddy Android Phone App

As part of PacTrans' outreach activities, PacTrans started a summer intern program in 2013 to attract talented high school and college students to work and study on transportation related issues. The first two students recruited to this program were Kevin Yang, an incoming high school junior at the Lakeside School in Seattle, and Jinglan Wang, an incoming sophomore at Wellesley College. Both students had demonstrated their talents by winning numerous awards in mathematics competitions. Particularly, Kevin won the 3rd place in Mathcounts National Competition in 2011 and received honorable mentions in both the United States of America Mathematical Olympiad (USAMO) 2013 and the United States of America Physics Olympiad (USAPO) 2013. Additionally, Jinglan is a talented athlete that won 4th place in the US Rowing Youth National Championships in 2012 when she was the captain of the Lakeside School's crew team. The two interns worked closely together at the Smart Transportation Applications and Research Laboratory (STAR Lab) of the University of Washington over the summer and produced an Android phone app called Seattle Bus Buddy available for download at the Google Play Store at https://play.google.com/store/apps/details?id=com.starlab.busbuddy.

Left: PacTrans' summer interns Jinglan Wang and Kevin Yang on the UW campus in Seattle

Right: The summer interns with STAR Lab researcher Yingying (Rebecca) Zhang in the UW STAR Lab

The idea for Bus Buddy was born when Jinglan continuously napped through her bus stop, much to Kevin's amusement. They decided that many Seattleites likely faced a similar issue and set to work. The application they created allows users to set a GPS enabled alarm for their respective bus stops so that those who tend to miss their stop for various reasons will no longer worry about it. This application is meant to benefit all public transit users, especially those who are visually impaired. With data support from Sound Transit, the pre-installed accessibility options on the Android phone allow the user to navigate and utilize the application conveniently. They hope that they can someday develop an iPhone version and a Windows Phone version of the application, or that the open source app will capture the interest of other developers who are willing to optimize it for various cities and languages.

About Pacific NW Transportation Consortium

The Pacific Northwest Transportation Consortium (PacTrans) is the new Region 10 University Transportation Center (UTC) established in January 2012 with a $3.5 million grant from the US Department of Transportation (USDOT).

PacTrans is a coalition of transportation professionals and educators from Oregon State University (OSU), the University of Alaska, Fairbanks (UAF), University of Idaho (UI), University of Washington (UW), and Washington State University (WSU). With dual themes of safety and sustainability, PacTrans serves as an engine and showcase for transportation research, education, and workforce development in the Pacific Northwest.

The goal of PacTrans is to create an environment where consortium universities and transportation agencies within Region 10 work together synergistically. The solutions that we develop will meet the needs of the Region and provide direction for the five strategic goals of the US Department of Transportation:

- Safety
- State of good repair
- Livable communities
- Environmental sustainability
- Economic competitiveness

The Pacific Northwest offers a unique blend of opportunities to examine a variety of transportation issues, including those related to urban centers, rural communities, diverse geographic features (e.g., coastal plains, mountain ranges), and a growing population of pedestrians and bicyclists. This diversity makes the Pacific Northwest a natural laboratory in which to investigate transportation solutions that are applicable both locally and nationally. PacTrans is dedicated to collaborating with transportation agencies, companies, and research institutions to jointly develop safe and sustainable solutions for the diverse transportation needs of the Pacific Northwest.

The UW serves as the lead institution. The PacTrans Center is located at More 112 on the UW campus. Dr. Yinhai Wang, Professor of transportation engineering in the Civil and Environmental Engineering Department, serves as Director of PacTrans.

News and Events

PacTrans Welcomes New Faculty

Oregon State University and University of Idaho are happy to welcome four new faculty members this year. Each member joins their respective universites with an impressive track record in research and a strong teaching background.

Kevin Chang, Ph.D., P.E., is a new Assistant Professor in the Department of Civil Engineering and Center for Secure and Dependable Systems at the University of Idaho. The Center for Secure and Dependable Systems has formed a multi-disciplinary group that is focusing on cybersecurity with an emphasis in the areas of power systems and transportation engineering. This research endeavor is part of a broader vision through the Idaho Global Entrepreneurial Mission (IGEM) and this group will be closely examining issues related to critical information infrastructure and support for secure software.

Kevin obtained his undergraduate and graduate degrees in Civil Engineering, with an emphasis in transportation, from the University of Washington. His research areas include traffic safety and operations, transportation security, livable communities, and transportation education. He previously served as an Affiliate Assistant Professor at the University of Washington and as a supervisor in the Traffic Engineering Section for the King County Department of Transportation in Seattle.

Kevin is the current Vice Chair of the Institute of Transportation Engineer's (ITE) Transportation Education Committee, Past President of the ITE Washington State Section, Chair of the Transportation Research Board's (TRB) School Transportation Subcommittee, and a certified Safe Routes to School National Course instructor. Kevin is a strong advocate for civic engagement and previously served as a trustee on his neighborhood community council and Chair of its Safe Streets Program.

For more information about his research, contact Dr. Kevin Chang (kchang@uidaho.edu).

Continued on page 3

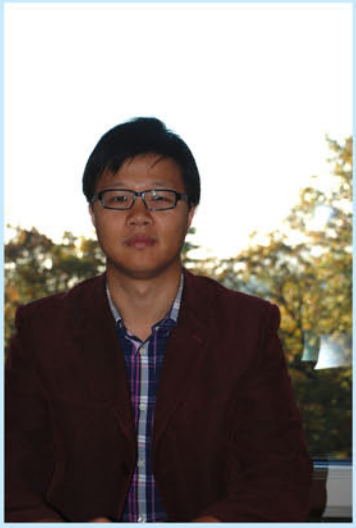
News and Events

PacTrans Welcomes New Faculty (continued from page 2)

Dr. Sal Hernandez joins Oregon State University from the University of Texas at El Paso and earned his PhD from Purdue University in 2010. Sal will join our transportation group and is an expert in freight, with emphasis in safety and logistics. He is developing novel modeling and assessment tools that will integrate traffic safety early in the transportation planning process to mitigate crashes and reduce infrastructure costs.

His research interests consist of (i) a systems approach to the modeling of transportation safety and security, environmental impacts, and corresponding policy implications, (ii) the application of operations research, graph theory, mathematical programming, and econometric modeling to address a wide range transportation problems (e.g.,logist (iii) modeling supply chain firm behavior to understand their propensity to adopt to new operational and business paradigms, (iv) use of information and sensor technologies for real-time operations of time dependent logistic systems, and (v) applications of game theory techniques for the derivation of pricing mechanisms for logistics companies.

For more information about his research, contact Dr. Sal Hernandez (sal.hernandez@oregonstate.edu).



Dr. Haizhong Wang joins OSU from the Trine University in Angola, Indiana where he worked as assistant professor with the Reiners Department of Civil and Environmental Engineering. Before joining Trine University, he spent a short time as a research associate with Institute for Multimodal Transportation at Jackson State University in Jackson, Mississippi.

His current research includes traffic flow modeling and simulation from both deterministic and stochastic perspectives, transportation system planning and travel behavior analysis, traffic system control and optimization, intelligent transportation system in particular the impacts of connected and autonomous vehicle on traffic operation and infrastructure management, emergency evacuation and disaster response in particular the evacuee decision-making behavior under emergent scenarios through agent-based modeling and simulation, and post-disaster transportation network resiliency and recovery problems.

For more information about his research, contact Dr. Haizhong Wang (Haizhong.Wang@oregonstate.edu).

Dr. Shane Brown joins OSU from the Washington State University where he has been for the past several years teaching in Civil Engineering. Shane earned his PhD in Corvallis. Shane is an expert in engineering education and is recognized for both his research and teaching expertise, with a National Science Foundation CAREER Award and the prestigious ASCE ExCEED National New Faculty Excellence in Teaching Award.

His research interests are in cognition and learning, with a particular emphasis on conceptual change and situated cognition. His conceptual change research examines why concepts are harder to learn than others and how to develop environments that facilitate understanding, particularly within transportation and solid and fluid mechanics. His situated cognition research explores differences in ways of knowing and how core concepts are used in engineering practice. His efforts to develop and assess research-based educational interventions aim to enhance success and improve how they assimilate complex engineering concepts. Brown has more than five years of professional engineering experience.

For more information about his research, contact Dr. Shane Brown (shane.brown@oregonstate.edu).

PacTrans 2013 Multi-Institution Research Projects

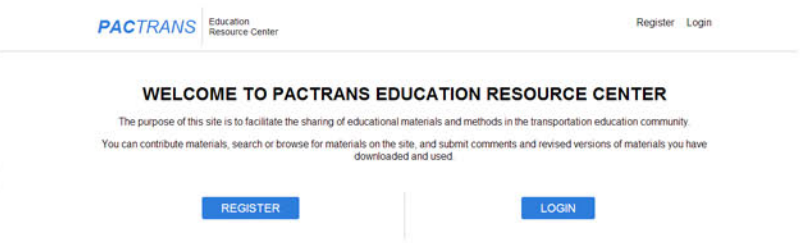
The following large regional projects started in the early fall 2013. As regional projects, they involve more than one institution and address transportation challenges in the Pacific Northwest Region. For more information on PacTrans research projects, visit the PacTrans website at www.pactrans.org.

EDUCATION: Refinement and Dissemination of a Digital Platform for Sharing Transportation Education Materials Phase II

Principal Investigators: William Cofer (WSU) and Shane Brown (OSU)

Co-Investigators: Dave Hurwitz (OSU), Robert Perkins (UAF), Linda Boyle (UW), Ahmed Abdel-Rahim (UI)

During the past year the project team has developed a prototype website, the PacTrans Transportation Education Resource Center (PPTERC), for sharing transportation curriculum and best practices. The research team used an action research approach to develop and refine the website and have uploaded approximately 100 different activities from educational experts in transportation education. An action research approach is an iterative cycle of research and application, in this case research on



the usability and adoptability of the site followed by site improvements. We have used an iterative process of collecting feedback from potential future users and using this information to develop and revise the site. The objective this year is to continue this strategic development process with the goal of having a functional web platform for the collection and dissemination of materials in the PNW and across the country. We will also develop a plan for long-term sustainability of the site.

For more information about this research, contact Dr. William Cofer (wcofer@wsu.edu) and Dr. Shane Brown (shane.brown@oregonstate.edu).

OUTREACH: Educating Teenage Drivers in the Pacific Northwest Regarding the Dangers of Distracted Phase II

Principal Investigator: David Hurwitz (OSU)

Co-Investigators: Linda Boyle (UW), Ahmed Abdel-Rahim (UI), Ghulam Bham (UAF), William Cofer (WSU)

Driver distraction can be defined as the diversion of driver attention away from the driving task, and it can result from factors both within and outside of the vehicle (Sheridan, 2004). It can include anything that distracts a driver from the primary task of driving and has been categorized as follows: visual (e.g. reading a map), auditory (e.g., listening to a conversation), biomechanical (e.g., tuning a radio), and cognitive (e.g. 'being lost in thought,' and 'looking but not seeing') (Ranney et al., 2000). Most distractions are actually a combination of these, thus it may be more useful to categorize distractions according to the task that drivers are engaged in while driving (rather than the combination of the forms of distractions). For example, cell phones are associated with cognitive, auditory, biomechanical, and potentially, visual distractions.

As teenage drivers gain moderate levels of experience, they also tend to have greater crash risks related to driver distraction when compared to drivers in other age groups (Lam, 2002). One proposed explanation for this is that younger drivers appear more willing to accept new technologies and devices than other drivers. As younger drivers become confident in their driving abilities, they tend to overestimate their ability to multitask with these devices while driving (Sarkar and Andreas, 2004). Poysti et al. (2005) also found that young drivers, from 18-to 24years old, were more likely to use their cell phones while driving than middle-aged drivers.

The goal of the study is to examine driver distraction among teenagers including what tasks they consider to be distracting as compared to their level of engagement in these same distracting tasks. This study differs from other studies in that a follow-up period will be used to identify differences in response based on feedback and education on distraction.

For more information about this research project, contact Dr. David Hurwitz (David.Hurwitz@oregonstate.edu) and Dr. Linda Boyle (linda@uw.edu).

PacTrans 2013 Multi-Institution Research Projects

Behavior of Drilled Shafts with High-Strength Reinforcement and Casing

Principal Investiagor: Armin Stuedlein (OSU)

Co-Investigator: Pedro Arduino (UW)

Drilled shafts provide significant geotechnical resistance for support of highway bridges, and are used throughout the States of Oregon and Washington to meet their structural foundation requirements. Due to changes in construction methods and poor near-surface soils, the use of permanent steel casing for drilled shaft installation has increased. However, geotechnical design models for axial and lateral resistance of drilled shafts are largely based on soil-concrete interfaces, not soil-steel interfaces associated with large diameter steel casing. Owing to the increased understanding of our regional seismic hazards, the amount of steel reinforcement used in drilled shaft construction has increased over the past several decades, creating a new construction concern for engineers: the increased steel area results in a reduced clearance between adjacent reinforcement bars in the steel cage, such that concrete has an increased difficulty in penetrating the cage, increasing the likelihood for voids and defects within the shaft, which can lead to poor structural and geotechnical performance.

The use of high-strength reinforcement steel can lead to increased clearance within the steel cage, mitigating concreting issues. The use of steel casing and the amount of steel area control the axial and lateral resistance of the shaft. However, depending on the method of construction, the steel casing may result in reduced axial load transfer to the surrounding soil. Thus existing analytical approaches need to be evaluated for modern construction methods, and new approaches developed if necessary to ensure desired performance criteria are met.

For more information about this research, contact Dr. Armin Stuedlein (armin.stuedlein@oregonstate.edu).

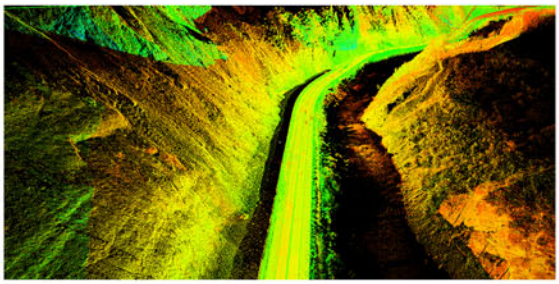
A Platform for Proactive Risk-Based Slope Asset Management Phase II

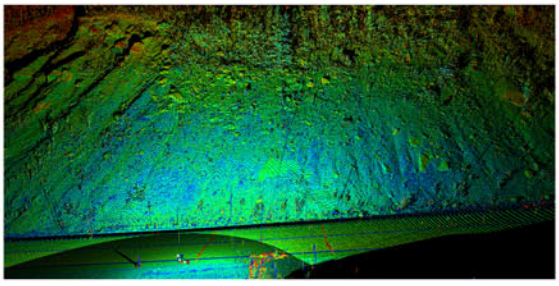
Principal Investigator: Keith Cunningham (UAF)

Co-Investigators: Michael J. Olsen (OSU), Joseph Wartman (UW)

Unstable slopes, including coherent landslides, rock falls, and debris flows, present significant risk to safety and regional commerce. This risk is a long-term concern that highway managers contend with on an on-going basis. The widespread spatial and temporal distribution of these landslides poses a number of challenges when deciding when, where, and how to allocate funds for mitigation efforts to maintain these assets. This challenge is compounded by the high level of effort currently required to survey, inspect and sample slopes for the purpose of condition assessment as part of an asset management program. Slope assessment has traditionally been costly and laborious, limiting it to a few sites. However, routine assessment is altogether necessary due to the potential consequences of a failure. Current best-practices for management do not necessarily facilitate proactive slope management – identifying and remediating hazardous conditions before a failure occurs.

The scope of the current PACTRANS-funded project Phase I, entitled "A Platform for Proactive Risk-based Slope Assessment" includes the development of qualitative relative risk model for slope stability assessment using terrain models created from Mobile laser scanning (MLS) data. In the second phase of the work, we will focus on quantitative time-series analysis using MLS data and integrating this information into the model developed in the first phase of research and into an agency's transportation asset/performance management program.





For more information about this research, contact Dr. Keith Cunningham (kwcunningham@alaska.edu).

PacTrans 2013 Multi-Institution Research Projects

Data Collection and Spatial Interpolation of Bicycle and Pedestrian Data

Principal Investgator: Michael Lowry (UI)

Co-Investigators: Yinhai Wang(UW), Mike Dixon (UI), Ahmed-Abdel Rahim (UI) and Mark Hallenbeck (UW)

It is very difficult to measure safety without knowing how many people use a facility. For this reason, millions of dollars and decades of research have sought to estimate and forecast travel demand, such as through the ubiquitous 4-step model. Unfortunately, existing methods are lousy for estimating pedestrian and bicycle volumes. In fact, most agencies forego expensive, data-intensive models and instead resort to simply using expert judgment when estimating pedestrian and bicycle volumes. Cities and state DOTs struggle to collect and utilize pedestrian and bicycle data in an effective and meaningful way.

This project will create new planning tools to estimate and forecast pedestrian and bicycle volumes. Local agencies and state DOTs can use the tools to help improve safety, prioritize capital improvement projects, and create transportation plans that improve overall quality of life by enhancing these modes.

For more information about this research, contact Dr. Michael Lowry (mlowry@uidaho.edu).

High Performance Bridge Systems for Lifeline Corridors in the Pacific Northwest

Principal Investigator: Marc Eberhard (UW)

Co-Investigators: Andre Barbosa (OSU), Dawn Lehman (UW), Charles Roeder (UW), John Stanton (UW), David Trejo (OSU)

Reinforced concrete bridges in seismic regions have changed little since the mid-1970s, when ductile details were first introduced. Nearly all bents (intermediate supports) are constructed of cast-in-place reinforced concrete and conventional reinforcing steel. Such bridges have served the PNW well in the past, but to meet current performance expectations, new structural systems are needed to improve: (1) speed of construction, (2) seismic resilience, (3) durability, and (4) life-cycle costs.

In this project, researchers will partner with Pacific NW DOTs to develop and evaluate the benefits of implementing three new strategies: (1) incorporation of high-strength steel into bridge columns, (2) replacement of cast-in-place columns with concrete-filled tubes, and (3) replacement of cast-in-place columns and beams with precast components. These strategies need to be evaluated considering the unique environmental and seismic conditions in the PNW.

For more information about this research, contact Dr. Marc Eberhard (eberhard@uw.edu).

Performance-Measure Based Asset Management Tool for Rural Freight Mobility in the Pacific Northwest

Principal Investigator: Jeremy Sage (WSU)

Co-Investigators: Ahmed Abdel-Rahim (UI), Kenneth Casavant (WSU)

MAP-21 establishes national objectives to increase productivity and economic efficiency of the nation's freight infrastructure. The recent passage of MAP-21 has placed an emphasis on integrating asset and performance management tools to help transportation agencies better manage the critical transportation infrastructure. Infrastructure performance management expands the more traditional definition of Asset Management to include measurement and reporting of how those assets achieve their targeted operational objectives. While congestion and bottlenecks in urbanized areas readily, and deservedly, catch the attention of policy makers, many miles of multimodal transportation occur prior to freight trips arriving in (or accrue after leaving) urban areas.

These miles and the ability to efficiently navigate them directly impact the productivity of the region's diverse transportation system. This project identifies and seeks to remedy performance measure gaps and freight mobility issues as they relate to identifying the appropriate infrastructure capacity to meet demand for both domestic and international economic competitiveness.

For more information about this research, contact Dr. Jeremy Sage (jlsage@wsu.edu).

Research Highlights

PacTrans 2012 Projects

The current PacTrans project portfolio is composed of projects of small, medium and large scopes. The small projects are designed to help foster pilot projects within each consortium university. The medium and large sized projects are designed to include one or more partner institutions. The following projects in this section are all first year projects, meaning that they started during the first year of PacTrans operations in 2012. Professor Cynthia Chen's project is a large, regional project, involving researchers from more than one institution. The remaining four are small projects.

Rolling Samples: An Innovative Survey Design to Capture Sustainable Travel Behaviors and Answer Questions of the Time

Household travel surveys, the primary data source for transportation planning analysis, are widely recognized to have many problems. Two of them are particularly salient: 1) the typical once-in-a-decade survey schedule prevents them from providing adequate answers to questions of the time and are vulnerable to the impacts of unexpected events; and 2) the conventional reliance on administrative or geographic boundaries in sampling often results in that sustainable travel behaviors such as walking and cycling cannot be adequately captured.

A recent study conducted by the University of Washington and the University of Idaho designed and implemented a 2-wave rolling sample survey to evaluate the potential of a rolling sample design to address these two issues. A rolling sample design is one that selects k non-overlapping probability samples and each sample is interviewed in a single time period until all samples are interviewed after k periods.

When carefully designed and administered, a rolling sample survey offers a pooled sample (pooled over multiple time periods) that is equivalent to a sample collected during a single survey period. This feature is demonstrated by collecting data in two independent waves in King County, Washington, and the results showed that the two waves are statistically similar in all aspects. It is also shown that by using the parcel-based sampling method, a sufficient amount of walking and cycling behaviors can be captured. Through analyzing the data, results reveal complex relationships among walking and cycling behaviors, the built environment and attitudes and perceptions.

For more information about this research, contact Dr. Cynthia Chen (qzchen@uw.edu).

Assessment of A New Screening Model for Siting Near-Road NO2 Monitors

EPA significantly revised its NO2 national ambient air quality standard in 2010. The current regulatory focus has shifted from assessment of longer-term (annual average) NO2 concentrations measured at locations away from busy roads to shorter-term (1-hour average) concentrations measured at locations near busy roads such as major freeways. It is not yet known exactly how many urban areas will be in attainment of the new standard due to a lack of historical near-road monitoring information. The answer is sensitive to the exact siting of these monitors with respect to the roadway.

Professor Tim Larson along with graduate students Mengyu Cai and Hui Cheng, assisted by John Williamson at the Washington State Department of Ecology, examined the feasibility of using a new plume dispersion model, the Quick Urban Industrial Complex (QUIC) model, to help locate potential near road monitoring sites and to assess the factors that influence the concentrations at these locations. The QUIC model has not been used for this application in the past, but has the advantage that it can account for the influence of buildings and other structures on the dispersion of exhaust plumes, in this case emitted from vehicles traveling along Interstate 5 in downtown Seattle (see figure). In addition to successfully adapting the model for this application, Professor Larson and his students also made measurements of NO2 at numerous locations near I-5 and compared these measurements with the predictions from the QUIC model. The model was able to identify those multi-block areas with the highest observed NO2 concentrations, whereas traditional roadway dispersion models were unable to do so. This approach provides additional insight into the extent and thus the overall significance of near-road NO2 "hot spots" and will help inform near-road monitoring efforts.

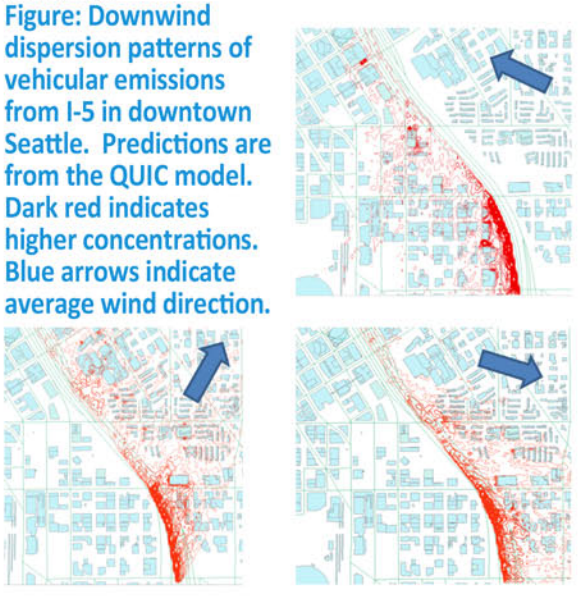


Figure: Downwind dispersion patterns of vehicular emissions from I-5 in downtown Seattle. Predictions are from the QUIC model. Dark red indicates higher concentrations. Blue arrows indicate average wind direction.

For more information about this research, contact Dr. Timothy Larson (tlarson@uw.edu).

Research Highlights

PacTrans 2012 Projects

Characterization of Frictional Interference in Closely-Spaced Reinforcements in MSE Walls

The use of reinforced earth in the United States began in 1972; since then, Mechanically Stabilized Earth (MSE) walls have grown in popularity, and can be found along nearly every state and interstate highway corridor. Due to their inherent flexibility, MSE walls are being constructed to greater heights, in non-linear geometries, with multiple tiers and with very tight reinforcement spacing. MSE walls will proliferate due to increasing urbanization, right-of-way issues, and wetland mitigation; in other words, they offer a sustainable alternative to conventional grade separation, due to reduced mining and hauling of earth materials and reduced footprint. However, our understanding of the working stress behavior, including reinforcement strains and displacements, of tall, single and multi-tier walls is unsatisfactory. The research conducted in this project aimed to address one of several knowledge gaps in the understanding of tall MSE wall behavior: prediction of reinforcement loads impacted by frictional interference of closely-spaced reinforcements associated with tall walls and/or walls in seismically active regions.

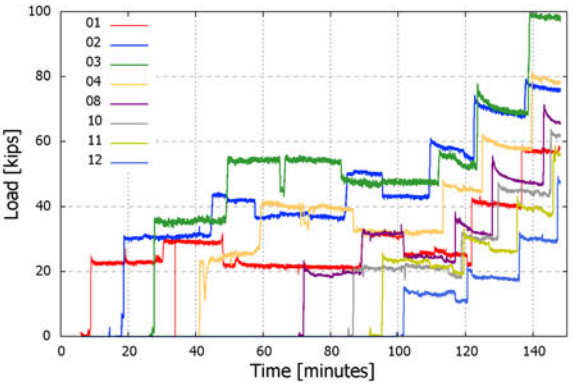
An experimental program requiring testing of the reinforced fill soil and the frictional behavior of the strips was required. Following an extensive large-diameter triaixal test program, the design and construction of two reinforcement strip pullout boxes was undertaken to observe the frictional behavior in single and multi-strip arrangements. More than twenty pullout tests were performed on single reinforcement strips; to-date, more than 8 multi-strip pullout tests have been performed in the large pullout box. Early results indicate that the confinement of strips installed with small spacing have a significant effect on the resistance to pullout generated by the strip; in other words, there appears to be significant interaction between closely-spaced reinforcement strips. This work aims to form the basis for changes to commonly used design models to produce more accurate estimations of the loading and resistance of closely-spaced MSE Wall reinforcement strips.

For more information about this research, contact Dr. Armin Stuedein (armin.stuedlein@oregonstate.edu).

Alaska Investigates Its High-mast Light Pole Anchor Rods

The Alaska Department of Transportation and Public Facilities (AKDOT&PF) thought that it had a nut loosening problem. But if researchers at the University of Alaska Anchorage (UAA), a member of the statewide Alaska University Transportation Center (AUTC), are correct, it more likely that it has a bolt stretching problem. ADOT&PF discovered several years ago that the anchor nuts on its High-mast Light Poles (HMLPs) were becoming loose after their initial installation. HMLPs are very tall (upwards of 170 feet) light poles used to illuminate major interchanges. There are approximately 120 HMLPs, mostly surrounding Anchorage, AK. Their light is crucial to traffic safety, particularly in Alaska's dark winters.

When the loose nuts were discovered, AKDOT&PF instituted an inspection and re-tightening program. So far this program has identified and fixed 171 loose nuts on 41 poles. But this program is expensive, and without knowing the cause, the department couldn't be sure that re-tightening the nuts was really solving the problem.



Top Right: Results of tightening procedure using instrumented anchor rods on a 12 rod HMLP

Bottom Left: Tightening strain-gaged anchor rods on an HMLP. Scott Hamel (UAA), left, Rod Blohm, center, and Taylor Medley (AKDOT&PF)

What the UAA researchers have found is that the anchor rods are likely being over-tightened using the current tightening procedure, and the steel in the rods is "yielding". This causes them to stretch significantly during their first large wind event. When maintenance workers return, it appears that the nuts are loose, because the rods are longer than they were initially.

The UAA team is now working with AKDOT&PF to develop a new tightening procedure, improved baseplate designs for new HMLPs, and retrofits for the existing poles.

For more information about this research, contact Dr. Scott Hamel (sehamel@uaa.alaska.edu).

Research Highlights

PacTrans 2012 Projects

Evaluating the Effectiveness of Recycled Concrete as Aggregate in New Concrete Pavement

Figure (left) Deteriorated Concrete Pavement; (right) Construction of New Concrete Pavement Containing Recycled Concrete

Recycled concrete is a proposed solution to environmental, sustainability, and financial concerns inhibiting the repair and replacement of the national highway system within Washington State. It is important to consider cost-effective and sustainable alternatives in concrete pavement construction because the majority of the concrete pavements have greatly exceeded designed service lives and are in dire need of reconstruction.

Research being performed at Washington State University, by Dr. Haifeng Wen, Dr. Dave McLean, Spencer Boyle, Tim Spry, Danny Mjelde, has been focused on the effectiveness of recycling concrete to obtain an alternative source of aggregate in new concrete pavements. The research at Washington State University focused on the aggregate properties of RCA as well as the effects it has on various fresh and hardened concrete properties including slump, air content, density, compressive strength, modulus of rupture, coefficient of thermal expansion, drying shrinkage, and freeze-thaw durability.

Test results have been positive in terms of RCA's viability. The effects of RCA on all concrete properties have been promising; typically no effect or a very small reduction in performance values occurred. Ultimately, the research has shown that RCA can effectively be used as an alternative to natural aggregate. Further research will be necessary to determine if higher replacement rates of RCA for natural aggregate should be used. Additionally, research into long-term durability performance of RCA concretes would be worthwhile.

For more information about this research, contact Dr. Haifeng Wen (haifang_wen@wsu.edu).

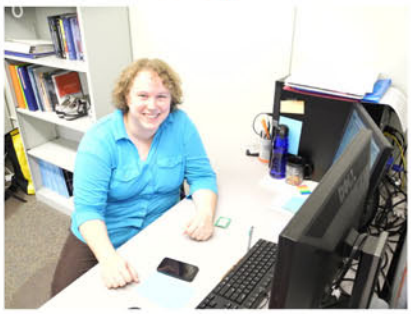
Education

UW CEE Graduate Students Get Improved Study Area

As the new academic year began, the Civil and Environmental Engineering Department at the University of Washington unveiled the new graduate student area dedicated to transportation and construction graduate students. This facility contains ten desks for individual student use in between classes or after hours, white boards for collaborative group work, and 21 lockers for students to store personal items. Renovations on the area were fully completed on September 27th, 2013. The area is frequently used by students as a quiet area to study for exams, to collaborate on homework assignments and projects with peers. Graduate students have found it to be a peaceful environment that also allows for direct interaction with faculty

Left: New Graduate Student Study Area for Transportation and Construction students.

PacTrans Supports UW Students at AEG Meeting in Seattle, WA



Lisa Dunham, a Geotechical engineering graduate student at University of Washington, recently gave a talk at the Association of Environmental and Engineering Geologists (AEG) meeting held in Seattle Washington from Sept 8-14. This conference focused on Applied Geology and topics ranged from Landslides to Volcanoes. The PacTrans project Lisa works on, "A Proactive Platform for Risk-Based Slope Asset Management", is a collaboration between the University of Washington, Oregon State University, and the University of Alaska, Fairbanks. Using mobile LiDAR, this project is researching the ability to find morphological indices, such as roughness, to determine the likelihood of failure to allow Department of Transportations a tool to assess geologic assets in a more automated and in-depth fashion.

Right: Lisa Dunham, graduate student at the UW, who participated in the September AEG Meeting

Meet the PacTrans Board of Directors

Yinhai Wang, Ph.D
Director
University of Washington

Linda Boyle, Ph.D.
Associate Director of Research
University of Washington

Anne Vernez-Moudon, Ph.D.
Associate Dir. of Education
University of Washington

Mark Hallenbeck, M.S.
Associate Director of Outreach,
University of Washington

Chris A. Bell, Ph.D.
Associate Director at Oregon State University

Billy Connor
Associate Director at the University of Alaska, Fairbanks

Kenneth L. Casavant, Ph.D.
Associate Director at Washington State University

Karen R. Den Braven, Ph.D.
Associate Director at the University of Idaho

Meet the PacTrans External Advisory Board

Jerry Whitehead
Chairman of the Idaho Transportation Department

Ned Parrish
Research Program Manager for the Idaho Transportation Department

Clint Adler, P.E.
Alaska Dept. of Transportation & Public Facilities

Edward Mantey
Vice President of Toyota Vehicle Planning, Corporate Strategy, Technical Administration

Wayne Kittelson
Kittelson & Associates

Charlie Howard
Dir. of Integrated Planning for Puget Sound Regional Council (PSRC)

Leni Oman
Director of Research and Library Services, Washington State Department of Transportation

Michael Bufalino
Research Manager, Oregon Department of Transportation

Scott Drumm
Mgr., Research & Strategic Analysis Dept. at the Port of Portland, Portland, Oregon

For contact information and Board member bios see PacTrans website: http://www.pactrans.org