



Program Progress Performance Report for University Transportation Centers

Prepared for the USDOT Research and Innovative Technology Administration (RITA)

Project title: **Pacific Northwest Transportation Consortium (PacTrans): Using Technological Advances to Develop Data-driven, Sustainable Solutions for the Diverse Transportation Needs of the Pacific Northwest**

RITA Sponsor Award Number: DTRT12-G-UTC10

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Report #4, PPPR reporting on six months (July 1, 2013 – December 31, 2013)

1. Accomplishments

- **What are the major goals and objectives of the program?**

PacTrans focuses on using technological advances to develop data-driven, sustainable solutions for the diverse transportation needs of the Pacific Northwest. Major goals and objectives of PacTrans include: serving as Region 10's research engine, applied technology showcase, workforce development base, educational leader, information center, and collaboration platform.

- **What was accomplished under these goals?**

During the six month period (from July 1 – December 31, 2013), we have conducted several key activities to ensure our region's transportation expertise contributes to the advancement of the nation and region's transportation workforce development, education, research, technology transfer, and outreach including K-12. Worth noting is the following:

- PacTrans funded the following seven new multi-institution research projects:
 1. Education: Refinement and Dissemination of a Digital Platform for Sharing Transportation Education Materials Phase II
 2. Outreach: Educating Teenage Drivers in the Pacific Northwest Regarding the Dangers of Distracted Driving Phase II
 3. Behavior of Drilled Shafts with High-Strength Reinforcement and Casing
 4. A Platform for Proactive Risk-Based Slope Asset Management Phase II
 5. Data Collection and Spatial Interpolation of Bicycle and Pedestrian Data
 6. High Performance Bridge Systems for Lifeline Corridors in the Pacific Northwest
 7. Performance-Measure Based Asset Management Tool for Rural Freight Mobility in the Pacific Northwest
- PacTrans also funded 25 small research projects to support investigations of innovative ideas potentially influential and transformative. Project information can be found on the PacTrans website (<http://depts.washington.edu/pactrans/research/>). All projects are currently in progress.
- Final reports for PacTrans' first year projects are currently being reviewed and will be posted on the PacTrans website when approved.
- PacTrans' External Advisory Board met with the PacTrans Board of Directors on October 17, 2013 to review the previous year's progress towards meeting the major goals and objectives of the program, as well as to strategize on the upcoming year's activities.
- PacTrans held its first annual transportation conference entitled, "Transportation Decision Making in the Big Data World" on October 18, 2013. The conference, which brought together over 160 participants from various transportation agencies, universities, and industry in Alaska, Idaho, Oregon, and Washington, served three major purposes: (1) to provide an opportunity for transportation leaders to review and update critical transportation issues for Region 10

transportation professionals to address, (2) to establish a forum for PacTrans researchers to share research ideas on data-driven solutions to transportation problems, and (3) to provide a platform for PacTrans to showcase its research products for potential applications and technology transfer.

- PacTrans student leaders organized a Region 10 Student Conference on October 19, 2013, on the UW campus. Students chose three topic areas to focus on in this conference: database research, sustainability and the environment, and human factors in transportation.
- A Region 10 transportation safety workshop was held on December 9, 2013 to seek safety issues of regional importance. Approximately 40 people from all four states, representing transportation agencies, research institutes, and industry, attended the workshop. A brainstorming session helped generate a prioritized list of safety research topics that forms the basis for the proposed projects in this proposal. Those projects not addressed immediately but of regional importance will be potential topics for future PacTrans research projects. In the new funding cycle, PacTrans plans to continue this annual safety workshop, which created a true collaboration of ideas among our regional stakeholders, transportation agencies, and local industries.
- The PacTrans Seminar Series, which launched in Fall 2012, organized a November 2013 seminar on the UW campus, which attracted many students, faculty, staff, and transportation professionals in the Pacific NW region who engage in transportation research and practice. This PacTrans Seminar talk was broadcast over the Internet in real time to provide remote audiences an opportunity to listen and ask questions. The speaker was Beaman Professor of Civil & Environmental Engineering and Director of Safety Programs-Center for Transportation Research at University of Tennessee, Knoxville, Dr. Asad Khattak, who spoke on the level of volatility in instantaneous driving decisions.
- Each consortium partner also hosted their own academic exchange events with PacTrans support. The University of Washington invited a number of recognized professionals from research institutes, industry, and transportation agencies to visit the UW campus and shared their research findings and success stories with faculty and students.

For example, Washington State University's Freight Policy Transportation Institute (FPTI) in the Transportation Research Group of the School of Economic Sciences, and PacTrans sponsored the following two seminars at WSU in 2013:

1. "Relationship between vehicle miles traveled and economic activity as measured by gross domestic product," by OSU Professor B. Starr McMullen in August 2013.
2. "Coal Demand and Transportation," by UO Professor Wesley Wilson in November 2013.

- **What opportunities for training and professional development have the program provided?**

The vast majority of research projects involve graduate students, which also provide many opportunities to work with state and local transportation agencies. By involving students, PacTrans provide students an invaluable opportunity to develop skills they need to be successful in their future careers in academia, industry, and government. The intern program between PacTrans and WSDOT continued to

offer great training opportunities for undergraduate students. PacTrans worked with regional industry (e.g. Transpo) and transportation agency partners (e.g. Seattle DOT) to initiate many new intern positions for graduate students. Additionally, starting this past summer, PacTrans initiated a new internship program for promising young high school students. The driving force behind this program is to introduce young people to transportation engineering before university by getting them involved in research projects.

- **How have the results been disseminated? If so, in what way/s?**

PacTrans has a strong outreach program to local and state transportation agencies and private partners in the region, through which PacTrans research outcomes are presented and demonstrated. Several outcomes of Region 10 UTC funded research projects have been showcased in invited talks, conference presentations, and archival publications. PacTrans promotes research outcomes through social media, such as the PacTrans website and Twitter, as well as in the annual report and quarterly newsletter. In each newsletter issue, which is distributed widely to over 300 subscribers, several research project findings are highlighted. Also, in our Region 10 Transportation Conference, held on the UW campus in October 2013, all projects were presented in the poster session.

- **What do you plan to do during the next reporting period to accomplish the goals and objectives?**

- PacTrans will continue to follow its implementation plan to ensure that all PacTrans funded research, education, and outreach activities move forward as scheduled.
- We are currently planning several public talks as part of the PacTrans seminar series for winter and spring 2014. As with all PacTrans seminars, the talks will be open to the PacTrans university community as well as the entire Pacific NW transportation community. For those who cannot attend in person, we will continue to make the talk available as a webinar through GoTo Meeting.
- PacTrans will host a regional workshop on transportation research to identify transportation issues of regional importance.
- PacTrans will work with our technology transfer committee to identify research products with a potential for technology transfer from Year 1 research and work with interested agencies and companies to facilitate the process.
- Products from the PacTrans education research project will be tested and evaluated for possible use in transportation programs in Region 10 and possibly other regions.
- We will continue to enhance the PacTrans website to include additional information about our projects and research findings, and future research opportunities.

2. Products (for the reporting period of January 1 – June 30, 2013)

	PacTrans Total	UW	WSU	UI	OSU	UAF
Publications: peer reviewed journal articles	74	24	12	1	37	0
Publications: Book chapters and other edited manuscripts	7	3	1	2	1	0
Conference papers	65	11	11	5	38	0
Conference presentations	72	20	7	5	39	1
Lectures/Seminars /Workshops/ Invited Talks	27	22	2	0	2	1
Inventions, patent applications, and/or licenses	0	0	0	0	0	0
Other products: data or databases, physical collections, audio or video products, software or NetWare, models, educational aids or curricula, instruments, or equipment	6	3	1	1	1	0

- **Examples of peer reviewed journal articles**

Chiaromonte, M.M., Arduino, P., Lehman, D.E., and Roeder, C.W. Seismic Analysis of Conventional and Improved Marginal Wharves. *Earthquake Engineering and Structural Dynamics*, 42 (10), 1435-50, 2013.

Khaleghi, B., Schultz, E., Seguirant, Steve, Marsh, M.L., Haraldsson, O.S., Eberhard, M.O. and Stanton, J.F. Accelerated Bridge Construction in Washington State -- From Research to Practice. 2013 reprint of 2012 publication, to appear in *Concrete Journal, Japanese Concrete Institute*. In Japanese.

Moon, J., Lehman, D.E., Roeder, C.W., and Lee, H-E. Evaluation of Embedded Concrete Filled Tube (CFT) Column-to-Foundation Connections. *Engineering Structures*, 56, 22-35, Elsevier, 2013.

Palmer, K.D., Roeder, C.W., Lehman, D.E., Okazaki, T., and Shield, C.K. Experimental Performance of Two-Story, One-Bay by One-Bay Steel Braced Frame Systems. *Journal of Structural Engineering*, 139 (8), 1274-84, ASCE, Reston, VA, 2013.

Tsai, C-Y, Tsai, K-C, Lin, P-C, Ao, W-H, Roeder, C. W., Mahin, S.A., Lin, C-H, Yu, Y-J, Wang, K-J, Wu, A-C, Chen, J-C, and Lin, T-H. Seismic Design and Hybrid Testing of a Full-Scale 3-Story Concentrically Braced Frame Using In-Plane Buckling Braces. *Earthquake Spectra, Earthquake Engineering Research Institute*, 2013.

- **Example of book chapters and other edited manuscripts**

Sage, J., Casavant, K., Goodchild, A., McCormack, E., McMullen, S., Wang, Z., Holder, D. Development of a Freight Benefit/Cost Methodology for Project Planning. Washington State Department of Transportation, WA-RD 815.1, July 2013.

- **Examples of conference papers**

Casavant, K., McCracken, V., Nguyen, D., Sancewich, B., Jessup, E., McCluskey, J. and Sage, J. Examining Agribusiness Shippers' Responses to Regulatory Change. Presented at the *13th World Conference on Transportation Research* in Rio de Janeiro, Brazil, July 15-18, 2013.

Clayton, P.M., Dowden, D.M., Li, C.-H., Berman, J.W., Lowes, L.N., Bruneau, M., Tsai, K.- C. Pseudo-dynamic Testing of Self-Centering Steel Plate Shear Walls. *Proc. 5th International Conference on the Advances in Experimental Structural Engineering*, Taipei, Taiwan, November, 2013.

- **Examples of conference presentations**

Bham, Ghulam. The Value of Depressed Medians on Divided Highways in Alaska Gave project presentation AKDOT, Anchorage, AK, October 2013.

Casavant, K., McCracken, V., Nguyen, D., Sancewich, B., Jessup, E., McCluskey, J. and Sage, J. Examining Agribusiness Shippers' Responses to Regulatory Change. Presented at the *13th World Conference on Transportation Research* in Rio de Janeiro, Brazil, July 15-18, 2013.

Cunningham, Keith. A Platform for Proactive Risk-based Slope Asset Management Poster Presentation: *Region 10 Pac Trans Conference*, Seattle, WA, October 2013.

Sage, J., K. Casavant, J.B. Eustice, and Y. Zhou. Washington State Commodity Flows: Perishable Goods' Mitigation of Extended Weather Induced Road Closures. Presented at the *Food Distribution Research Society Annual Meeting* in Chicago, IL, October 7-8, 2013.

Taylor, J., K. Casavant, J. Sage, and B. Ivanov. The Cost of Congestion: The True Costs of Slowing the Distribution Networks. Presented at the *Food Distribution Research Society Annual Meeting* in Chicago, IL, October 8th, 2013.

Wang, B.S., Berman, J.W., Roeder, C.W., and Lehman, D.E. Estimation of the Maximum Von Mises Stress in the Steel Truss Bridge Gusset Plate Connections. *Proceedings of the 30th International Bridge Conference*, Pittsburgh, PA, June 2013.

Wang, B.S., Berman, J.W., Jost, S., Roeder, C.W., and Lehman, D.E. Re-Evaluating the Effect of Connection Length in Riveted Steel Connections. *Proceedings of the 30th International Bridge Conference*, Pittsburgh, PA, June 2013.

Xiao, Feng. Phase II Structural Health Monitoring and Condition Assessment of Chulitna River Bridge, Poster Presentation: *Region 10 PacTrans Conference*, Seattle, WA, October 2013.

- **Example of lectures/seminars/workshops/invited talks**

Hamel, Scott. Investigation of High Mast Light Poles Presentation at AKDOT Bridge Design, Juneau, AK, 11/2013 *Seminar* at UAA School of Engineering for Professionals, Anchorage, AK, Nov. 2013

- **Examples of technologies or techniques**

Kun, A., Boyle, L.N., Reimer, B., Reiner, A. Interacting with technology in vehicles: Perspectives from the Automotive UI 2012 conference. *IEEE Pervasive Computing*, 12, 2, 80-82, 2013.

Richard, C.M., Campbell, J.L., Lichty, M., Brown, J.L., Chrysler, S., Lee, J.D., Boyle, L., Reagle, G. Motivations for Speeding, Volume I: Summary report (Report No. DOT HS 811 658). Washington, DC; National Highway Traffic Safety Administration, 2013.

- **Scheduled known academic talks for upcoming reporting period (Jan. 1 – June 30, 2014)**

Sage, J., K. Casavant, Y. Zhou, J.B. Eustice. The Search for Commodity Flow Data: Just Stop and Ask Them. To be Presented at the Transportation Research Forum Annual Meetings in San Jose California, March 2014.

Sage, J., K. Casavant, A. Miller, J. Maxwell. Freight Asset Management: Threshold and Viability Analyses of Freight Multi-Modal Facilities. To be Presented at the Transportation Research Forum Annual Meetings in San Jose California, March 2014.

Wang, Y. Big Data to Big Discoveries and Big Decisions: Challenges and Opportunities for Transportation Professionals. To be presented at the *RITA Transportation Innovation Series*, in Washington, D.C., February 19, 2014.

3. Participant and Collaborating Organizations: Who has been involved?

- **What individuals have worked on the program?**

- PacTrans Director, Yin Hai Wang, Ph.D., professor of Civil and Environmental Engineering at the University of Washington (UW), devotes 50 percent of his time directing PacTrans. Dr. Wang has overall responsibility for program management, oversight of PacTrans operations, including the Research Committee, the Education and Workforce Development Committee, and the Outreach and Technology Transfer Committee, and Student Leadership Council. He is the regional and national leadership for PacTrans, and the contact person for management relationships with USDOT Research and Innovative Administration (RITA) and other USDOT organizations.
- PacTrans Associate Director in Research, Linda Ng Boyle, Ph.D., associate professor with joint appointments in Industrial and Systems Engineering, and Civil and Environmental Engineering at the

UW spends 15 percent of her time managing the research program for PacTrans and coordinates the research collaboration across the five partner institutions.

- PacTrans Associate Director in Education and Workforce Development, Anne Vernez-Moudon, Dr. es SC, Professor of Architecture, Landscape Architecture, and Urban Design and Planning, Adjunct Professor of Epidemiology and in Civil and Environmental Engineering, devotes 10 percent of her time leading the Education and Workforce Development Committee. She is involved in curriculum changes, professional training program development, and educational enhancements among the partner institutions.
- PacTrans Associate Director in Outreach, Mark Hallenbeck is also the Director of the Washington State Transportation Center (TRAC) office located at the UW. Mr. Hallenbeck works closely with Associate Director Anne Vernez-Moudon on organizing student seminars, internships and fellowship programs.
- PacTrans Associate Director in Oregon State University (OSU), Chris Bell, Ph.D., professor of Civil and Environmental Engineering at OSU, devotes 10 percent of his time to managing and organizing the education, outreach, and research activities within OSU. He coordinates all results and outcomes with the UW on a regular basis.
- PacTrans Associate Director in the University of Alaska Fairbanks (UAF), Billy Connor, Director of the Alaska University Transportation Center (AUTC), devotes 10 percent of his time to managing and organizing the education, outreach, and research activities within UAF. He coordinates all results and outcomes with the UW on a regular basis.
- PacTrans Associate Director in University of Idaho (UI), Karen Den Braven, Ph.D., professor of Mechanical Engineering at UI, devotes 10 percent of her time to managing and organizing the education, outreach, and research activities within UI. She coordinates all results and outcomes with the UW on a regular basis.
- PacTrans Associate Director in Washington State University (WSU), Ken Casavant, Ph.D., professor and transportation economist in the School of Economic Sciences at Washington State University (WSU) and Director of WSU's Freight Policy Transportation Institute, devotes 10 percent of his time to managing and organizing the education, outreach, and research activities within WSU. He coordinates all results and outcomes with the UW on a regular basis.
- Center staff at the UW includes full-time Assistant Director, Ms. Meghan MacKrell, who devotes 100 percent of her time to the day-to-day operations in support of the PacTrans mission. Her responsibilities include project management, grant management, social media and outreach, and managing the PacTrans operations team. PacTrans also has a second full-time Fiscal Specialist, Ms. Eva Lu, who devotes 100% of her time to fiscal matters of the center and projects. Additionally, PacTrans has a number of grad students who help out on various projects.

- The Student Leadership Council, composed of graduate students at all Consortium partner universities, is an active part of the PacTrans management structure. The Student Leadership Council facilitates student and center communications and plans their own activities. For example, one important student event was the PacTrans schedule is the Region 10 Student Conference, held on the UW campus October 19, 2013. Leaders of the three UTCs in this region – PacTrans, the National Institution for Transportation and Communities (NITC), and Transportation for Livability by Integrating Vehicles and the Environment (TranLIVE) –all assisted in the sponsorship of this conference.
- Additionally, PacTrans has 23 fulltime faculty at the UW engaged in transportation research. Our consortium partners (OSU, UI, WSU, UAF) have 39 fulltime faculty directly involved in PacTrans research.
 - **What other organizations have been involved as partners?**
- The state transportation agencies in Alaska, Idaho, Oregon, and Washington have all been extensively involved in PacTrans in terms of research, outreach, and technology transfer activities. Their research office directors are members of our PacTrans External Advisory Board (EAB), which provides strategic oversight to the PacTrans Board of Directors. In addition to the state DOTs, many other public transportation agencies and private companies are also actively involved in PacTrans activities.
- The PacTrans EAB provides strategic guidance to the PacTrans Board of Directors. In addition to state DOT members on the PacTrans EAB, membership includes a representative from Toyota Corporate, Port of Portland, the Puget Sound Regional Council (PSRC), as well as a representative from Idaho industry, Western Trailers.
- PacTrans also collaborates with Portland State University’s UTC (NITC) and University of Idaho’s TranLIVE on various Region 10 events.

4. Impact

- **What is the impact on the development of the principal discipline(s) of the program?**

The impact to our transportation program has been quite substantial and reaches across our education program, our collaboration with others in the region, and the research we can do on a regional level, which has outcomes of national importance.

Specifically, the following impact has been observed:

- Collaborative research teams have been built to address several critical transportation problems of regional importance through our multi-institutional research projects. As transportation agencies of multiple states are involved in these research efforts and work closely with our faculty and students, our education curriculums will be strengthened with our clear understanding of needs from our region.
- Our new conceptual investigation projects produced interesting research results that can be new course materials and lead to new research directions. Particularly, we developed two new sensors and tools for measuring traffic movements, including pedestrian movements that are potentially influential.
- Three extra courses taught by external instructors with great practical experience were added to our transportation curriculum due to PacTrans support.
- Our educational research project with all five consortium partners involved has produced educational modules potentially valuable for any other universities to use for transportation education. The modules are currently being tested.
- Our outreach project on distracted driving has reached out to over 10 high schools and delivered numerous presentations to high school students to educate teenage drivers the negative impact of distracted activities on driving. Highly positive feedback has been received from high schools involved in this project.
- Our regional seminars and conferences offer great inputs for our curriculum reform and research initiative development. A set of research topics and training workshops have been identified for future PacTrans activities and support.

- **What is the impact on other disciplines?**

Faculty of multiple other disciplines worked directly or collaboratively with transportation faculty in our consortium. During this reporting period, we communicated and collaborated with professionals in environmental engineering, electrical engineering, computer science and engineering, public health, and mathematics for various PacTrans activities. Our regional transportation needs are clearly delivered to people from these relevant disciplines. They will join our effort in development of data-driven, sustainable solutions for the diverse transportation needs of the Pacific Northwest.

- **What is the impact on transportation workforce development?**

PacTrans is continuing our solid progress in transportation workforce development. In addition to the award-winning intern program with WSDOT, PacTrans is developing new intern programs for students with public and private partners. Examples are the intern programs with Seattle Department of Transportation and with Transpo, Inc. We are working with these partners to develop a new platform to facilitate the match between our partner employers and PacTrans students seeking for intern. Additionally, we invited 16 external speakers to deliver talks to our seminars and training workshops. For example, the City of Lynnwood transportation engineering, Paul Coffelt, delivered a great training session on traffic signal control. The WSDOT transportation engineering John Nisbet also delivered a talk to the UW transportation students on transportation system operations. Also, discussions are ongoing with Seattle City Traffic Engineer and ITE Washington president Dongho Chang, on re-establishing

Transpeed, a short-term transportation training program for working professionals. Furthermore, the four online transportation degree granting programs are performing very well and serving over 120 continuing education students each year.

- **What is the impact on physical, institutional, and information resources at the university or other partner institutions?**

PacTrans has funded seven regional projects and 15 small projects in 2012 and another seven regional projects and 25 small projects in 2013. These projects definitely add new physical, institutional, and information resources and facilitate cross sharing of existing resources. Research laboratories of PacTrans consortium partners working on PacTrans projects added new research equipment, software tools, and other academic resources as part of their research efforts. For example, the UW STAR Lab developed a Kinect-based pedestrian detection system through a PacTrans funded regional project led by the UI in the 2012-2013 academic year. Data collected through these research projects and publications of the findings will be new resources available for public access.

- **What is the impact on technology transfer?**

PacTrans emphasizes technology transfer and involves relevant parties early in those funded projects with a technology development component. Its regional transportation conference in October 2013 offered a great platform for researchers and practitioners to talk about potential technologies for transfer. Also, the PacTrans STAR Lab maintains the state of the practice hardware currently utilized by WSDOT and other local transportation agencies. These hardware and software applications utilized in UW transportation courses and research are helpful for researchers to target the right problems for technology development.

- **What is the impact on society beyond science and technology?**

As mentioned earlier, our outreach project directly addresses the safety needs of teenage drivers. PacTrans researchers also actively participated in discussions of important regional transportation issues. Given that transportation ties to everyone's daily life, our activities are definitely far-reaching to everyone's life. Through the regular open house events and other international exchange events, PacTrans research labs have received thousands of visitors and demonstrated our research products to the general public

5. Changes/Problems

None.

6. Special Reporting Requirements

None.