



Program Progress Performance Report for University Transportation Centers

Prepared for the USDOT OFFICE OF THE ASSISTANT SECRETARY FOR RESEARCH AND TECHNOLOGY

Project title: Pacific Northwest Transportation Consortium (PacTrans): Developing Data Driven Solutions and Decision-Making for Safe Transport in the Pacific Northwest

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Report #1, PPPR reporting (June 30, 2014 – March 31, 2015)

1. Accomplishments

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

Pacific Northwest Transportation Consortium (PacTrans) consists of institutions from all four states in our region with the University of Washington (UW) as the lead and Oregon State University (OSU), University of Alaska Fairbanks (UAF), University of Idaho (UI), and Washington State University (WSU) as partner institutions. PacTrans' theme centers on "Developing Data Driven Solutions and Decision-Making for Safe Transport". PacTrans will serve as a focal point within Region 10 to develop initiatives and facilitate collaborative activities with regional partners to maximize the effectiveness of their collective services and programs toward the U.S. Department of Transportation (USDOT) strategic goal of Safety. 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 reporting period, our major activities followed our implementation plan and aimed to ensure our region's transportation expertise contributes to the advancement of the national and regional transportation workforce development, education, research, technology transfer, and outreach including K-12. Worth noting is the following:

- As Region 10's research engine, PacTrans has selected four multi-institutional general research projects (coded with MG), one multi-institutional education research project (coded with ME), one multi-institutional outreach project (coded with MO), and eleven single-institutional research projects (coded with SR and university acronym):

MG-1: Bicycle Safety Analysis: Crowdsourcing Bicycle Travel Data to Estimate Risk Exposure and Create Safety Performance Functions (Research team: OSU, UI, and UW)

MG-2: Mixed Use Safety on Rural Facilities in the Pacific Northwest (Research team: UAF and UI)

MG-3: Unmanned Aircraft System Assessments of Landslide Safety for Transportation Corridors (Research team: UAF, OSU, and UW)

MG-4: Regional Map Based Analytical Platform for State-Wide Highway Safety Performance Assessment (Research team: WSU and UW)

ME-1: Safety Data Management and Analysis: Addressing the Continuing Education Needs for the Pacific Northwest (Research team: UI, OSU, UAF, OSU, and UW)

MO-1: Mitigation of Lane Departure Crashes in the Pacific Northwest through Coordinated Outreach (Research team: OSU, UAF, UI, UW, and WSU)

SR-OSU-1: Development of Low-Cost Wireless Sensors for Real-Time Lifeline Condition Assessment

SR-OSU-2: Cost-Effective Bridge Safety Inspections Using Unmanned Aerial Vehicles (UAVs)

SR-OSU-3: 3D Virtual Sight Distance Analysis Using Mobile LIDAR data

SR-OSU-4: Fault Tree Analysis for Accident Prevention in Transportation Infrastructure Projects

SR-UI-1: Evaluation of Ultra-wideband Radio for Improved Pedestrian Safety at Signalized Intersections

SR-UI-2: Modeling Passing Behavior on Two-Lane Rural Highways: Evaluating Crash Risk under Different Geometric Conditions

SR-UW-1: Relationships among Worker Gender, Communication Patterns, and Safety Performance in Work Zones

SR-UW-2: An Evaluation of Safety Impacts of Seattle's Commercial Delivery Parking Pricing Project

SR-UW-3: Safe Main Street Highways (SMSh)

SR-WSU-1: Determination of Creep Compliance and Indirect Tensile Strength for Mechanistic-Empirical Pavement Design Guide (MEPDG)

SR-WSU-2: Evaluation of the Social Cost of Modal Diversion: A Multi-Modal Safety Analysis

- The 2014 PacTrans Regional Transportation Conference was held successfully on October 17, 2014. The conference theme was "The IOUs of Safety – Infrastructure, Operations, and Users." Over 170 transportation professionals gathered at the University of Washington (UW) to attend this conference packed with the latest research findings and innovations achieved by PacTrans researchers. Participants came from across the Pacific Northwest, representing transportation agencies, universities, and private companies from all four states in Region 10 (Alaska, Oregon, Idaho, and Washington). The purpose of this conference was to create opportunities for PacTrans researchers, government officers, and transportation practitioners to come together to share research results, identify research needs, facilitate technology transfers, network, and form potential collaborations. More details of this important event can be found online from the PacTrans Special Issue Newsletter (http://depts.washington.edu/pactrans/wp-content/uploads/2014/11/PacTrans_Conference_2014.pdf).
- Jointly sponsored by PacTrans and the UW student chapter of the Washington Institute of Transportation Engineers (ITE Washington), the Region 10 Student Conference was held on October 18, 2014. Transportation student representatives from all four states in Region 10 assembled at the UW and learned about new transportation research occurring in the Pacific Northwest and how to prepare for success in the professional world of transportation engineering. Wayne Kittelson, the Founding Principal of Kittelson & Associates and member of the PacTrans External Advisory Board (EAB), delivered the keynote speech on career

opportunities in transportation engineering. Mark Hallenbeck, associate director of PacTrans and director of Washington State Transportation Center (TRAC) also attended this Region 10 Student Conference and delivered a talk on engineering communications.

- PacTrans hosted the Autumn Regional Transportation Seminar on November 5, 2014. Professor Michael Cassidy of UC Berkeley, Director of the Region 9 University Transportation Center funded by US Department of Transportation, was the speaker. Dr. Michael Cassidy is Chancellor's Professor of Civil and Environmental Engineering at UC Berkeley, and Director of the University of California Center on Economic Competitiveness in Transportation. His lecture entitled "Lessons Learned from Spatiotemporal Studies of Freeway Carpool Lanes" attracted more than sixty participants on site and multiple remote participation sites through the webinar link. This PacTrans Regional Transportation Seminar is video recorded and can be accessed online at http://mediasite6.pce.uw.edu/Mediasite/Catalog/catalogs/PacTrans_Seminar_Nov5.
- PacTrans was a non-financial co-sponsor for the ARTBA 2014 TransOvation Workshop. This was the fourth annual Dr. J. Don Brock TransOvation Workshop that was held November 17 – 19, 2014 at Microsoft Corporate Headquarters in Redmond, Washington. Transportation design and construction professionals gathered to hear from research institutes, private sector, and government thought leaders on the potential impact of big data and other technological and social changes on transportation infrastructure over the next 15 years. More than ten PacTrans researchers attended this workshop. Professor Yinhai Wang, director of PacTrans, spoke about PacTrans research on transportation big data at this TransOvation workshop.
- PacTrans joined over 12,000 people for the world's largest gathering of transportation professionals at the Transportation Research Board (TRB) 94th Annual Meeting. Held from January 11 – 15, the conference met at the Walter E. Washington Convention Center in Washington, D.C and attracted researchers, practitioners, and representatives of government, industry, and academia from around the world. The 2015 TRB annual meeting represented an important opportunity to demonstrate PacTrans' research and educate upcoming transportation professionals. PacTrans researchers from the five consortium universities (Oregon State University, University of Alaska Fairbanks, University of Idaho, University of Washington, and Washington State University) presented more than 100 academic papers and talks. To foster student learning and transportation leadership development, PacTrans provided travel funds to support student attendance at the TRB annual meeting. Many students received travel support packages to attend the conference to present papers, attend workshops and sessions, and interact with transportation professionals.
- On January 12, TRB annual meeting attendees gathered at the Region 10 reception, hosted by PacTrans in partnership with the Center for Environmentally Sustainable Transportation in Cold Climates and the National Institute for Advanced Transportation Technology. The conference location, the Walter E. Washington Convention Center, provided an excellent reception venue for professionals, researchers, students, and public officials to meet and interact. At the reception, the Michael Kyte Region 10 Outstanding Student Award was given to Jennifer

Warner, Oregon State University MS student. Established in honor of University of Idaho Professor of Civil Engineering Michael Kyte, the award recognizes outstanding research, scholarship and professional leadership in transportation studies.

- PacTrans and the Washington Traffic Safety Commission (WTSC) met on March 3 at the University of Washington to exchange information and learn more about the activities of each organization for potential collaboration. With transportation safety a primary goal, WTSC and PacTrans are strategically aligned and find partnerships with other agencies and organizations critical to developing safe solutions. Darrin Grondel, Director of WTSC, provided a background of the commission and discussed top programs and priorities. Guiding the commission's priorities is the Washington's Strategic Highway Safety Plan, called Target Zero, which aims for zero deaths and serious injuries on roadways by 2030. The plan is formed through a collaboration of traffic safety professionals and organizations from a variety of disciplines, and aligns well with PacTrans' center theme of developing data-driven solutions and decision-making for safe transport. The workshop also provided a venue for PacTrans researchers to introduce their work in a wide range of safety-related topics for WTSC guests.
- The PacTrans Board of Directors (BOD) met at the end of February to discuss strategies, procedures, and implementation plans for the successful operation of the center in 2015 and beyond. Many events are scheduled and in the planning phase for this year, including the PacTrans Regional Transportation Seminar on Innovation held on March 6, PacTrans Regional Transportation Safety Workshop on May 5, PacTrans sessions at the Traffic Safety Conference on October 15, the 2015 PacTrans Regional Transportation Conference on October 16, the 2015 Region 10 Student Conference on October 17, and Dr. Man-Chung Tang's talk at PacTrans' Winter Regional Transportation Seminar, etc. The BOD also finalized a schedule and procedure for PacTrans' 2015 proposal solicitation, review, and project selection.
- Innovation is critical for research institutes. However, there are very few opportunities for students and faculty to learn keys to innovation. PacTrans' Winter Regional Transportation Seminar focused on the innovation topic. Dr. Man-Chung Tang, Chairman of T.Y. Lin International and member of the U.S. Academy of Engineering, was invited as the speaker for this seminar on March 4. As the designer of over one hundred bridges, Dr. Tang is highly qualified to deliver this topic. He is known not only for his contributions to the overall bridge design industry, but for the quality and innovation of his individual designs. In his encouraging talk, Dr. Tang broke down the components of innovation into an easy to use formula: 5I + 3W + 3C. While somewhat mysterious at first glance, the formula divides the weighty concept into three parts: the definition, process, and prerequisites of innovation. Dr. Tang's talk attracted nearly one hundred onsite participants and many other online attendees as well.
- In addition to the innovation seminar, PacTrans also delivered a leadership training seminar talk to faculty and students on Feb. 19, 2015. Dr. Robert Stevens, President of the American Society of Civil Engineers (ASCE), was the speaker of this seminar. With 50+ years of experience in engineering practice, Dr. Stevens shared his story and opinion on leadership development.

Recorded video of his talk can be found online at <https://www.youtube.com/watch?v=4OuvLCd4ogk>. PacTrans has scheduled more leadership training talks in the spring quarter of 2015.

- University of Washington PhD student Kristian Henrickson was honored with the PacTrans Student of the Year award during the Annual Council of University Transportation Centers (CUTC) Awards Banquet. Kristian is a research assistant for a PacTrans research project. He is also serving as manager of the PacTrans STAR Lab.

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

PacTrans provides training and professional development opportunities through multiple channels:

- Research channel. All the selected research projects will involve graduate students, which also provides many opportunities to work with state and local transportation agencies. By involving students, PacTrans provides students an invaluable opportunity to develop skills they need to be successful in their future careers in academia, industry, and government.
- Educational channel. PacTrans consortium partners offer a variety of on-campus and online courses designed for professional development. The online programs, such as the online master's program of sustainable transportation, are particularly good for working professionals because of the flexibility in schedule and location. PacTrans also sponsored working professionals to offer important courses on campus, such as CEE 498 geometric design and CEE 410 fundamentals of transportation engineering to enrich our transportation educational curriculum.
- PacTrans fellowship program. PacTrans keeps supporting student education and research activities. The UW awarded PacTrans fellowships to four outstanding new graduate students: Ryan Hughes, Michael Corwin, Kelly Fearon, and Jackson Lester. In the recently completed graduate student admissions process, five more new students have accepted our PacTrans fellowship offers. These students are: Thomas Steckel, Richard Lee, Kimball Riley, Carl Luke Peters, and Jeffrey Conor.
- Seminars and workshops. The following seminars were delivered during the reporting period:
 - o Edward Smaglick, associate professor at Northern Arizona University, gave a seminar presentation to 25 Oregon State University students in CE 552 Isolated Signalized Intersections class on a variety of traffic signal related research projects.
 - o PacTrans and the Washington Traffic Safety Commission (WTSC) jointly organized a workshop on March 3 at the University of Washington to exchange information and learn more about the activities of each organization for potential collaboration. Darrin Grondel, Director of WTSC, provided a background of the commission and discussed top programs and priorities. The workshop also provided a venue for PacTrans researchers

to present their work in a wide range of safety-related topics. Dr. Anne Vernez-Moudon, Urban Design and Planning professor and PacTrans Associate Director of Education, presented her talk, “High-risk Locations of Pedestrian –Motor Vehicle Collisions in King County: A Data-Driven Approach.” Dr. Qing Shen, Urban Design and Planning professor, discussed graduate student Peng Chen’s research on the risks of bicycle use in the urban environment. Dr. Jessica Kaminsky, Civil and Environmental Engineering assistant professor, presented her talk, “Work Zone Safety and Social Network Analysis.”

- Dr. Robert Stevens, President of the American Society of Civil Engineers (ASCE), delivered a PacTrans leadership training seminar on “Engineering the Future” on February 19, 2015. Using his own prolific career and involvement in ASCE as a springboard, Stevens discussed the outlook of civil engineering education and leadership development, and dispensed words of wisdom for young engineers still exploring their educational and professional path.
 - Dr. Man-Chung Tang, Chairman of T.Y. Lin International and member of the U.S. Academy of Engineering, discussed innovation at the PacTrans Regional Transportation Seminar on March 4.
 - On February 10, officials from Washington State Department of Transportation (WSDOT) met with PacTrans for a workshop to discuss DRIVE Net, the Digital Roadway Interactive Visualization and Evaluation Network. WSDOT expressed interest in establishing DRIVE Net as the organization’s data management and analysis tool, and discussed system maintenance options with the STAR Lab research team.
- Interns. PacTrans has established a collaborative network with transportation agencies and companies that provides numerous intern opportunities for PacTrans students. For example, Washington State Department of Transportation (WSDOT) hires several undergraduate students each year to help their traffic operations at the Traffic System Management Center. Additionally, PacTrans itself also offers intern opportunities for both graduate and undergraduate students to work in the PacTrans consortium university labs to gain hands on experience in transportation. For example, the PacTrans Smart Transportation Applications and Research Laboratory (STAR Lab) offered six student internships during the reporting period. One of these interns is Summer Xia, a graduate student at the UW who started her intern position in the STAR Lab and worked on an Android phone app for transit users.
 - Conference channels. PacTrans provides travel funds to support student attendance at the TRB annual meeting and other important transportation conferences. For example, more than 100 academic papers and talks were delivered by PacTrans researchers at the 2015 TRB annual meeting and majority of the presenters were students that received PacTrans travel support packages to attend the conference. Furthermore, PacTrans also uses its Region 10 Transportation Conference and Region 10 Student Conference as important opportunities for training and professional development. Both conference programs highlighted professional development components. More details of the conferences can be found online at the special issue newsletter: http://depts.washington.edu/pactrans/wp-content/uploads/2014/11/PacTrans_Conference_2014.pdf.

- **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. In addition to these conventional channels, PacTrans also promotes its research findings through social media (such as Twitter), its annual report, and quarterly newsletters. To facilitate technology transfer, the annual PacTrans Region 10 Transportation Conference serves as a primary platform for research exchange and provides valuable opportunities for researchers to communicate directly with practitioners on their research products. The 2014 PacTrans Region 10 Transportation Conference, held on the UW campus on October 17, 2014, featured poster presentations of all PacTrans-funded research projects. Over 170 people participated in this conference from all four states in our region. Research exchange and technology transfer were two key threads through the conference.

Additionally, PacTrans participated and presented research at the following events:

1. PacTrans and Washington Traffic Safety Commission (WTSC) Joint Workshop on Transportation Safety. PacTrans approached the WTSC for partnership on transportation safety. A joint workshop was held on March 3 at the University of Washington to exchange information and learn more about the activities of each organization for potential collaboration. PacTrans researchers presented their work in a wide range of safety-related topics. For example, Dr. Anne Vernez-Moudon, Urban Design and Planning professor and PacTrans Associate Director of Education, presented her research on “High-risk Locations of Pedestrian – Motor-vehicle Collisions in King County: A Data-Driven Approach.”
2. The 2014 TransOvation Workshop. PacTrans was a non-financial co-sponsor for this event held November 17 – 19, 2014 at Microsoft Corporate Headquarters in Redmond, Washington. About 100 people attended this workshop. Dr. Yinhai Wang shared PacTrans research on big data and introduced other active PacTrans research projects at the workshop.
3. Summit of University Transportation Centers for Safety. PacTrans joined safety-focused University Transportation Centers (UTC) from across the country in Pittsburgh for the Summit of University Transportation Centers for Safety: Working in partnership to address real world transportation problems. From March 19 – 20, government and industry leaders and UTC officials learned about UTC research and education efforts, as well as government interests and industry needs in these areas. The summit featured keynote speaker Greg Winfree, US DOT Assistant Secretary for Research and Technology, as well as agency and industry representatives speaking to their respective transportation safety priorities. Ms. Maria Bayya, assistant director of PacTrans and Dr. Zhibin Li, research associate at the University of Washington, participated in this event on behalf of PacTrans. Dr. Li presented an overview of PacTrans’ safety research and educational activities at the summit.

4. Exchange events with external visitors. Several international or domestic delegations visited PacTrans during the reporting period. For example, Dr. Sam Oh, professor of data science at Sungkyunkwan University, led a student group visit to PacTrans on February 10, and Professor Danya Yao of Tsinghua University in China led a connected vehicles group visit to the PacTrans STAR lab on March 6, 2015. PacTrans research findings on transportation safety were presented to all these groups. Notably, also on February 10, officials from WSDOT met with PacTrans to discuss technology transfer issues regarding DRIVE Net, the Digital Roadway Interactive Visualization and Evaluation Network. WSDOT expressed interest in establishing DRIVE Net as the organization's data management and analysis tool, and discussed system maintenance options with the STAR Lab research team. WSDOT's Statewide Travel and Collision Data Office (STCDO) learned about data stored in DRIVE Net, and is willing to contribute more data to the system. DRIVE Net is an online platform for transportation data sharing, modeling, visualization, and decision support. Both WSDOT and PacTrans funding were received in developing the system.
5. Conference presentations and invited talks. PacTrans researchers were invited to deliver presentations at conferences, workshops, and research institutes. For example, Professor Yin Hai Wang, director of PacTrans, delivered his research on big data applications to safety at the International Conference on Transportation Innovation, Edmonton, Canada; Washington Transportation Professionals Forum, Southwest Jiaotong University, Chongqing Jiaotong University, Beijing Jiaotong University, and Chang'an University in China.
6. Publications. PacTrans researchers are active in journal and proceedings publications. Although the time has been short since the research projects for the 2014-2015 were selected, PacTrans researchers have produced 30 peer-reviewed journal articles and 18 conference papers, and delivered 36 conference presentations and 22 invited talks, to publicize PacTrans research findings.

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

PacTrans will keep following its implementation plan to ensure that all PacTrans funded research, education, and outreach activities move forward as scheduled. Specifically, the following events are planned in approaching its goals.

- Regional transportation safety research workshop in spring 2015. This workshop will bring transportation agency and industry partners to the UW campus to talk about critical transportation research issues and regional research efforts in the Pacific Northwest. The expected outcome of the workshop is a prioritized research project list for PacTrans to consider funding with local partners in the coming year.

- Leadership training workshop to PacTrans students. This is a follow-up event for Robert Stevens' seminar. Ms. Marsha Anderson Bomar, previous president of Transportation and Development Institute (T&DI) in American Society of Civil Engineers (ASCE), has accepted our offer to come to deliver a talk on "Language of Leadership". Marsha has been a successful entrepreneur and agency leader over the past decades. Her experience will be highly valuable for students, particularly female students.
- PacTrans will continue to enhance the PacTrans website to include additional information about our projects and research findings, and future research opportunities.
- PacTrans Regional Transportation Seminar series and other PacTrans sponsored seminar and conference events will continue to attract top level speakers to deliver cutting edge research and practical engineering solutions to our audience. The spring regional seminar speaker will be Professor Imad Al-Qadi from University of Illinois at Urbana-Champaign.
- PacTrans will work with other UTCs in Region 10 to actively prepare for our Regional Transportation Conference and Region 10 Student Conference.

2. Products (for the reporting period of June 30, 2014 – March 31, 2015)

	PacTrans Total	UW	WSU	UI	OSU	UAF
Publications: Peer reviewed journal articles	30	13	4	4	9	0
Publications: Book chapter and other edited manuscripts	0	0	0	0	0	0
Conference Papers	18	4	4	4	5	1
Conference Presentations	36	10	8	3	5	10
Lectures/Seminars/Workshops/Invited Talks	22	12	2	2	0	6
Inventions, Patent Applications, and/or licenses	0	0	0	0	0	0
Website	6	2	1	1	0	2
Other products: Data or Database, physical collections, audio or video products, software or NetWare, models, educational aids or curricula, instruments, or equipment	22	12	2	5	1	2

- **Examples of peer reviewed journal articles**

Wang, Z. and A. Goodchild. "A GPS Data Analysis of the Impact of Tolling on Truck Speed and Routing: A Case Study in Seattle, WA." *Journal of the Transportation Research Board*. 2411, 112-119, 2014.

Wang, Z. , A. Goodchild, and E. McCormack. "Measuring Truck Travel Time Reliability Using Truck Probe GPS Data." *Journal of Intelligent Transportation Systems: Technology, Planning, and Operations*. In Press. 2015.

Chen, X., K. Henrickson, and Y. Wang. "Kinect-based Pedestrian Detection for Crowded Scenes." *Computer-Aided Civil and Infrastructure Engineering*. In Press. April 2015.

Zou, Y., X. Hua, Y. Zhang, and Y. Wang. "Hybrid Short-Term Freeway Speed Prediction Methods Based on Spatial-Temporal and Periodic Analysis." *Canadian Journal of Civil Engineering*. In Press. April 2015.

Ma, X., Z. Tao, Y. Wang, H. Yu, and Y.P. Wang. "Long Short-term Memory Neural Network for Traffic Speed Prediction Using Remote Microwave Sensor Data." *Transportation Research Part C: Emerging Technologies*. Vol. 54, 187-197, 2015. <http://dx.doi.org/10.1016/j.trc.2015.03.014>.

Zhang, S., J. Tang, H. Wang, and Y. Wang. "Enhancing Traffic Incident Detection Using Spatial Point Pattern Analysis in Social Media." *Transportation Research Record*. In Press. 2015.

Tang, J., Y. Wang, S. Zhang, H. Wang, and F. Liu. "On Missing Traffic Data Imputation Based on Fuzzy C-means Method by Considering Spatial Temporal Correlation." *Transportation Research Record*. In Press. 2015.

Henrickson, K., Y. Zou, and Y. Wang. "Flexible and Robust Method for Missing Loop Detector Data Imputation." *Transportation Research Record*. In Press. 2015.

Wang, Y.S., W. Ma, K. Henrickson, Y. Wang, and Xiaoguang Yang. "Dynamic Lane Assignment Approach for Freeway Weaving Segment Operation." *Transportation Research Record*. In Press. 2015.

Wright, B., Y. Zou, and Y. Wang. "The Impact of Traffic Incidents on the Reliability of Freeway Travel Times." *Transportation Research Record*. In Press. 2015.

Xiao, S., C. Liu, and Y. Wang. "Data-driven Geospatial-enabled Transportation Platform for Freeway Performance Analysis." *IEEE Intelligent Transportation Systems Magazine*. Vol. 7(2), 10-21, 2015.

Kaminsky, J., and A. Javernick-Will (2014). "The Internal Social Sustainability of Sanitation Infrastructure: A Set Theoretic Approach." *Environmental Science and Technology*, 48(17), pp 10028-10035.

Kaminsky, J. and A. Javernick-Will. (2014). "Theorizing the Internal Social Sustainability of Sanitation Organizations." *Journal of Construction Engineering and Management*, 10.1061/(ASCE)CO.1943-7862.0000933 , 04014071.

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

None.

- **Examples of conference papers**

Zhu, W., Z. Li, and Y. Wang. "Capacity Modeling and Control Optimization for Two-lane Highway Lane Closure Work Zones." Submitted to the International Symposium on Enhancing Highway Performance (ISEHP). March 2015.

Chen, X., Y. Zou, B. Wright, and Y. Wang. "Examining the Impact of Traffic Incidents on the Travel Time Variability of Freeway Managed Lanes." Submitted to the International Symposium on Enhancing Highway Performance (ISEHP). March 2015.

Kaminsky, J. "Photo Elicitation Methods in Engineering Research." Engineering Project Organization Conference, Winter Park, CO, USA, July 2014.

Kaminsky, J. "Mapping WASH Sustainability Frameworks to Legitimacy Theory." Construction Research Congress, Atlanta, GA, USA, May 2014.

- **Examples of conference presentations**

Debol'skiy, M., R. Daanen, R. Hock, A. Liljedahl, and V. Romanovsky. (2014). Assessing the role of glacier and permafrost on northern hydrology. Oral presentation at the North-West Glaciologists Meeting, October 17-18, 2014, Fairbanks, Alaska.

Gatesman, T.A., A. Liljedahl, T. Douglas, and T. Trainor. (2015). Hydrograph separation of a sub-arctic glacial watershed using stable water isotope variation. Oral presentation at the UAF Environmental Chemistry Symposium. April 24, 2015, Fairbanks, AK.

Gatesman, T.A., A. Liljedahl, T. Douglas, and T. Trainor. (2015). Hydrograph separation of a sub-arctic glacial watershed using stable water isotope variation. Oral presentation at the Midnight Sun Science Symposium. March 26, 2015, Fairbanks, AK.

Gatesman, T.A., N. Jacobs, M. Debol'skiy, J. Bailey, C. Barnard, T. Douglas, A. Gusmeroli, R. Hock, A. Liljedahl, and A. Wagner. (2015). What role do glaciers play in terrestrial subarctic hydrology? Poster presentation at the Delta Farm Forum. February 21, 2015. Delta Junction, AK.

Gatesman, T.A., A. Liljedahl, T. Douglas, and T. Trainor. (2015). Hydrograph separation of a sub-arctic glacial watershed using stable water isotope variation. Oral presentation at the Department of Chemistry and Biochemistry, UAF Seminar. February 21, 2015, Fairbanks, AK.

Gatesman, T.A., A. Liljedahl, T. Douglas, and T. Trainor. (2015). Hydrograph separation of a sub-arctic glacial watershed using stable water isotope variation. Oral presentation at the Water and Environmental Research Center Symposium. February 6, 2015, Fairbanks, AK.

Gatesman, T.A., A. Liljedahl, T. Douglas, and T. Trainor. (2014). Hydrograph separation of a sub-arctic glacial watershed using stable water isotope variation. Oral presentation at the Northwest Glaciologists' Meeting. October 17, 2014, Fairbanks, AK.

Wang, J., M. Wang, Y. Wang, X. Yan, and R. Xiong. "Analysis of Sideswipe Collision Precursors Considering Spatial-Temporal Characters of Freeway Traffic." Presented by Jiangfeng Wang at the 94th Annual Meeting of Transportation Research Board, Jan. 2015.

Wang, Y.S., Y. Zou, K. Henrickson, Y. Wang, and X. Yang. "Google Earth Elevation Data Extraction and Accuracy Assessment for Transportation Applications." Presented by Yinsong Wang at the 94th Annual Meeting of Transportation Research Board, Jan. 2015.

Wright, B., Y. Zou, and Y. Wang. "The Impact of Traffic Incidents on the Reliability of Freeway Travel Times." Presented by Benjamin Wright at the 94th Annual Meeting of Transportation Research Board, Jan. 2015.

Henrickson, K., Y. Zou, and Y. Wang. "Flexible and Robust Method for Missing Loop Detector Data Imputation." Presented by Kristian Henrickson at the 94th Annual Meeting of Transportation Research Board, Jan. 2015.

Zhang, S., J. Tang, H. Wang, and Y. Wang. "Enhancing Traffic Incident Detection Using Spatial Point Pattern Analysis in Social Media." Presented by Jinjun Tang at the 94th Annual Meeting of Transportation Research Board, Jan. 2015.

Tang, J., Y. Wang, S. Zhang, H. Wang, and F. Liu. "On Missing Traffic Data Imputation Based on Fuzzy C-means Method by Considering Spatial Temporal Correlation." Presented by Jinjun Tang at the 94th Annual Meeting of Transportation Research Board, Jan. 2015.

Zou, Y., X. Hua, Y. Zhang, and Y. Wang. "Hybrid Short-Term Freeway Speed Prediction Methods Based on Periodic Analysis." Presented by Yajie Zou at the 94th Annual Meeting of Transportation Research Board, Jan. 2015.

Ke, R., Y. Zhang, and Y. Wang. "Roadway Surveillance Camera Calibration Using Standard Moving Object." Presented by Ruimin Ke at the 94th Annual Meeting of Transportation Research Board, Jan. 2015.

G. H. Bham, Poster presentation on the project at the UAA Faculty Showcase

Kaminsky, J. "Photo Elicitation Methods in Engineering Research." Engineering Project Organization Conference, Winter Park, CO, USA, July 2014.

Kaminsky, J. "Mapping WASH Sustainability Frameworks to Legitimacy Theory." Construction Research Congress, Atlanta, GA, USA, May 2014.

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

Liljedahl et al. (2015), Estimating future flood frequency & magnitude in basins affected by glacier wastage, Water and Environmental Research Center, University of Alaska, 17 April, Fairbanks.

Liljedahl et al. (2015), Estimating future flood frequency & magnitude in basins affected by glacier wastage, AK DOT&PF State Hydraulic Engineers Meeting, 14 April, Fairbanks.

Wang, Y. International Conference on Urban Traffic Safety. "Traffic Data Sensing Technologies." April 30, 2015.

Wang, Y. Washington State Transit Insurance Pool Executive Meeting. "PacTrans Research on Transportation Safety." March 26, 2015.

Wang, Y. Beijing Jiaotong University. "Transportation Big Data Analytics for Smart Cities Applications." March 20, 2015.

Wang, Y. Fast-forward 10 Years: How Information Technology Is Changing Transportation Planning, Engineering, and Operations at the 2015 Transportation Research Board Annual Meeting. "Big Data Analytics: Opportunities and Challenges for Transportation Professionals." January 12, 2015.

Kaminsky, J. Michigan State University, School of Planning, Design and Construction & MSU Office for Inclusion and Intercultural Initiatives. "Diversity in Construction Management." March 2015.

Kaminsky, J. Ontario Onsite Wastewater Association Annual Conference and Tradeshow, Niagara Falls, Ontario, Canada. "The Global Importance of Onsite Sanitation." March 2015.

Kaminsky, J. Washington Traffic Safety Commission Workshop, UW STAR Lab. "Work Zone Safety and Social Network Analysis." March 2015.

Kaminsky, J. Engineering Project Organization Conference PhD Seminar, Winter Park, CO, USA. "The First Year on the Tenure Track." July 2014.

- **Examples of technologies or techniques**

None.

- **Scheduled known academic talks for upcoming reporting period (Jan. 1 – June 30, 2015)**

Wang, Y. Society for Knowledge Discovery in Distributed and Ubiquitous (KD2U) Environments. "Transportation Big Data Analytics for Network-wide Performance Analysis and Decision Support." NGDM'15. June 2, 2015.

Wang, Y. Arkansas Transportation Research Council Annual Conference. "DRIVE Net: A Large-Scale Online Data Platform for Performance Analysis and Decision Support." May 21, 2015.

Wang, Y. Wuxi's Smart City Kickoff Workshop. "Smart Transportation: Challenges and Opportunities." Wuxi City, China. May 18, 2015.

Wang, Y. International Conference on Urban Traffic Safety. "Traffic Data Sensing Technologies." April 30, 2015.

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

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

PacTrans Director, Yinhai 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., Professor with joint appointments in Industrial and Systems Engineering and Civil and Environmental Engineering at the UW spends 10 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 in organizing student seminars, internships and fellowship programs.

PacTrans Associate Director in Oregon State University (OSU), Chris Bell, Ph.D., Professor of Civil and Construction 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), Ahmed Abdel-Rahim, Ph.D., Associate Professor of Civil Engineering at UI, devotes 10 percent of his time to managing and organizing the education, outreach, and research activities within UI. He 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.

Maria Bayya devotes 100 percent of her time Assistant Director with responsibilities of grant management, project management and oversight of the PacTrans operations team.

Elysse Reyna, Communications Manager devotes 33% of work time in publications, reports, articles and write-ups for PacTrans newsletter and website.

Weibin Zhang, Research Coordinator devotes 80% of work time in research report review, research resource coordination for request for proposal, seminar, workshop, etc, and research collaboration across partner institutions.

Melanie Paredes, Program Coordinator devotes 100% of work time as program assistant serving as the resource person for events, seminar talks and conferences and assisting in budget and fiscal tasks.

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 on the PacTrans schedule is the Region 10 Student Conference, held at the UW campus on October 18, 2014. Sponsors were leaders of three UTCs in this region – PacTrans, Center for Environmentally Sustainable Transportation in Cold Climates (CESTiCC), and Transportation for Livability by Integrating Vehicles and the Environment (TranLIVE).

Additionally, PacTrans has 26 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 departments of transportation 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, for example Washington Traffic Safety Commission, Washington State Transit Insurance Pool, Lummi Nation (a nationally recognized leader in tribal self-governance and education), Transpo, etc.

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), University of Alaska Fairbanks' Center for Environmentally Sustainable Transportation in Cold Climates (CESTICC), and University of Idaho's Transportation for Livability by Integrating Vehicles and the Environment (TranLIVE) on various Region 10 events.

4. Impact

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

Since our research projects selected for this center just started recently, no impact on the development of the principal discipline has been observed yet.

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

Since our research projects selected for this center just started recently, no impact on other disciplines have been observed yet.

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

PacTrans continues its dedication to transportation workforce development. In addition to the award-winning intern program with WSDOT and several other new intern programs recently

established, PacTrans is making great efforts to merge the gap between practice and university education. One such effort is to sponsor training workshops to address practical issues on demand. Many such events were sponsored by PacTrans, including the 2014 PacTrans Regional Transportation Conference and Student Conference, Robert Stevens Leadership Seminar, TransOvation, etc.

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

PacTrans funded six multi-institutional research projects and eleven small projects in FY 2015-2016. They will definitely add new physical, institutional, and information resources and facilitate cross sharing of existing resources among consortium partners.

- **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 2014 offered a great platform for researchers and practitioners to talk about procedures and available resources for technology 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.

The ongoing process on using DRIVE Net as WSDOT's data management and analysis tool is likely to form a good example for future PacTrans projects to follow.

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

PacTrans researchers actively participated in various meetings and conferences to disseminate knowledge on traffic and safety issues. Because transportation is related to everyone's daily life, our research certainly adds benefit to everyone's life. Through regular open house and other domestic or international exchange events, PacTrans research laboratories have received thousands of visitors. In addition to showcasing PacTrans research products, researchers also took the opportunity to educate the general public for the correct behaviors to ensure transportation safety, sustainability, and mobility.

PacTrans joined over 12,000 people for the Transportation Research Board (TRB) 94th Annual Meeting, held from January 11 – 15 in Washington, D.C. With researchers, practitioners, and representatives of government, industry, and academia present from around the world, the TRB

annual meeting represents an important opportunity to demonstrate PacTrans' research and educate upcoming transportation professionals. PacTrans researchers from the five consortium universities (Oregon State University, University of Alaska Fairbanks, University of Idaho, University of Washington, and Washington State University) presented more than 100 academic papers and talks. These research papers and presentations foster a bettering understanding of transportation safety issues and therefore help improve safety of society.

5. Changes/Problems

None.

6. Special Reporting Requirements

None.