



Program Progress Performance Report for University Transportation Centers

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

RITA Sponsor Award Number: **DTRT12-G-UTC10**

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**

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Report #7, PPPR reporting for six months (January 1, 2015 – June 30, 2015)

Project/Grant Period: January 01, 2012-January 31, 2016

Reporting Period End Date: June 30, 2015

Report Term: Semi-Annual

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, education leader, information center, and collaboration platform.

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

During the six month period from January 1 – June 30, 2015, we conducted several key activities to ensure our transportation expertise contributes to the advancement of the nation and region's transportation workforce development, education, research, technology transfer, and outreach, including K-12 audiences.

- As Region 10's research engine, we have completed seven multi-institutional research projects funded for Year 2 (2013-2015) and are now undergoing final report review. Additionally, the twenty four small research projects (referred to as single institutional projects) funded in 2013 and conducted during the 2013-2015 period were also completed and are currently being posted to the PacTrans website and distributed to the different repositories.

Below is a list of the multi-institutional projects for Year 2 (2013):

1. Behavior of Drilled Shafts with High-Strength Reinforcement and Casing
2. A Platform for Proactive Risk-based Slope Asset Management Phase II
3. Data Collection and Spatial Interpolation of Bicycle and Pedestrian Data
4. High Performance Bridge Systems for Lifeline Corridors in the Pacific Northwest
5. Performance-Measure Based Asset Management Tool for Rural Freight Mobility in the Pacific Northwest
6. Refinement and Dissemination of a Digital Platform for Sharing Transportation Education Materials
7. Educating Teenage Drivers in the Pacific Northwest Regarding the Dangers of Distracted Driving Phase II

The twenty four small research projects for Year 2 (2013) are:

1. Geospatial Analysis of Bicycle Network "Level of Stress", Bicycle Crashes and the Geo-coded Pavement Conditions for Risk Factors Identification
2. Evaluation of Existing and Alternative Information Signs in Oregon
3. SSI Bridge 2: Evaluation of Soil Structure Interaction Effects on PNW Bridges
4. Assessing the Capacity of the Pacific Northwest as an Intermodal Freight Transportation Hub
5. Improving Sustainability of Urban Streets via Rain Gardens – How Effective Are These Practices in the Pacific Northwest?
6. Development of Improved Corrosion Inspection Procedures for Reinforced Concrete Bridges

7. Investigating the Feasibility of Using QR (Quick Response) Codes for Construction Document Control in Highway Construction
 8. The Value of Depressed Medians on Divided Highways in Alaska
 9. Evaluate Presawn Transverse Thermal Cracks for Asphalt Concrete Pavement
 10. Improving Performance, Knowledge, and Methods to Provide Quality Service and Products
 11. Evaluate H2RI Wicking Fabric for Pavement Applications
 12. Encouraging Young Civil Engineers: Support for the UAF College of Engineering and Mines Steel Bridge Team Competition Steel Bridge
 13. Roundabout Design Training for Alaska's Engineers
 14. A Framework for Improved Safety and Accessibility through Pedestrian Guidance and
 15. Modeling Passing Behavior on Two-Lane Rural Highways: Evaluating Crash Risk under Different Geometric Condition
 16. Enhancing the Resilience of Idaho's Transportation Network to Natural Hazards and Climate Change
 17. Field Validation of Recycled Concrete Fines Usage
 18. Changing Retail Business Models and the Impact on CO2 Emissions from Transport: E-commerce Deliveries in Urban and Rural Areas
 19. Identifying and Analyzing the Relative Advantages and Disadvantages of Public-Private Partnerships and Traditional Delivery for Roadway Projects
 20. Testing of Cavity Attenuation Phase Shift Technology For Siting Near-Road NO2 Monitors
 21. Smartphone-Based System for Automated Detection of Walking
 22. Development of a Durable Asphalt Mix for Eastern Washington and Mountain Passes
 23. NDE System for Determining Wood Guardrail Post Integrity
 24. Assessment of Lube Oil Management and Self-Cleaning Oil Filter Feasibility in WSF (WA State Ferries)Vessels
- In addition to research projects, PacTrans also funds education, outreach, and workforce development activities at both the center level and the consortium institution level. For example, *M6. Refinement and Dissemination of a Digital Platform for Sharing Transportation Education Materials* is a multi-institutional education research project focused on educational material sharing across universities. *M7. Educating Teenage Drivers in the Pacific Northwest Regarding the Dangers of Distracted Driving Phase II* is a multi-institutional outreach research project. Both projects involve PIs from all five consortium universities to collaborate and work together.
 - To ensure PacTrans research results in outreach to the right audience in an appropriate format and facilitates the potential technology transfer process, PacTrans released a call for success stories (<http://depts.washington.edu/pactrans/successstory2015/>). These stories will be evaluated by the PacTrans Technology Transfer Taskforce for potential of technology transfer. The outstanding ones will be funded for various outreach and technology transfer activities, including video production, workshop presentation, etc.
 - 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.

- 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 on January 10, 2015. Kristian is a research assistant for a PacTrans research project. He is also serving as manager of the PacTrans STAR Lab.
- On January 12, 2015, 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, the National Institute for Advanced Transportation Technology, and all the five consortium universities. 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, 2015 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' 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 and goals. 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 were scheduled and planned for the year, including the PacTrans Regional Transportation Seminar on Innovation held March 4, 2015 and delivered by Dr. Man-Chung Tan, member of National Academy of Engineering, 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, 2015, 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 National Academy of Engineering, was invited to speak at 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>. As part of PacTrans leadership training seminar series, Dr. Stevens' talk was the kickoff event.
- On April 20, 2015, Marsha Anderson Bomar delivered a PacTrans Student Leadership Training. Marsha Anderson Bomar is a transportation entrepreneur, leader, and trailblazer for women in transportation engineering with a list of awards and recognitions that rivals the length of a term paper. To get to where she is today, Anderson Bomar recognizes the importance of developing strong communication skills for career and leadership success. For the PacTrans Student Leadership Training, Anderson Bomar critically examined the way language can work for and against us, the communication differences between men and women, and what students can do now to build skills to grow as strong leaders.
- On April 28, 2015, Dr. Imad Al-Qadi, an internationally renowned professor in pavement materials and engineering, visited the University of Washington to speak at the Spring PacTrans Regional Transportation Seminar. Dr. Al-Qadi, Founder Professor at the University of Illinois at Urbana-Champaign, delivered his talk entitled "Transportation Infrastructure Assessment Techniques Using Ground Penetrating Radar (GPR)." Dr. Al-Qadi has been working on GPR research for more than two decades, among his other diverse research interests. He is the Director of the Advanced Transportation Research and Engineering Laboratory (ATREL) and the founding Director of the Illinois Center for Transportation (ICT). A registered professional engineer, Dr. Al-Qadi has authored/co-authored more than 550 publications and has delivered more than 550 presentations, including numerous keynote lectures.
- On May 5, 2015, the PacTrans Region 10 Transportation Safety Workshop drew representatives from universities, public agencies, and private companies across the Pacific Northwest to discuss important regional transportation safety issues. This workshop was jointly organized by PacTrans, ITE

Washington, ITE Oregon, ITE Idaho, and ITE Alaska. Open only to invited participants, more than 70 attendees, both in-person and online, joined the workshop at the Talaris Conference Center to identify critical regional transportation safety issues for PacTrans to study. Regional transportation experts representing industry, agency, and university perspectives contributed to PacTrans' research agenda, shared ongoing efforts in addressing critical safety problems, and solidified partnerships in transportation safety research and practice.

- On May 26, 2015, PacTrans welcomed transportation professionals from Japan as part of an international exchange to share best practices in data, organizational collaboration, and road management. Kenji Saita, Assistant Manager, West Nippon Express Company (NEXCO), and Seishu Kitamura, Senior Researcher and Kzuhiko Makimura, Deputy Director, both of the Institute of Behavioral Sciences, visited the PacTrans STAR Lab to learn about the center's work in intelligent transportation systems (ITS).
 - On June 4, Emily Feenstra, Director for Infrastructure Initiatives of the American Society of Civil Engineers (ASCE), spoke at the PacTrans-sponsored Transportation Seminar. Her talk, "The Case for Engaging in Public Policy – Your Projects Depend on It," related the current status of infrastructure funding, how ASCE has engaged in the policy debate, and the importance of engineers' involvement in policy.
 - PacTrans joined University Transportation Center representatives from across the nation for the 2015 Council of University Transportation Centers Summer Meeting, June 1-4 in Brunswick, New Jersey. Held at Rutgers, the event brought transportation and university professionals and administrators together to share best practices and success stories to advance research, education, and development in the transportation field.
 - June 19, incoming first year women pre-engineering University of Washington students and high school science teachers had the unique opportunity to visit the PacTrans STAR Lab. As part of the Women in Science and Engineering (WiSE) UP Summer Bridge program, participants learned about the lab's work in intelligent transportation systems, data science, detection and data collection technologies, and conventional transportation engineering issues. The WiSE UP program allows young women to explore engineering majors, gain a better understanding of STEM professions, and prepare for academic success at the collegiate level.
- **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 of Sustainable Transportation, are particularly good for working professionals because of the flexibility in schedule and location. PacTrans also sponsored working professionals offering important courses on campus, such as CEE 498 Traffic Simulation and CEE 589 Transit System Planning to enrich our transportation educational curriculum.
- Outreach channel. PacTrans offer training and educational opportunities to K-12 students through its outreach activities. For example, PacTrans helped fund Alaska Summer Research Academy (ASRA). High school students enrolled in the ASRA Civil Engineering Module applied basic design principles of statistics and structural analysis showing how engineering principles are used to solve problems. PacTrans STAR Lab also hosted visitors from K-12 schools including both students and teachers.
- PacTrans fellowship program: PacTrans continues to support student education and research activities. 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, Riley Kimball, Carl Luke Peters and Jeffrey Conor.
- Seminars and workshops. PacTrans invited outstanding transportation professionals to deliver talks to PacTrans students in the form of leadership, educational and informational seminars from transportation safety to international trade and logistics. These events are not only helpful in building students' comprehensive understanding of transportation, but increase skills to address critical transportation issues in future practice and prepare students to be leaders in their field of expertise. The following seminars/workshops were delivered during the reporting period:
 - o PacTrans Leadership Training Seminar. Speaker: Robert Stevens, President of ASCE. Feb 19, 2015.
 - o Innovation – it tops the list of most used (and misused) words of the past decade. Speaker: Dr. Man-Chung Tang, member of National Academy of Engineering. March 4, 2015.
 - o Graduate Transportation Seminar on modeling. Speaker: Suzanne Childress, Principal Travel Modeler, Puget Sound Regional Council. April 14, 2015.
 - o PacTrans Student Leadership Training. Speaker: Marsha Anderson Bomar. Date: April 20, 2015.
 - o Transportation Infrastructure Assessment Techniques Using Ground Penetrating Radar Speaker: Dr. Imad Al-Qadi. Date: April 28, 2015.
 - o Region 10 Transportation Safety Workshop. This workshop was jointly organized by PacTrans, ITE Washington, ITE Oregon, ITE Idaho, and ITE Alaska. Open only to invited participants. More than 70 attendees, both in-person and online, joined the workshop at the Talaris Conference Center. May 5, 2015.
 - o Graduate Transportation Seminar on tolling. Speaker: Craig Stone, Assistant Secretary, WSDOT. May 5, 2015.
 - o Graduate Transportation Seminar on transit. Speaker: Cos Roberts, Owner and President of Urban Tech Systems. May 19, 2015.

- Graduate Transportation Seminar on asset management. Speaker: Stephanie MacLachlan, Asset Management and Technical Services Program Manager, King County DOT. May 26, 2015.
 - The Case for Engaging in Public Policy – Your Projects Depend on It. Speaker: Emily Feenstra. June 4, 2015.
- PacTrans Internship Program: PacTrans internship program continues to offer students great training opportunities by partnering not only with local agencies but also private industries. We have an internship program with WSDOT, Seattle DOT, Bellevue Transportation Department, Transpo Group, FEHR & PEERS, Parsons Brinckerhoff, Puget Sound Regional Council, ODOT, etc. 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 five student internships during the reporting period.
 - 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. A student committee has been set up in preparation of the Region 10 Student Conference scheduled on October 17, 2015.
 - PacTrans Partnership Program with Institute of Transportation Engineers (ITE). PacTrans has developed strong partnerships with local ITE chapters in student mentoring and training. For example, ITE Washington has a mentor program for university students. They offer student fellowships and also host events for student training. For example, the 2015 ITE Student Night event was hosted on May 12, 2015. A student project competition was conducted and winners received cash award donated by local transportation engineers and companies.

- **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. Research outcomes are posted on the PacTrans website, distributed through our quarterly newsletter and annual reports, and promoted through meetings, workshops, and social media such as Twitter and the University of Washington press media. We have also participated and presented our research at the following events that were reported on our website at www.pactrans.org:

1. 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. 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.”

2. 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.
3. PacTrans also introduced its research findings to transportation agencies and companies, including King County Metro, WSDOT, Bellevue Transportation Department, Arkansas State Highway and Transportation Department, Wuxi City, China, Edmonton, Canada, etc.
4. On May 5, 2015, the PacTrans Region 10 Transportation Safety Workshop drew representatives from universities, public agencies, and private companies across the Pacific Northwest to discuss important regional transportation safety issues. This workshop was jointly organized by PacTrans, ITE Washington, ITE Oregon, ITE Idaho, and ITE Alaska. Open only to invited participants, more than 70 attendees, both in-person and online, joined the workshop at the Talaris Conference Center to identify critical regional transportation safety issues for PacTrans to study. Regional transportation experts representing industry, agency, and university perspectives contributed to PacTrans’ research agenda, shared ongoing efforts in addressing critical safety problems, and solidified partnerships in transportation safety research and practice.
5. Exchange events with external visitors. PacTrans hosted visits of nine delegations from five countries (China, Korea, Japan, Canada, and Italy) and introduced PacTrans research findings to the visitors 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. Several follow up meetings have been conducted to facilitate the technology transfer process. Both WSDOT and PacTrans funding were received in developing the system.
6. 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 urban sustainable growth at the Smart Cities Workshop in Wuxi, China; Novi, Michigan, etc.
7. Publications. PacTrans researchers are active in journal and proceedings publications. During the reporting period, PacTrans researchers have produced 66 peer-reviewed journal articles and 22

conference papers, and delivered 65 conference presentations and 54 invited talks, to publicize PacTrans research findings. Also, a short video focusing on the PacTrans outreach project on teenage drivers' distracted driving has been produced and published online at https://www.youtube.com/watch?v=bM_iNEyVxcg.

- **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. Specifically, the following events have been planned for the ensuing months and endeavors mapped to meet our goals.

- PacTrans will work with other UTCs in Region 10 to actively prepare for our Regional Transportation Conference and Region 10 Student Conference.
- PacTrans will release a call for success stories. The success stories received will be used for evaluating potential for technology transfer and allocation of technology transfer funds to facilitate the process when necessary.
- 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.
- As the center grant DTRT12-G-UTC10 will be closed early next year, preparation work will start in the summer to ensure a smooth and successful closure of the center grant.

2. Products (for the reporting period of January 1 – June 30, 2015)

	PacTrans Total	UW	WSU	UI	OSU	UAF
Publications: peer reviewed journal articles	66	46	5	1	12	2
Publications: Book chapters and other edited manuscripts	15	14	0	1	0	0
Conference papers	22	9	5	0	2	6
Conference presentations	65	37	10	6	9	3
Lectures/Seminars /Workshops/ Invited Talks	54	34	2	1	11	6
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	16	2	2	3	8	1

- **Examples of peer reviewed journal articles**

- 1) Hooshmand, A.1, Horner-Devine, A.R. and Lamb, M. P. (2015). Structure of turbulence and sediment stratification in wave-supported mud layers. *J. Geophys. Res.* 120.
- 2) Horner-Devine, A. R., Hetland, R. D., and MacDonald, D.G. (2015). Transport and mixing in coastal river plumes. *Annu. Rev. Fluid Mech.* 47:569–94.
- 3) Palmer, K.D., Roeder, C.W., and Lehman, D.E. (2015). Connection Design Recommendations for Improved BRBF Performance. Accepted for publication, *Engineering Journal*, American Institute of Steel Construction, Chicago.
- 4) Kim, T-C, Yoo, J-H, and Roeder, C.W. (2015). Experimental Investigation on Strength and Curling Influence of Bolted Connections on Thin-walled Carbon Steel. *Thin-walled structures*, Vol. 91, June 2015, Elsevier.
- 5) Palmer, K., Roeder, C. and Lehman, D. Connection Design Recommendations for Improved BRBF Performance. *AISC Engineering Journal*, Accepted to appear, May 2015.
- 6) Mykleby, P.M., Lenters, J.D., Cutrell, G.J., Herrman, K.S., Istanbuluoglu, E., Scott, D.T., Twine, T. E., Christopher, J., Kucharik, T. Awada, and Soyly, M. E. (2015). Water and energy balance response of a riparian wetland to herbicide treatment of invasive *Phragmites Australis*. *Journal of Hydrology*.
- 7) Chang J, Y. Wang, E. Istanbuluoglu, T. Bai, Q. Huang, D.Yang, and S. Huang (2015). Impact of climate change and human activities on runoff in the Weihe River Basin, China, *Quaternary International*, <http://dx.doi.org/10.1016/j.quaint.2014.03.048>.
- 8) Wang T., E. Istanbuluoglu, D. Wedin, P Hanson (2015). Impacts of devegetation on the temporal evolution of soil saturated hydraulic conductivity in a vegetated sand dune area. *Environ Earth Sci.* 73:7651–7660. DOI 10.1007/s12665-014-3936-8.
- 9) Ziels, R.M., Beck, D.A.C., Genero, M.M., Gough, H.L., Stensel, H.D., Svensson, B.H.(2015). Monitoring the dynamics of syntrophic β -oxidizing bacteria during anaerobic degradation of oleic acid by quantitative PCR. *FEMS Microbiology Ecology*.
- 10) Lundquist, J. D., Wayand, N. E., Massmann, A., Clark, M. P., Lott, F., Cristea, N. C. (2015). Diagnosis of insidious data disasters, in press at *Water Resources Research*.
- 11) J.E. Freer, E.D. Gutmann, A.W. Wood, L.D. Brekke, J.A. Arnold, D.J. Gochis, and R.M. Rasmussen, (2015). A unified approach to hydrologic modeling: Part 1. Model structure, 51, *Water Resources Research*.
- 12) Clark, M.P., Nijssen, B., Lundquist, J.D., Kavetski, D., Rupp, D.E., Woods, R.A., Freer, J.E., Gutmann, E.D., Wood, A.W., Gochis, D.J., Rasmussen, R.M., Zippel, D., S. and J. Thomson (2015). Wave breaking and turbulence at a tidal inlet, *J. Geophys. Res.*, 120.
- 13) Schwendeman, M. and J. Thomson, (2015). A Horizon-Tracking Method for Shipboard Video Stabilization and Rectification, *J. Atmos. & Ocean. Tech.*, 32.

- 14) McCaffrey, K., B. Fox-Kemper, P.E. Hamlington, J. Thomson, Characterization of Turbulence Anisotropy, Coherence, and Intermittency at a Prospective Tidal Energy Site: Observational Data Analysis. *Renewable Energy*, 76(4), 441-453 (2015).
- 15) Clayton, P.M, Berman, J.W., and Lowes, L.N., (2015). "Seismic Performance of Self-Centering Steel Plate Shear Walls with Beam-Only-Connected Web Plates." *Journal of Constructional Steel Research*, Vol. 106, pp.
- 16) Chen, L., Tang, X., Kim, J., Korshin, G.V. (2015) Formation of Aldehydes and Carboxylic Acids in Ozonated Surface Water and Wastewater: A Clear Relationship with Fluorescence Changes. *Chemosphere*, 125: 182-190.
- 17) He, S., Yan, M., Korshin, G.V. (2015) Spectroscopic Examination Effects of Iodide on the Chloramination of Natural Organic Matter. *Water Research*, 70, 449-457.
- 18) Wei, Li, J.Tanumihardja, T.Masuyama, G.V.Korshin (2015) Examination of the Kinetics of Degradation of the Antineoplastic Drug 5-Fluorouracil by Chlorine and Bromine. *Journal of Hazardous Materials*, 282, 125-132.
- 19) Chen, Yao, M.Fabbricino, G.V.Korshin (2015) Spectroscopic In Situ Examination of Interactions of Rare Earth Ions with Humic Substances. *Water Research*, 68, 273-281.
- 20) Jeon, J.S., Lowes, L.N., DesRoches, R., Brilakas, I. (2015). "Fragility Curves for Non-Ductile Reinforced Concrete Frames that Exhibit Different Component Response Mechanisms," *Engineering Structures* 85: 127-143.
- 21) Kashani , M.M., Lowes, L.N., Crewe, A.J., Alexander, N.A. (2015). "Finite element investigation of the influence of corrosion pattern on inelastic buckling and cyclic response of corroded reinforcing bars," *Engineering Structures* 75: 113-125.
- 22) Taipale, S.J., Kainz, M.J., Brett, M.T. (2015). A low ω -3: ω -6 ratio in Daphnia indicates terrestrial resource utilization and poor nutritional condition. *Journal of Plankton Research* 37: 596-610.
- 23) Huete-Pérez, J.A., Alvarez, P.J.J. , Schnoor, J.L., Rittmann, B.E., Clayton, A., Acosta, M.L., Bicudo, C.E.M., Arroyo, M.T.K., Brett, M.T., Campos, V.M., Chaimovich, H., Jimenez-Cisneros, B., Covich, A., Lacerda, L.D., Maes, J.-M., Miranda, J.C., Montenegro-Guillén, S., Ortega-Hegg, M., Urquhart, G.R., Vammen, K., and Zambrano, L. (2015). Scientists Raise Alarms About Fast Tracking of Transoceanic Canal through Nicaragua. *Environmental Science & Technology* 49: 3989-3996.
- 24) Chen, X., Henrickson, K., and Wang, Y. "Kinect-based Pedestrian Detection for Crowded Scenes." *Computer-Aided Civil and Infrastructure Engineering*. In Press. April 2015.
- 25) Ma, X., Tao, Z., Wang, Y., Yu, H., and Wang, Y (2015). "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.
- 26) Wang, Y, Ma, X., Lao, Y., and Wang, Y (2015). "Two-Echelon Logistics Distribution Region Partitioning Problem based on a Hybrid Particle Swarm Optimization–Genetic Algorithm." *Expert Systems with Applications*. Vol. 42(12), 5019-5031.
- 27) Ma, X., Yu, H., Wang, Y., and Wang, Y (2015). "Large-scale Transportation Network Congestion Evolution Prediction Using Deep Learning Theory." *PLOS ONE*.

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

- 1) Istanbuluoglu E. (submitted). Catchment evolution models and ecosystem dynamics. In *Ecosystems: A Biogeoscience Approach*, E.A. Johnson and Y Martin (eds). Cambridge University Press.

- **Examples of conference papers**

- 1) Kramer, S.L., Sideras, S.S., and Greenfield, M.W. (2015). "The timing of liquefaction and its utility in liquefaction hazard evaluation," *Proceedings, 6th International Conference on Geotechnical Earthquake Engineering, Christchurch, New Zealand, November.*
- 2) Stewart, J.P., Kramer, S.L., Kwak, D.Y., Kayen, R.E., Tokimatsu, K., Bray, J.D., Cubrinovski, M., Sekigushi, T., Nakai, S., and Bozorgnia, Y. (2015). "PEER-NGL Project: Open Source Global Database and Model Development for the Next-Generation of Liquefaction Assessment Procedures," *Proceedings, 6th International Conference on Geotechnical Earthquake Engineering, Christchurch, New Zealand, November.*
- 3) Zhu, Wenbo, Zhibin Li, and Yinhai 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.
- 4) Chen, Xianzhe, Yajie Zou, Benjamin Wright, and Yinhai 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.

- **Examples of conference presentations**

- 1) Kolodziej, E.P. "Addressing the Challenge of Agricultural Pharmaceuticals and Bioactive Contaminants in Aquatic Systems." Invited presentation, Pennsylvania State University, Department of Ecosystem Science and Management; Department of Agricultural and Biological Engineering. April 24, 2015.
- 2) Baker, J., and Kolodziej, E.P. "Next Generation Design of Integrated Urban Water Systems." National Science Foundation, Invited presentation, EFRI program, Washington D.C. March 11, 2015.
- 3) Kolodziej, E.P., Du, B. "Investigating Contaminant Fate and Environmental Risk of Synthetic Steroids Using Mass Spectrometry and Bioassays" Invited presentation, PittCon 2015, New Orleans, LA, March 9, 2015.
- 4) Kolodziej, E.P. "Trace Organic Contaminant Fate and Transport in the Aquatic Environment: Observations and Issues." Presentation to NOAA/NMFS Montlake Lab, Seattle, WA, February 27, 2015.
- 5) Kolodziej, E.P. "Trace Organic Contaminant Fate and Transport in the Aquatic Environment: Observations and Issues." Invited Presentation to USGS Water Science Center, Tacoma, WA, February 11, 2015.

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

- 1) Michigan State University, School of Planning, Design and Construction & MSU Office for Inclusion and Intercultural Initiatives. “Diversity in Construction Management.” March 2015.
- 2) Ontario Onsite Wastewater Association Annual Conference and Tradeshow, Niagara Falls, Ontario, Canada. “The Global Importance of Onsite Sanitation.” March 2015.
- 3) Washington Traffic Safety Commission Workshop, UW STAR Lab. “Work Zone Safety and Social Network Analysis.” March 2015.
- 4) 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.
- 5) Arkansas Transportation Research Council Annual Conference. “DRIVE Net: A Large-Scale Online Data Platform for Performance Analysis and Decision Support.” May 21, 2015.
- 6) Wuxi’s Smart City Kickoff Workshop. “Smart Transportation: Challenges and Opportunities.” Wuxi City, China. May 18, 2015.
- 7) International Conference on Urban Traffic Safety. “Traffic Data Sensing Technologies.” April 30, 2015.
- 8) Washington State Transit Insurance Pool Executive Meeting. “PacTrans Research on Transportation Safety.” March 26, 2015.
- 9) Beijing Jiaotong University. “Transportation Big Data Analytics for Smart Cities Applications.” March 20, 2015.
- 10) Chongqing Jiaotong University. “Traffic Sensing, Data Integration, and Analytical Framework toward Smart City Applications.” March 16, 2015.
- 11) Southwest Jiaotong University. “Traffic Sensing, Data Integration, and Analytical Framework toward Smart City Applications.” March 12, 2015.
- 12) 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.

- **Examples of technologies or techniques**

- 1) Pedestrian detection and trajectory estimation using Bluetooth Sensing. Developed by the research team for Project “Data Collection and Spatial Interpolation of Bicycle and Pedestrian Data.” Project co-PIs: Mike Lowry at the University of Idaho and Yinhai Wang at the UW.

- **Scheduled known academic talks for upcoming reporting period (July 1-December 31, 2014)**

- 1) Workshop of Innovative Technologies and Methods to Improve Transportation Systems. “Mobile Sensing for Pedestrian and Bicyclist Data.” Southwest Jiaotong University, China, July 29, 2015.
- 2) Georgia Tech's National Center for Transportation Systems Productivity and Management (NCTSPM). “Transportation Big Data Analytics for Smart Cities Applications.” Aug. 27, 2015.

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 UW, devotes 10 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 of Transportation Engineering with joint appointments in Industrial and Systems Engineering and Civil and Environmental Engineering at the UW spends 5 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 5 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 5 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 5 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 5 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 5 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.
- From January to June 2015, Assistant Director, Ms. Maria Bayya, devoted 10 percent of her time to the day-to-day operations in support of the PacTrans mission. Her responsibilities include project management, grant management, events coordination and outreach, and managing the PacTrans operations team.
- Ms. Elyse Reyna is PacTrans Communications Manager. She devotes 10 percent of her time in managing and coordinating all aspects of PacTrans publications which include newsletters, website content and annual reports.
- PacTrans full-time Program Coordinator, Ms. Melanie Paredes, devoted 10 percent of her time to the Center's fiscal matters, support with events coordination and outreach and day to day administrative tasks.
- Weibin Zhang, Ph.D., Research Associate in the PacTrans STAR Lab at the University of Washington, devotes 30% of his time in providing research support and oversight of PacTrans consortium and center projects which include multi institution and small center projects.
- Graduate Student Assistant devotes 10 percent to assist with facilitating and coordinating seminars, workshops and events.
- 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, to be held on the UW campus October 17, 2015. Leaders of the four UTCs in this region – PacTrans, the National Institution for Transportation and Communities (NITC), Center for Environmentally Sustainable Transportation in Cold Climates (CESTiCC), and Transportation for Livability by Integrating Vehicles and the Environment (TranLIVE) – are all in support of this traditional regional student conference.
- 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 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. We have interactions and have partnered with City of Bellingham, City of Seattle, City of Lynnwood, City of Bellevue, City of Everett, King County, Snohomish County, Washington Traffic Safety Commission, Puget Sound Regional Council (PSRC), Washington Transportation Investment Board, American Society of Civil Engineers, and Institute of Transportation Engineers.

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, PSRC, as well as a representative from Idaho industry, Western Trailers.

PacTrans also collaborates with Portland State University's UTC (NITC), University of Idaho's TranLIVE, and UAF's CESTiCC on various Region 10 events.

All four electric cars won by an award from Innova have been delivered to the UW campus. PacTrans will work with Innova for various research projects that use the four fully instrumented electric cars for various research projects. Microsoft will use its Azure system to host the data generated by these cars during our research.

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 projects being worked on across the region, which has outcomes of national importance.

Specifically, the following impact has been observed:

- PacTrans keeps supporting multi-institutional research projects that require two or more institutions to work together. These projects typically involve local transportation agencies of multiple states and this creates a great platform for students, faculty, and practitioners to work together. In addition to the research benefits, each participating institution can learn from each other in enhancing its education curriculum with a clear understanding of the needs from our region.
- Our new research efforts produced interesting results that can be new course materials and lead to new research directions. All research projects funded in 2013 are now completed. The research reports will be published online for public access. For example, the mobile sensing method for transportation data collection offers a cost-effective yet powerful means for collecting various data highly valuable for transportation practice and research. This method has been employed by the UW Transportation Office for collecting transit origin-destination (OD) data to improve transit operations. King County Metro and other effective transit operators also showed strong interests to apply the method for their data collection.

- Our educational research project with all five consortium partners involved has produced educational modules and a resource sharing website to facilitate exchange of teaching materials among educational institutions. The modules and tools were tested and promoted for use in consortium institutions. Findings of this research project will definitely generate impacts on our transportation education curriculums.
- Our outreach project on distracted driving received continuous support to extend its benefit to more high schools. A statistical analysis using data collected from a survey to teenage drivers was completed and the research team will publish the results on an archived journal. The findings of the analysis will be helpful in understanding teenage driving and may offer great insights for teenage driver safety improvement. Some of the findings have been summarized in a video recently produced and published online (https://www.youtube.com/watch?v=bM_iNEyVxcg) to disseminate PacTrans research to the general public.
- PacTrans research and educational activities have identified a clear need for transportation programs to enhance education on information technology and data management skills to meet market needs of future transportation engineers. Data collected from PacTrans funded research will be made available for educational use. Computational facilities have been updated recently to accommodate such educational needs. PacTrans has reached an agreement with WSDOT to set up a testbed in a recently funded project for connected vehicles research and education.
- Our regional seminars and conferences offer great input for our curriculum reform and research initiative development. A set of important strategic directions have been identified for future PacTrans activities and support. In response to these needs, several new faculty members are hired to enhance the research and educational strengths in the identified areas.

- **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, public policy, 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, safe and sustainable solutions for the diverse transportation needs of the Pacific Northwest.

The Washington State Transit Insurance Pool (WSTIP) consists of 25 Washington public transit agencies that pool their resources in order to provide and purchase insurance coverage, manage claims and litigation, and receive risk management and training. Nearly \$7 million a year is paid for third party property damage and bodily injury claims against WSTIP members. In order to mitigate transit related collisions and enhance traffic safety, WSTIP and PacTrans are establishing a collaborative research partnership to test transit vehicle collision avoidance systems. As part of this effort, Mr. Jerry Spears, Deputy Director of WSTIP, invited PacTrans Director, Professor Yin Hai Wang, to attend the WSTIP Board's Executive Meeting on March 26, 2015. Dr. Wang delivered a speech at the Work Session to introduce

PacTrans and its past and active research on transportation safety. There is a clear need for WSTIP and PacTrans to partner for transit related safety research and education.

- **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 collaborate with professional organizations such as ITE and ASCE for training workshops and seminars to address practical issues on demand. Ten such events were sponsored by PacTrans, including the two events on training the Digital Roadway Interactive Visualization and Evaluation Network (DRIVE Net) and one event on training mobile sensing using data from mobile electronic devices. Our four online transportation degree granting programs continue to play an important role in workforce development, serving over 120 continuing education students during the reporting period. Furthermore, we are actively working with local partners to develop or re-establish workforce development programs, including the PacTrans-WSDOT graduate level training program. This program had produced many very successful transportation professionals at local transportation agencies before it was closed due to financial crisis in 2008. We are discussing ways to re-establish this program.

- **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 2012-2013 and seven regional projects and 25 small projects in 2013-2014. All projects have been completed and produced many useful research findings. They have definitely added new physical, institutional, and information resources and facilitate cross sharing of existing resources among consortium partners. 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 Media Access Control (MAC) address based traffic sensors in a PacTrans funded multi-institutional research project. These sensors have been made available for use by several research teams and agencies. The University of Idaho research team led by Dr. Michael Lowry developed mobile sensing apps to collect pedestrian and bicycle data. The phone app was installed in 50 smart phones and was used in the UW research as well. Data collected through these research projects and publications of the findings will be new resources available for public access. The resources made available through PacTrans research can also attract new research grants. The Connected Vehicle testbed project is a great example. Many traffic data collection devices developed by PacTrans researchers will be applied to this testbed for further evaluations and improvements.

- **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. In the 2015 PacTrans Region 10 Safety Workshop, important factors of technology transfer were specifically discussed among researchers and practitioners of Region

10. Since PacTrans Year One and Year Two projects have been completed, the 2015 PacTrans Region 10 Transportation Conference will serve as a technology showcase to potential users. PacTrans may provide gap funds for those technologies ready to transfer to practice.

Additionally, a Call for Success Stories has been released to collect information about the impact and application of the completed research projects. PacTrans Board of Directors will work with the Technology Transfer Taskforce to review the submissions and identify the projects with practical value and the best ways for technology transfer. PacTrans is also working with partners to set up venues for technology transfers. At this moment, four major events have been scheduled in addition to the PacTrans Region 10 Transportation Conference:

- PacTrans STAR Lab will serve as a technical tour destination for the 2015 ITS America Symposium in Seattle scheduled July 16-17, 2015. PacTrans students and faculty will demonstrate technologies to visitors.
- PacTrans will set up multiple technical sessions to introduce PacTrans research products at the Washington Traffic Safety Conference scheduled October 12 – 15, 2015.
- PacTrans STAR Lab will be an exhibitor at the first IEEE International Smart Cities Conference, scheduled Oct. 25 – 28, 2015 to demonstrate traffic sensing and data analytics tools and technologies.
- PacTrans will work with the Region Eight UTC to set up a UTC Technology Transfer Workshop at the ASCE International Conference for Transportation and Development scheduled in June 2016.

Additionally, PacTrans has decided to sponsor workshops to promote the Greenroads system developed through a previous research project funded by Region 10 UTC.

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

PacTrans outreach programs will meet the general transportation needs of the public. PacTrans researchers positively participate in various meetings and conferences to address traffic safety, efficiency, and development issues. Through regular open day events and other domestic and international exchanges, PacTrans research laboratories have jointly received thousands of visitors, and exhibited our research products to researchers, practitioners, as well as the general public. Moreover, PacTrans organizes a series of activities to promote safe travel, smart growth, sustainability, etc., serving as a common platform for collaborations. The visits from high school teachers and elementary school students recently hosted are examples of such efforts.

5. Changes/Problems

NONE

6. Special Reporting Requirements

NONE