



Semi Annual Progress Report for University Transportation Centers

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Technology (OST-R)

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Project title: **Pacific Northwest Transportation Consortium (PacTrans): Providing Data-Driven Solutions for the Diverse Mobility Challenges of the Pacific Northwest**

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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 research partners, as well as Boise State University (BSU) and Gonzaga University (GU) as education partners. PacTrans' theme centers on "Developing Data Driven Solutions for the Diverse Mobility Needs of People and Goods in the Pacific Northwest". PacTrans serves 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 mobility. Major goals and objectives of PacTrans include:

Research – Serving as Region 10's research engine, PacTrans is committed to funding research in both the categories of advanced and, more importantly, applied research.

Technology Transfer – PacTrans strives to be an applied technology showcase, providing additional funds to projects that are deemed as "Success Stories" to ensure dissemination of results to policy makers, educators, practitioners, other transportation professionals, and the general public.

Education – As a consortium of seven prestigious universities, PacTrans is devoted to being an education leader. This involves continued evaluation and evolution of our transportation engineering programs as well as providing state-of-the-art research laboratories, student conferences and seminars, mentoring, and scholarship opportunities for our students and future workforce trainees.

Workforce Development – PacTrans endeavors to be a workforce development base: hosting activities that focus on the development of transportation professionals, building strong partnerships with transportation agencies and companies in our region, and designing training programs to address the workforce development needs, while connecting our students with quality jobs where they can implement the knowledge they gained through their education.

Outreach – Throughout all of these other goals and objectives, PacTrans seeks to be in a continual process of outreach: promoting and building the educational student base, making new industry and agency partners, attracting new research, and providing opportunities to share and learn about key outcomes and achievements that have been learned through research and education activities.

Collaboration – PacTrans desires to be a platform for participation and is always on the lookout for potential new partner and new opportunities with current partners to collaborate on transportation related endeavors.

What was accomplished under these goals?

During the period from April 1, 2020 – September 30, 2020, PacTrans was actively engaged in each goal and objective identified above. This was achieved through a breadth of activities that were conducted to ensure our transportation expertise contributes to the advancement of the region's transportation

research, technology transfer, education, workforce development, outreach, and collaboration.

Research

As Region 10's research engine, PacTrans has been actively engaged in two broader categories of research projects. We engage in multi-institutional research projects that require participation from at least two consortium universities, and typically have a larger budget. Such projects include multi-institutional general research projects, as well as a multi-institutional educational project, and a multi-institutional outreach project. We also engage in single institutional projects (referred to as small research projects) that only require participation from a single consortium university and typically have smaller budgets. Both categories of research are geared towards the goal of advancing the region's transportation mobility research.

PacTrans endeavors to begin research performance periods in coordination with the academic school year. However, with the original FAST Act Grant scheduled to close by September 2022, the PacTrans Board elected to expedite the fifth Request for Proposals (year 5: 2021 - 2022) in order to give researchers maximum performance time to complete their research. Thus, during this reporting period, PacTrans released a Request for Proposals over the summer. Abstracts have been submitted and full proposals are due to PacTrans staff in early November. This performance period is expected to run from March of 2021 through March of 2022.

During this reporting period we collected research project progress reports from all active PIs with year 3 (2019 – 2021) funding, as well as any PIs with year 2 (2018 – 2020) who required a no cost extension that went beyond this reporting period. The majority of year 2 (2018 – 2020) projects, however, have been submitted and all of those technical reports are either already published on our website and submitted to the various required repositories, or are currently going through the process of peer and technical review. Several Year 3 (2019 – 2021) projects have also submitted their draft technical reports which are currently going through the same process.

Technology Transfer

During this past reporting period, seven PacTrans success story projects are in progress and are expected to wrap up by January 2021. Also, PacTrans released the 2020 RFP for success story funding. This funding is meant to encourage investigators with meaningful research results to generate outputs that are geared toward practitioners and implementation. In total, PacTrans received ten success story proposals and they are currently being reviewed and ranked by both PacTrans Board of Directors as well as the Technology Transfer Advisory Board. Selections will take place in mid to late November and projects are anticipated to commence in January of 2021.

PacTrans hosted two webinars, one in May and one in September, that explored various case studies of technology transfer. The first showcased a new website developed by the PacTrans STAR Lab that quantifies and visualizes network traffic performance using a measure called Traffic Performance Score. The second highlighted a partnership toward Vision Zero between PacTrans, the City of Bellevue, WA, Together for Safer Roads, and Transoft Solutions.

PacTrans PIs are also active in technology transfer activities. For example, in late September, PacTrans Director, Yinhai Wang, took part in a panel during the 2020 Institute of Electrical and Electronics

Engineers (IEEE) International Smart Cities Conference. This panel was on the effect of COVID-19 in transportation. Dr. Wang was joined by Kaan Ozbay, Vijay Vittal, Jeff Schlegelmilch, and Aleksii Paaso. Another example is that Dr. Anne Goodchild's research on urban freight deliveries funded by PacTrans has been widely reported by news media, including Geekwire (<https://www.geekwire.com/2020/university-washington-studies-future-urban-package-delivery-lockers-street-sensors/>) and TheCityFix (<https://thecityfix.com/blog/80-of-goods-start-or-end-in-cities-its-time-we-start-taking-urban-freight-seriously/>).

Education

During this past six-month performance period, PacTrans activities revolving around students and education have been incredibly successful.

This summer Oregon State University with support from PacTrans, and in partnership with the Oregon Department of Transportation and the Federal Highway Administration, hosted in first ever Summer Transportation Institute where ten students had the opportunity to leaving about surveying, drone flight, bicycle safety and infrastructure, and play in a virtual sandbox.

PacTrans consortium partner institution Institute of Transportation Engineers (ITE) Student Chapters also had an outstanding year. Boise State University sent two students, with PacTrans support, to the 2020 Student Leadership Summit at the University of California, Los Angeles. These students then took what they learned and brought it back to campus where they plan to start their own chapter. The Gonzaga ITE student chapter won the 2020 Momentum Award for the Western District, recognizing the great amount of improvement shown over the past year. Finally, the OSU student chapter won two Dam Distinguished Awards including: The Community Impact Award and the Inclusive Excellence Award; as well as the 2020 Western District Student Chapter Award. They also won the Western District Traffic Bowl and will not compete in the national traffic bowl.

This past May, several PhD students and recent graduates of the Interdisciplinary Urban Planning Program organized the Pandemic Urbanism Symposium. This one-day, virtual event brought together more than 50 academics, researchers, practitioners, and activists to share their thoughts on the emerging state of pandemic urbanism. With over 1200 registrants, the symposium offered three plenary sessions and eight breakout sessions on a variety of subjects, all geared at answering questions such as: What does COVID-19 mean for city life? What are the implications of this pandemic for urban form, mobility, sociability, and politics? PacTrans assisted with the promotion of this event, both for the call for proposals for presentations, as well as for attendees to the general event. One University of Washington, PacTrans student researcher, Parastoo Jabbari, was successfully selected to present during the breakout session on mobility. She presented recent longitudinal survey results having to do with perceptions of shared mobility before and during the COVID-19 quarantine/physical distancing orders.

PacTrans student researchers also brought now a significant number of outstanding accolades:

- UW PhD candidate, Katie Idziorek, received the Thomas J. O'Bryant Policy and Finance Fellowship as part of her acceptance to the 2020 Eno Future Leaders Development Conference.
- UI Master's student, Nuzhat Yamin, was awarded the Women in Transportation SW Idaho Leadership Scholarship.

- UW PhD Candidate, Zhiyong Cui, received the CEE Department Chair's Award.
- OSU Master's student, Travis Larson won the 2020 West District ITE Outstanding Student Award.
- UW PI, Anne Goodchild, received the CEE Department Mentoring Award

PacTrans welcomed four new PacTrans Fellows at the beginning of this school year; three from the University of Washington and one from Oregon State University. At UW, these are high achieving master's students who receive tuition funding from PacTrans in partnership with our respective departments. While in school, these students must maintain a high-grade point average and will all participate in internships to better prepare then for careers after they graduate. At OSU, this is a student research position given to just one student each year.

Workforce Development

In the past several years, PacTrans has been positioning itself to roll out the PacTrans Workforce Development Institute to provide professional training services within Region 10. Over the past six months, to support efficient operations and develop a self-sustainable and demand-responsive workforce development institute, PacTrans designed the administrative structure and business model that ensure sustainability, efficiency, and quality of the proposed program, and the collaboration with existing programs in Region 10. Based on the findings of state of practice review and survey, and through outreach activities with local DoTs and other transportation organizations, PacTrans is currently in the process of developing and delivering of training courses/programs in response to the regional workforce development needs. Specifically, courses under development and prepared for delivery in Spring 2021 include MUTCD training, project management, human factors in transportation engineering, transportation data analysis and tools, GIS for transportation, pedestrian safety planning, design, and operations.

Continuing to operate remotely, PacTrans also hosted a number of great webinars during this reporting period to offer students the opportunity to hear from academic researchers and working professionals from public agencies and the private sector:

1. PacTrans partner, Eric Shimizu, of DKS & Associates, gave a presentation in April on managing sudden change.
2. Faculty and staff from UW and OSU gave a technical training webinar in June that exploring online teaching and learning, content development, and new strategies to make virtual environments more interactive.

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

Many of the specific details of these opportunities have been discussed above. More generally, PacTrans provides training and professional development opportunities through multiple channels:

Research: Through the lifespan of this grant, PacTrans annually selected research projects that offered faculty and student researchers funding to conduct cutting edge research in a variety of areas directly tied to the USDOT strategic goals.

Education: PacTrans consortium partners offer a variety of other on-campus and online courses

designed for professional development in addition to the regular degree programs. 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. As an example, PacTrans sponsored the 2020 OSU National Summer Transportation Institute which attracted 10 high school students even in this pandemic situation.

Outreach: PacTrans offers training and educational opportunities to K-12 students through its outreach activities. Examples include: UW engineering discovery days, OSU undergraduate engineering expo, and Alaska Summer Research Academy (ASRA), where 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. For example, PacTrans PhD student Ruimin Ke delivered a webinar talk to over 70 high school students during the summer to introduce ITS research and applications.

Funding assistance: PacTrans has supported student education and research activities. Beyond our Fellowship for Master's level students, PacTrans has recently created the undergraduate student research fellowship where student will identify an adviser to oversee their work on a research project. PacTrans will then provide a small stipend for that student to either purchase materials that are necessary to conduct the research or to travel to a conference to present the work. This fellowship has been utilized by three students since it was created last year.

Seminars, workshops, and conferences: As outlined above, PacTrans offers many opportunities for training and professional development through its webinar series and various workshops. Furthermore, PacTrans also uses its Region 10 Transportation Conference and Region 10 Student Conference as important opportunities for training and professional development.

Internships: PacTrans regularly posts internship opportunities on our website as a student resource. During this reporting period for example, PacTrans circulated twelve separate announcements for internship opportunities. Further, we regularly work with our external partners to develop internship programs for our students. With the WSDOT for example, we have set up internship opportunities both with their traffic management center and their tolling operations group.

Partnerships: PacTrans has developed strong partnerships with local ITE chapters in student mentoring and training. ITE Washington has a mentor program for university students. They offer student fellowships and also host events for student training. PacTrans also has an Outstanding Partner Award to acknowledge the partner with the best collaboration with PacTrans. The City of Bellevue is the winner of this award in 2020.

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, where PacTrans research outcomes are presented and demonstrated. Research outcomes are posted on the PacTrans website, distributed through our *monthly newsletter* and *annual reports*, and promoted through social media such as *Facebook* and *Twitter* and the University of Washington *press media*. We also disseminate news, events and results via our website at www.pactrans.org.

Another avenue for dissemination that PacTrans leans on heavily is presentations at conferences, workshops, and symposia. This year, for example, at the 2020 Institute of Electrical and Electronics Engineers (IEEE) International Smart Cities Conference, PacTrans Director, Yin Hai Wang, presented on his lab's new Traffic Performance Score Website, and UW PhD candidate, Shuyi Yin won the best paper award of this conference due to the outstanding contribution of his paper. Each year we send roughly one hundred PIs and students (about 50 students) to the TRB annual meeting where we participate in over 120 committee meetings, poster presentations, workshops, and lectures. Our annual conference each October also provides an invaluable platform for our researchers to present work either through presentation or poster.

As has been mentioned above, PacTrans also encourages new, innovative dissemination materials through the identification of success stories, where PacTrans offers limited additional funds to projects that have results with potentially strong impacts. These funds can then be used to explore new and innovative opportunities to get knowledge, methods, and products gained, into the hands of practitioners. This year these funds have been used to host workshops/training, produce informational videos, build online tools and procedure manuals, etc.

New to PacTrans upcoming 2019 – 2021 research cycle, each PI will be required to host a seminar/webinar at the conclusion of their project. They were already asked during the proposal period to name invitees to their seminar/webinar which further reinforced the focus on technology transfer from the beginning stages of their research.

Finally, per our obligation as a UTC, research results are posted on our website and are disseminated to all of the required repositories that include, TRID, USDOT, Transportation Library, Volpe National Transportation Systems Center, Federal Highway Administration Research Library and the US Department of Commerce National Technical Information Service.

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

PacTrans is excited for the busy season ahead. Below are the center's identified plans and strategies for accomplishing its goals and objectives over the next reporting period.

Research

During this next reporting period PacTrans will finish processing and disseminating all remaining year 2 (2018 – 2020) projects. We will also continue to monitor all year 3 (2019 – 2021) and year 4 (2020 – 2022) projects. PacTrans will also complete the selection process for year 5 (2021 – 2022) projects, and initiate the new subawards in March.

Technology Transfer

During this next reporting period, PacTrans will complete the ongoing success story projects started in January 2020. Also, the selection process will be completed for the 2020 success story funds that were mentioned in the previous section. These projects are slated to begin before the end of the year and PIs will have up to twelve months to finish the proposed activities.

Also during this next reporting period, PacTrans has several great opportunities for technology transfer.

Two such examples are the PacTrans Region 10 Transportation Conference and the TRB Annual Meeting:

The PacTrans Region 10 Transportation Conference is held each October. This year it will be held virtually with a main event on the third Friday of October and a webinar each day the following week. This event attracts hundreds transportation professionals from public agencies, private industry, and academia each year. During the event, several researchers will have the opportunity to present their work during moderated technical sessions and others will create videos for our virtual poster sessions.

The TRB Annual Meeting has always been one of the most influential opportunities for our researchers to disseminate their work. As mentioned previously, each year we send roughly one hundred PIs and students (about 50 students) to the TRB annual meeting where we participate in over 120 committee meetings, poster presentations, workshops, and lectures.

PacTrans will also continue to incorporate technology transfer content in our monthly webinar series. In November, for example, Hamed Benouar, one of our technology transfer advisory board members, and a colleague, will present on effective technology transfer and commercialization.

Education

During this next reporting period PacTrans will be very busy with education endeavors. Each consortium partner receives some money each year for education and outreach activities. Those funds are at the discretion of the Associate Director (PI of the subaward) from each of the partner institutions. Those funds tend to be used to support activities such as the following:

1. We support professional organization student chapters, such as the Institute of Transportation Engineers, and student competition teams, such as UI's clean snowmobile team, and UW's Hyperloop team. Most of these teams have regional and national competitions during the spring.
2. Some of these funds are historically used to support the travel of students to conferences such as the Regional Transportation Conference and the TRB Annual Meeting to present their work.

We will also host the 2020 Region 10 Student Conference in October where students will have the opportunity to learn from practitioners, ask questions of a recent graduate panel, compete in a poster competition, and network with their student colleagues.

Workforce Development

PacTrans has a few important focuses for workforce development over this next reporting period:

The center will continue developing and delivering training courses and certificate programs that cover more topics with critical needs for workforce development. Besides, the center will develop an online training platform to better assist transportation practitioners to register for training courses and have access to training resources. In addition, the center will develop assessment and evaluation processes for training courses and the overall program of the PacTrans WDI. With the objective to develop a demand responsive institute that addresses regional workforce development needs, it is critical to develop a process for course development that iterates between the needs of the client and the curriculum offered, a holistic evaluation process for the courses and the overall program, and implement evidence-based instructional practices (EBIPS) in courses. The center will develop a guidebook including course development processes with carefully designed learning outcomes and

associated learning activities, active learning strategies, reliable assessment and evaluation processes of learning, and overall program and course evaluation.

PacTrans will also host our monthly webinar series. The speakers and topics for these webinars have not yet been determined.

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 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, **Jeff Ban**, Ph.D., Associate Professor of Transportation Engineering in 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, training program development, and educational enhancements among the partner institutions.
- PacTrans Associate Director in Oregon State University (OSU), **David Hurwitz**, 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), **Eric Jessup**, Ph.D., Associate Professor and Transportation Economist in the School of Economic Sciences at Washington State University (WSU), 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.

- Assistant Director, **Cole Kopca**, devoted 100 percent of his time to the day-to-day operations in support of the PacTrans mission. His responsibilities include project management, grant management, events coordination and outreach, and managing the PacTrans operations team.
- PacTrans full-time Program Coordinator, **Melanie Paredes**, devoted 100 percent of her time to the Center’s fiscal matters, support with events coordination and outreach and day to day administration.
- **Leona Vaughn**, undergraduate student in the College of Communications at the University of Washington was recently hire to do communications work for PacTrans. She’s spends 20 percent of her time on website upkeep and social media networking and posting.
- **Wei Sun**, Ph.D., Research Associate in the PacTrans STAR Lab at the University of Washington, devotes 30 percent of his time in providing research support and oversight.
- 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 such as the Region 10 Student Conference.
- PacTrans has 28 fulltime faculty at the UW engaged in transportation research. Our consortium partners (OSU, UI, WSU, UAF) have 41 fulltime faculty directly involved in PacTrans research.

What other organizations have been involved as partners?

While this iteration of our center is still very young, PacTrans has continuing relationships with many partners that have been cultivated over the years. The table below highlights the many partnerships that PacTrans has built over the duration of the center:

Partner	Type	Fund Match		Serve on EAB	Project Collaborator	Event Collaborator
		Financial	In Kind			
Alaska State Department of Transportation	Government	X		X		
Idaho Transportation Department	Government	X		X		
Oregon State Department of Transportation	Government	X		X		
Washington State Department of Transportation	Government	X		X		
City of Bellingham	Government				X	
City of Seattle	Government	X				
City of Lynnwood	Government				X	X
City of Bellevue	Government				X	X
City of Everett	Government					X
King County	Government				X	X
Snohomish County	Government				X	
Pierce County	Government				X	

Sound Transit	Government Agency			X	X	
Washington Traffic Safety Commission	Government Agency					X
Washington State Transportation Insurance Pool	Government Agency	X				X
University of Alaska, Anchorage	Educational Institution		X		X	X
University of Washington Transportation Services	Educational Institution				X	
Washington State Department of Ecology	Government	X				
Puget Sound Regional Council	Government			X		
Washington State Transportation Investment Board	Government Agency					X
American Society of Civil Engineers	Professional Association					X
Institute of Electrical and Electronics Engineers	Professional Association					X
Institute of Transportation Engineers	Professional Association					X
Intelligent Transportation Systems of Washington	Professional Association					X
Port of Portland	Government			X		
BMW Group	Private Industry			X		
Western Trailers	Private Industry			X		
Coral Sales Co.	Private Industry	X				
National Institute for Transportation and Communities	University Transportation Center				X	X
Transportation for Livability by Integrating Vehicles and the Environment	University Transportation Center				X	X
Center for Environmentally Sustainable Transportation in Cold Climates	University Transportation Center				X	X
Aichele and Associates	Private Industry				X	
Alstom Grid Inc.	Private Industry				X	
Alta Planning and Design	Private Industry				X	
Battelle	Private Industry				X	X
Cascade Bicycle Club	Non-profit/Foundation				X	X
Feet First	Non-profit/					X

	Foundation					
DKS Associates	Private Industry	X				X
Fehr and Peers	Private Industry				X	X
FLIR	Private Industry				X	
Pierce Transit	Transit Agency	X				
King County Metro	Transit Agency	X				
Q-Free	Private Industry	X				
HDR	Private Industry				X	X
T-Mobile	Private Industry	X				
Verizon	Private Industry		X			
INRIX Inc.	Private Industry				X	
Nokia	Private Industry	X				
NVidia	Private Industry				X	
Transpo Group	Private Industry	X				X
Luum	Private Industry				X	X
Kittelson and Associates	Private Industry			X		X
Microsoft	Private Industry				X	X
BlackBerry	Private Industry				X	X
PACCAR, Inc.	Private Industry				X	X
West Salem High School	Educational Institution				X	X
The Bush School	Educational Institution				X	X

Outputs

	Total	UW	WSU	UI	OSU	UAF	GU	BSU
Publications: peer reviewed journal articles	116	42	28	15	28	1	1	1
Publications: Book chapters and other edited manuscripts	8	4	1	1	1	1	0	0
Conference papers	72	34	7	12	12	5	0	2
Conference presentations	76	39	9	12	9	6	0	1
Lectures/Seminars /Workshops/ Invited Talks	94	33	7	10	23	20	1	0
Policy Papers	4	3	1	0	0	0	0	0
Websites or Other Internet Sites	11	7	2	1	1	0	0	0
New Methodologies, Technologies or Techniques	12	5	0	2	3	2	0	0
Inventions, patent applications, and/or licenses	0	0	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	32	7	3	3	10	9	0	0

OUTPUTS: Technology Transfer Plan Output Metrics	Annual Targets	Numbers for Reporting Period
Number of publications, presentations, and posters made at conferences or workshops explaining or promoting the research outputs	200	358
Number of software tools and technologies made available to practitioners	10	12

Examples of peer reviewed journal articles

- Madkour, F.E., Mohammad, U., Sorour, S., Hefeida, M. and Abdel-Rahim, A. (2020). Vendor-Independent Reliability Testing Model for Vehicle-to-Infrastructure Communications. *Transportation Research Record*, 2674(9), pp.898-912.
- Zou, T., Khaloei, M., & MacKenzie, D. Effects of Charging Infrastructure Characteristics on Electric Vehicle Preferences of New and Used Car Buyers in the United States. *Transportation Research Record: Journal of the Transportation Research Board*. (in press)
- Shen, Q., Y. Wang, and C. Gifford. Exploring Partnership between Transit Agency and Shared Mobility Company: An Incentive Program for App-Based Carpooling. *Transportation*. (Accepted for publication; forthcoming in 2020)
- Wang, Y., A. Moudon, and Q. Shen. How Does Ride-Hailing Influence Individual Mode Choice? An Examination Using Longitudinal Trip Data from Seattle Region. Accepted for presentation at annual TRB meeting and being considered for publication in *Transportation Research Record*.

- Sun, F., Moudon, A., Shen, Q., Ban, X., Lee, B. (2020). The impact of shared mobility option on demand. Submitted to Transportation Research Part A.
- J. Hisham, D. Cobb, D. Hurwitz, E. McCormack, A. Goodchild, and M. Sheth (2020). Developing Design Guidelines for Commercial Vehicles Envelopes on Urban Streets. Transportation Research Part F.
- Pimentel, R., Lowry, M. Pimentel, D., *Glazer, A., Moe, G., and Knysh, M. (2020). If You Provide, Will They Ride? Motivators and Deterrents to Shared Micro-Mobility. International Journal of Business and Applied Social Science, Vol 6, Issue 6, pp 26-38.
- Pimentel, D., Lowry, M. *Koglin, T., and Pimentel, R. (2020). Innovation in a Vacuum: The Uncertain Legal Landscape for Shared Micro-mobility. Journal of Law and Mobility, pp. 17-20.
- Madkour, F. E., Mohammad, U., Sorour, S., Hefeida, M., & Abdel-Rahim, A. (2020). Vendor-Independent Reliability Testing Model for Vehicle-to-Infrastructure Communications. Transportation Research Record, 2674(9), 898-912.
- Chang, K., Lutz, B., and Brown, S. (2020). Workforce Development Needs and Objectives of Today's Transportation Engineering Professional: Regional Perspectives from the Pacific Northwest. Transportation Research Record. 1-9. 10.1177/0361198120926995.
- Jashami, H., Cobb, D., Hurwitz, D. S., McCormack, E., Goodchild, A., & Sheth, M. (2020). The Impact of Commercial Parking Utilization on Cyclist Behavior in Urban Environments. Transportation Research Part F: Traffic Psychology and Behaviour, 74, 67-80.
- Jashami, H. *, Cobb, D. *, Hurwitz, D., McCormack, E., Goodchild, A., & Sheth, M. (2020) Developing Design Guidelines for Commercial Vehicles Envelopes on Urban Streets. Transportation Research Part F Traffic Behavior and Psychology, Volume 74, Pages 67-80.
- Saha, M., Chauhan, D., Patil, S., Kangas, R., Heer, J., Froehlich, J. E. (2020). Urban Accessibility as a Socio-Political Problem: A Multi-Stakeholder Analysis. ACM Journal on Human Computer Interaction (PACM HCI). Presented at CSCW2020. Published.
- Barlow, Z. *, Mohammed, H.A. *, & Hurwitz, D. (2020). Development and Evaluation of Temporary Traffic Control Devices for Unmanned Aerial System Operations. Journal of Surveying Engineering, ASCE. Volume 146, Issue 2.

Examples of conference papers and presentations

- Yamin, Nuzhat, Lauren Smith, Syrine Belakaria, Sameh Sorour, and Ahmed Abdel-Rahim. Fleet Re-Balancing with In-Route Charging for Multi-Class Autonomous Electric MoD Systems. In ICC 2020-2020 IEEE International Conference on Communications (ICC), pp. 1-7. IEEE, 2020.
- Belz, N.P., Fulton, G. (submitted for 2020; postponed to 2021). The Use of Spectrometry for Non-Invasive Measurement of Anti-Icing and Deicing Chemicals, 2020 International Conference on Winter Maintenance and Surface Transportation Weather and Winter Maintenance National Peer Exchange, Atlanta, GA
- Belz, N.P., Fulton, G. (November 2019). The Potential of Spectrometry for Quantifying In-Situ Anti-Icing and Deicing Chemicals, 2019 Annual Meeting of the Intelligent Transportation Society of Alaska, Anchorage, AK
- Y. Xu, Y. Turkan, A. Karakhan, D. Liu, Exploratory Study of Potential Negative Safety Outcomes Associated with UAV-assisted Construction Management, ASCE Proceedings of Construction Research Congress 2020, Tempe, AZ, 2020.
- Stuefer, S., Richards, E. River Ice Measurements for Transportation Safety in Rural Communities. 2020 PacTrans | CSET Regional Transportation Conference, Mobility for a Rapidly Changing Society; dates of the conference are to be determined.
- Stuefer, S., Richards, E. Ice measurements to explore safety of winter travel on the Yukon River to the conference. Cryosphere 2020: International symposium on ice, snow and water in a warming world. Conference was postponed to September 2021 due to pandemic.
- Zhuang, Y., Ke, R. and Wang, Y. Edge-Based Traffic Flow Data Collection Method Using Onboard Monocular Camera. Journal of Transportation Engineering, Part A: Systems, 146(9), p.04020096, 2020.
- Ke, R., Cui, Z., Chen, Y., Zhu, M. and Wang, Y. IoT System for Real-Time Near-Crash Detection for Automated Vehicle Testing. arXiv preprint arXiv:2008.00549, 2020.
- Pu, Z., Zhu, M., Li, W., Cui, Z., Guo, X. and Wang, Y. Monitoring Public Transit Ridership Flow by Passively Sensing Wi-Fi and Bluetooth Mobile Devices. IEEE Internet of Things Journal, 2020.
- Chang, K., Warmbrodt, S., Hurwitz, D., and Simpson, E. A Regional Assessment of Crash Reporting Processes. Transportation Research Board Conference; Washington, DC, 2020.

Chang, K., Lutz, B., and Brown, S. Workforce Development Needs and Objectives of Today's Transportation Engineering Professional: Regional Perspectives from the Pacific Northwest. Transportation Research Board Conference; Washington, DC, 2020.

Example of lectures/seminars/workshops/invited talks

Ahmed Abdel-Rahim, "Infrastructure Needs to Support Smart City Implementation in Developing Countries" Department of Electrical and Computer Engineering, Minia University, Minia, Egypt

Ahmed Abdel-Rahim, "Educating Future Civil Engineers to Support Smart City Implementation - Opportunities and Challenges" Department of Civil Engineering, Minia University, Minia, Egypt

PacTrans Webinar Series: "Learning from Network-wide Traffic Sensor Data: Vehicle Travel and Traffic Performance Changes under the Influence of COVID-19"

Pu, Z., Zhang, Q., Zhuang, Y., Lv, Y. and Wang, Y. (2020). August. A Device-Free Wi-Fi Sensing Method for Pedestrian Monitoring Using Channel State Information. In International Conference on Transportation and Development 2020 (pp. 207-220). Reston, VA: American Society of Civil Engineers.

Parrish, C., C. Simpson, and R. Slocum. (2020). Summer Transportation Institute, UAS in Transportation Lecture/Field Demonstration, 20 Aug, Oregon State University.

Froehlich, J. E., Saugstad, M., Saha, M., Johnson, M. (2020). Towards Mapping and Assessing Sidewalk Accessibility Across Socio-cultural and Geographic Contexts. Proceedings of Data4Good: Designing for Diversity and Development

Froehlich, J. E., Saugstad, M., Martínez, E., de Buen Kalman, R. (2020). Sidewalk Accessibility in the US and Mexico: Policies, Tools, and A Preliminary Case Study. Workshop Proceedings of Civic Tech 2020.

Connor, Billy. (2020). Webinar: Introduction to Managing Dust May 28, 2020

Connor, Billy. (2020). Webinar: Planning for Dust Management June 18, 2020

Examples of New Methodologies, Technologies or Techniques

New, state-of-the-art analysis tools and techniques to enable more efficient and effective assessments of the risks of closure associated with unstable highway slopes.

Methodology to use neural networks to study the effects of fluid-structure interaction.

A cross-language version of the Project Sidewalk website and deployed into two Mexican cities. We've also performed initial cross-city comparisons of sidewalk infrastructure, as presented in our workshop papers above.

Truck parking availability prediction algorithm based on multi-task learning; real-time roadway ice/snow/rain conditions detection algorithm based on video sensing;

A mixed integer linear optimization model for determining the optimal charging locations of battery electric buses

Complex Road Marking Extraction Algorithm to extract and classify complex pavement markings. 3D rockslope facet detection to identify different features on rockslopes

Algorithms were developed for safety applications for 1) bicycles and 2) traffic participants with low mobility, e.g., pedestrian or wheel chair

Examples of Websites

<http://ses.wsu.edu/research-project-videos/>

<http://tps.uwstarlab.org/>

<https://uidaho.maps.arcgis.com/apps/opsdashboard/index.html#/012bb13099e44aadbb59f9e16af587c5>

<http://spgg.projectsidiwalk.org>

<http://cdmx.projectsidiwalk.org>

<http://newberg.projectsidiwalk.org>

<http://seattle.projectsidiwalk.org>

<http://columbus.projectsidiwalk.org>

<http://research.engr.oregonstate.edu/parrish/lidar-and-uas-traffic-network-monitoring#overlay-context=user>

Examples of Data/Database/Video/Software/Educational Aids/Curricula/Equipment

Spectral data library for anti-icing and deicing chemicals.

Software package for providing a BSM output from the traffic in the popular traffic simulator VISSIM. An API for interacting with traffic and receiving SPAT messages for traffic signal control. This allows traffic engineers to write software that interacts with VISSIM as if it were a real traffic network including connected cars creating BSMs and signals taking SPAT control messages. A short video about the project goals and achievements was produced.

All of our Project Sidewalk data is open and available on their respective city pages.

The file is a Microsoft Access Database of laws governing e-bikes (bicycles equipped with electric motors to assist in propulsion), and e-scooters (stand-up kick scooters powered by an electric motor) in all fifty states and the District of Columbia. The researchers used the LEXIS/NEXIS legal database, WESTLAW, and state-operated websites in each assigned jurisdiction to find the relevant laws.

Laser scan surveys at Long Lake and Glitter Gulch Alaska.

One (1) videos related to the heavy vehicle simulator

Three (3) videos related to student experiences in the driving simulator lab

The machine learning model uses data from existing experimental tests of bridges to study fluid-structure interaction. New data on fluid-structure interaction will result from this study.

Augmented reality interaction with traffic simulations

The GPR and manual river ice measurements and support documentation were submitted via email to the PacTrans data management personnel. DOI has not been created for this dataset.

An early WebGL version of our ATV simulator system is usable in-browser here: https://chris-mcclure.github.io/AK_ATV/ "UAS in Transportation" video prepared for PacTrans conference and for outreach for UAS Summit on October 27-28.

Outcomes

OUTCOMES: Technology Transfer Plan Outcomes Metrics	Annual Targets	Numbers for Reporting Period
Number of early adopters of our research outputs	10	6
Changes made to the transportation system, or its regulatory, legislative, practice manuals, design standards, or policy frameworks	2	3

The following are several great examples of the outcomes seen due to PacTrans funded research:

Over the years, PacTrans has funded a number of projects on freight, and specifically related to urban freight delivery that have been led by UW researcher Anne Goodchild. This work, along with other funded work, has made her one of the field's foremost experts. It was for this reason that she was invited to address the House Transportation and Infrastructure Committee of the U.S. Congress in Washington D.C. on December 5 of last year. She gave well articulate argument for more focus on the last mile and final 50 of urban goods deliver.

On that same subject, we have reported in the past about the common carrier locker pilot that Dr. Goodchild and her lab facilitated with the Seattle Department of Transportation. That pilot, funded in part by PacTrans, has led to a US Department of Energy project with a new, smart locker system that

was installed in the Belltown Neighborhood of Seattle. This implementation happened in partnership with the City of Seattle, King County Metro, Sound Transit, CBRE, Puget Sound Clean Air Agency, and the City of Bellevue.

The dust palliative work led by UAF researcher Billy Connor that we’ve highlighted in past semi-annual reports has hit a new milestone. During this reporting period, the Alaska Department of Transportation and Public Facilities formally adopted and published the Dust Column test method for selection of dust palliatives for Alaskan roads and airports.

Several years ago, PacTrans funded a UW researcher, Jon Froehlich, who has been creating an open source, crowd sourcing method and application for collecting sidewalk accessibility data. This work has also hit new milestone during this reporting period. As we reported in the last semi-annual report, “a company, PathVu, has begun to use this code base to develop their own Project Sidewalk version.” During this reporting period, PathVu has begun using Project Sidewalk in a pilot deployment in Pittsburgh.

Impact

IMPACTS: Technology Transfer Plan Impacts Metrics	Annual Targets	Numbers for Reporting Period
Number of research outputs that positively contribute to the reduced roadway vehicle to vehicle or vehicle to ped/bike crash rates	3	3
Number of research outputs that positively contribute to improving roadway travel reliability, efficiency, accessibility	7	3

What is the impact on the effectiveness of the transportation system?

A great example of the impact on the adoption of new practices during this reporting periods is the Dust Column Test work that was described above in the outcomes section. Again, during this reporting period the Alaska Department of Transportation and Public Facilities (AKDOT&PF) formally adopted and published the Dust Column test method for selection of dust palliatives for Alaskan roads and airports. This dust suppressant test method is the first of its kind and the only one to be officially adopted by a state DOT. It is helping AKDOT&PF keep dust from being released into the atmosphere and mitigating health hazards, safety concerns, and environmental impacts of dust on Alaskan roads and on its airports. This research team is currently working on the development of a small, portable version of the dust column so that tests can be done in real time in the field as well.

What is the impact on the adoption of new practices, or instances where research outcomes have led to the initiation of a start-up company?

Several years ago, PacTrans funded work out of the University of Washington titled, *Developing a Cost-Effective Bus-to-Pedestrian Near-Miss Detection Method Using Onboard Video Camera Data*. This initial project, cofounded by the TRB Idea grant, sought to build a machine learning algorithm that could identify near-misses on a transit collision avoidance system. Several years later, PacTrans also funded a success story technical transfer project with the same team to build an edge computing method so that the large video files, recorded on the buses system, could be processed on board, and only the pertinent near-miss footage would then be transmitted for storage. Today, the research team has completed the design, development, and installation of four Transit Event Logging Systems (TELS). They are now running on Pierce Transit buses 230, 231, 232, and 233 for data fusion, near-miss event detection, data collection, and event video recording (all in real-time). This work is helping transit authorities to better understand impediments to transit safety and helping operators of transit vehicles to be better prepared to navigate traffic safety conditions.

What is the impact on the body of scientific knowledge?

Over the past decade, Oregon State University, PacTrans PI, John Gambatese has been working with the Oregon Department of Transportation (ODOT) on a series of projects on a variety of topics related to improving safety in construction and maintenance work zones. This work has helped to identify way to reduce speeds and speed variation in work zones, increasing worker safety. This works also includes practices such as, use of blue lights on paving equipment, additional lighting for traffic controls, work zone intrusion alert technologies, and radar speed displays in work zones.

What is the impact on transportation workforce development?

PacTrans WDI brings together decades of collective experience in educational research and continuing education throughout Region 10 of the Pacific Northwest. Each university carries its own strength in transportation research and education and conducts outreach activities with local agencies. WSDOT and AKDOT&PF have committed resources to help PacTrans launch the WDI. The first training course for AKDOT&PF has already been delivered and the first course for WSDOT employees is scheduled for delivery in February 2020. Besides, several training courses are under development include project management, human factors in transportation engineering, transportation data analysis and tools, GIS for transportation, pedestrian safety planning, design, and operations. In addition, PacTrans is developing an online training platform to better assist transportation practitioners to register for training courses and have access to training resources. PacTrans WDI is expected to have great impact by providing demand-responsive and flexible training services to address the training needs in the Pacific Northwest.

Changes/Problems

NONE.

Special Reporting Requirements

Research Project Requirements

Per our research update above, PacTrans is in the process of selecting new projects for the 2021 – 2022 research performance period. Those projects are scheduled to begin in March, but records of these projects will be uploaded to RiP and put on our website within one month of final selection. Further, PacTrans has begun include the requirement for an ORCID number from each PI before their project funds are released.

Submission of Final Research Reports

As final versions of technical project reports are completed and checked for ADA compliance, they are then uploaded to our repository and linked on the research project profiles on the PacTrans website. Then they are submitted to TRID and Research HUB as well. PacTrans staff have completed submission of our Year 1 final technical reports, and are about halfway through year 2 final technical reports. We are also preparing to begin receiving draft technical reports for Year 3 funded projects.