PACIFIC NW TRANSPORTATION CONSORTIUM

PACTRANS

REGION 10

Annual Report

2020 – 2021

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Letter from the Director

As I reflect on the past year my thoughts dwell on how much of our daily lives have changed some for the better and some for the worse. In my own life, before COVID I would travel upwards of 250,000 miles per year to various conferences, workshops, and symposia around the globe. The COVID pandemic has halted that travel which has allowed me more time to spend with my family and focus on my own personal health (I have walked 10,000 steps per day since the pandemic began). On the flip side, the lack of travel has precluded me from visiting other institutions and colleagues to share experiences, and brainstorm new ideas for the future of transportation.

At PacTrans, the story is much the same. Take our Region 10 Transportation Conference for example. In 2020 we were forced to shift our regularly in-person event to a virtual one. This limited the personal interactions and side conversations that always bear significant fruit: establishing relationships, flushing out research project ideas, and making connections. On the flip side, we attracted a broader and more diverse audience than ever before, to learn about PacTrans and all the great work we have been doing.

I am also keenly aware of the changes this past year has brought more broadly to our transportation sector. It is projected that the pandemic caused e-commerce to catapult its market share trajectory almost 10 years into the future. While Americans drove less in 2020, early estimates show that an estimated 38,680 people died in motor vehicle traffic crashes, which is the largest projected number of fatalities since 2007. It represents a 7.2 percent increase compared to fatalities reported in 2019. These statistics are even more dramatic for pedestrians and bicyclists, with an estimated 21 percent increase. The list of changes to the status quo goes on and on. This makes me realize there has never been a more important time for us to be good at what we do.

Over the past year PacTrans has funded nineteen new projects that seek to address the diverse mobility challenges of people and goods across the Pacific Northwest. We funded four new technology transfer projects that seek to move meaningful research outputs closer to practice. We funded five new fellowships to cultivate the next generation of transportation leaders. Our student organizations and competition teams, which PacTrans supports, were incredibly successful on the regional, national, and international stage. Our students themselves received more well earned accolades than we can recount. Perhaps most importantly, this year PacTrans launched the new Workforce Development Institute, which provides short term training to today's transportation workforce, and K-12 STEM outreach programs to the workforce of tomorrow.

I am incredibly proud of the hard work and accomplishments that have been achieved by all seven PacTrans consortium partner members here in the Pacific Northwest. On behalf of all of us, I would like to express our tremendous appreciation for your support over the past year, and I humbly submit to you the contents in the following pages as a testament to these efforts.

Sincerely yours,

Yinhai Wang, Ph.D., P.E., Professor

DIRECTOR OF PACTRANS

PacTrans Center

The Pacific Northwest Transportation Consortium (PacTrans) is the University Transportation Center (UTC) for Region 10. Established in January 2012, PacTrans continues to function as the UTC for Federal Region 10 with funding from the US Department of Transportation (USDOT) and local transportation agencies and industry. PacTrans is a coalition of transportation professionals and educators from Oregon State University (OSU), the University of Alaska, Fairbanks (UAF), University of Idaho (UI), Washington State University (WSU), and the University of Washington (UW). With recent success in the FAST Act UTC competition, PacTrans has recently added two new educational partners in Boise State University (BSU), and Gonzaga University (GU).

This new center also shifts PacTrans' focus from safety to *mobility*. PacTrans' theme centers on *develop data-driven solutions for the diverse mobility needs of the Pacific Northwest*. It 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 USDOT strategic goal of mobility.

MANAGEMENT STRUCTURE

The University of Washington serves as the lead institution in the PacTrans Consortium. The PacTrans Center is located at More Hall room 112 on the UW campus. Dr. Yinhai Wang, Professor of transportation engineering in the Civil and Environmental Engineering Department, serves as Director for PacTrans. The management structure of PacTrans, aside from the director, includes a staff, a Board of Directors, and an External Advisory Committee.

The PacTrans Board of Directors includes the PacTrans center director; associate directors of research, education, and outreach (each from the UW) ;and associate directors from all five consortium universities. The Board of Directors meets in person on a quarterly basis to discuss matters pertaining to PacTrans research, education, outreach, and technology transfer.

The PacTrans External Advisory Board (EAB), which is composed of nine members, includes directors from the research offices of the four state DOTs in Region 10 and representative from other transportation agencies, private industries, and the community. The role of the EAB is to provide input to PacTrans' strategic planning and outreach activities.

PACTRANS OPERATIONS TEAM

Yinhai Wang, Director; Professor, UW Civil and Environmental Engineering Department,

(206) 616-2696, yinhai@uw.edu

Jeff Ban, Associate Director of Research, Associate Professor, UW Civil and Environmental Engineering Department

Cole Kopca, Assistant Director, (206) 685-6648, ckopca@uw.edu

Melanie Paredes, Program Coordinator, (206) 221-9290, melqcp@uw.edu

Christina Yarbrough, Finance, Grants and Contracts, (206) 221-9290, crystina@uw.edu

John Ash, PacTrans STAR Lab Manager, jeash@uw.edu

Tasha Thakkar, Student Communications Intern

Wei Sun, PacTrans Research Associate

BOARD OF DIRECTORS

Yinhai Wang, Director, PacTrans, Professor, University of Washington

Xuegang (Jeff) Ban, Associate Director of Research, PacTrans, Associate Professor, University of Washington

David Hurwitz, Associate Director, PacTrans, Professor, Oregon State University

Eric Jessup, Associate Director, PacTrans, Research Associate Professor, Washington State University

Billy Connor, Associate Director, PacTrans, Director, Alaska University Transportation Center

Anne Vernez-Moudon, Associate Director of Education, PacTrans, Professor Emeritus, University of Washington

Ahmed Abdel-Rahim, Associate Director, PacTrans, Professor, University of Idaho

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Ned Parrish, Research Program Manager, Idaho Transportation Department (ITD)

Jerry Whitehead, President and CEO, Western Trailers, Chairman, Idaho Transportation Board

Anna Bosin, PE Chief of Research, Development & Technology Transfer, Alaska Department of Transportation and Public Facilities

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Managing Director
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Gareth Robins
Director of Analytics
EROAD

Chris Herman
Director of Trade and Transportation
Washington Ports Association

Highlights from 2020–2021

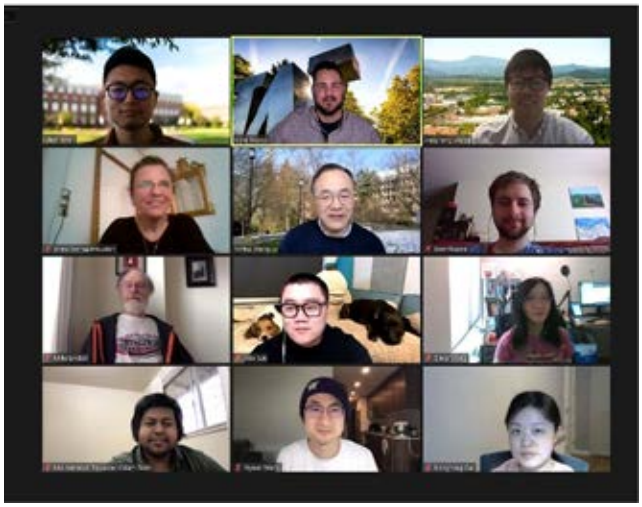
PACTRANS OFFICIALLY LAUNCHES WORKFORCE DEVELOPMENT INSTITUTE

In concert with the first class of its first training course, PacTrans officially launched its Workforce Development Institute (WDI) in 2021. The journey toward this milestone began four years ago when the PacTrans Board of Directors created an ongoing multi-institutional education project to explore and develop a program to support industry and agency partners to combat growing workforce development and continuing education challenges.

Over the past four years, PacTrans researchers have surveyed and interviewed hundreds of practitioners and managers of transportation companies and agencies to identify the gaps and needs in workforce development and continuing education. According to PacTrans Director, Professor Yinhai Wang, a report published by the Transportation Research Board predicts about 50% of the existing transportation workforce is likely to retire in 5-10 years and far fewer people are joining the industry than those retiring. Further, the proliferation of big data and new technologies in the field require new skill sets that classically trained transportation engineers have not previously had.

PACTRANS LAUNCHES DOCTORAL WEBINAR SERIES

In March 2021, PacTrans launched a new doctoral webinar series. This series is being spearheaded by PacTrans Associate Director of Education and UW Professor Emeritus of Urban Design and Planning, Anne Vernez Moudon. The goal is to create a platform for students to present their research to their peers.



The inaugural webinar was presented by OSU doctoral candidate Chen Chen and titled, An Interdisciplinary Agent-based Evacuation Modeling Framework: Seeking Convergence of Social, Natural, and Engineered Systems to Improve Life Safety in the Cascadia Subduction Zone. In this webinar, Chen along with his academic advisor, Associate Professor Haizhong Wang, presented work on an agent-based modeling (ABM) framework to improve life safety in the Cascadia Subduction Zone.

PacTrans has a long-term vision that this series, which has been created for students, will also be primarily organized by students. We are currently in the process of establishing a student advisory committee for the continuation of the webinar series.

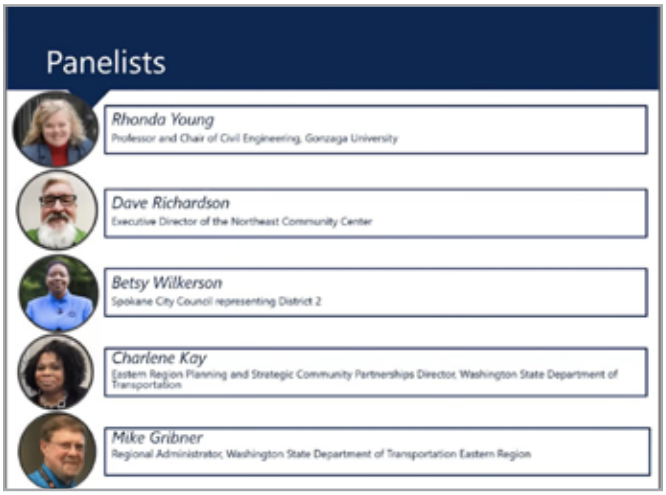
PACTRANS MAKES STRONG SHOWING AT 2021 VIRTUAL TRB ANNUAL MEETING

In February 2021, the Transportation Research Board (TRB) Annual Meeting celebrated its 100th anniversary. Also noteworthy this year, the conference was held virtually for the first time in its existence. This annual conference typically consists of more than 13,000 transportation professionals from around the world hosting more than 5,000 presentations in nearly 800 sessions and workshops in what always amounts to a jam packed week in frigid Washington D.C. This year, the virtual event spanned the entire month of January but still featured thousands of activities and presentations that participants attended from behind the computer of their homes and/or offices. The theme of the 100th annual meeting was Launching a New Century of Mobility and Quality of Life.

PACTRANS PARTNER GONZAGA UNIVERSITY HOSTS CIVIL ENGINEERING SOCIAL JUSTICE EVENTS

In June 2021, the School of Engineering & Applied Sciences at the Gonzaga University hosted a series of Civil Engineering Social Justice events. These events supported by PacTrans funding were moderated by Abigail Marquez (student) and led by Dr. Rhonda Young, Professor of Civil Engineering at Gonzaga University.

The Transportation, Social Justice, and Equity event was hosted in collaboration with representatives from WSDOT, Opportunity Northeast, and Councilwoman Wilkerson. The event focused on I-90 as a case study through the Spokane area and how it disproportionately affected residents of East Central. Not only did the event allow future civil engineering students and other guests to ground down the importance of weighing social issues in their projects, but also actively engaged the audience by asking their rank of importance on various issues related to transportation.



PACTRANS DIRECTOR WEIGHS IN ON THE ROLE OF AI IN TRANSPORTATION ASSET MANAGEMENT

In March 2021, PacTrans Director and Professor of Civil and Environmental Engineering at UW, Dr. Yinhai Wang, was interviewed by the National Academies for their article titled The Era of Smart Infrastructure Demands Strong Data, Technology Management. As the incoming chair of the Transportation Research Board's Standing Technical Committee on Artificial Intelligence and Advanced Computing Applications, professor Wang exchanged his views on how Artificial Intelligence (AI) could be employed in transportation asset management as a way to address safety and system reliability.

PACTRANS AD RECOGNIZED BY ASCE, ITE, AND HOME INSTITUTION FOR EXCELLENCE IN TEACHING AND MENTORING

Over the past year, PacTrans Associate Director and OSU Professor of Civil and Construction Engineering, David S. Hurwitz, has received several recognitions for his outstanding contributions in teaching and mentoring.

Professor Hurwitz's most recent accolade was the 2021 Wilbur S. Smith Distinguished Transportation Educator Award presented by the Institute of Transportation Engineers (ITE). The Wilbur S. Smith Distinguished Transportation Educator Award recognizes a person who has made an outstanding contribution to the transportation profession by relating academic studies to the actual practice of transportation.

Also this year, Professor Hurwitz is the recipient of the 2021 Oregon State University College of Engineering Faculty Teaching Excellence Award, which recognizes unusually significant and meritorious achievement in teaching and in scholarship which enhances the effectiveness of instruction.

"Dr. Hurwitz is a dedicated educator who has been recognized by OSU, ITE, ASCE and by ASEE for excellence in teaching. He served as a mentor for the American Society of Civil Engineering Excellence in Civil Engineering Education (ExCEEd) national workshops for developing faculty in their role as educators. He is an excellent mentor to his students,faculty and to the public, as well as being a wonderful advocate for OSU, Engineering and Transportation. As an example of his level of engagement, he was the featured speaker at Convocation for the current academic year."

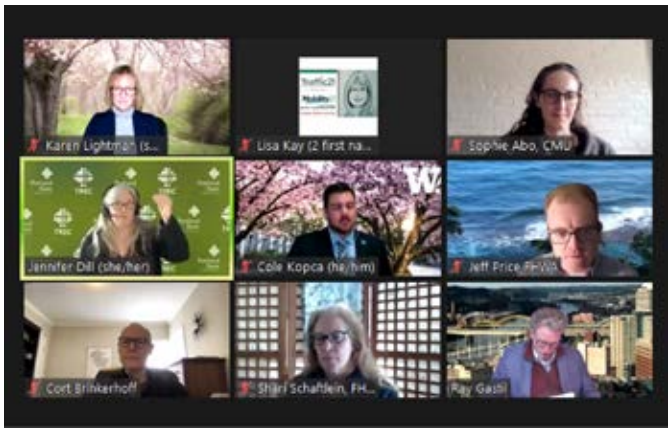
Finally, in April 2021, Civil Engineering Source, ASCE's news and information hub, published a wonderful article about Professor Hurwitz. The article titled, *Engagement and Commitment are Hallmarks of Transportation Engineering Course at Oregon State University*, summarized an interview conducted with Professor Hurwitz about the effectiveness of his teaching pedagogy.

"I believe that teaching is a performance art. To promote effective information transfer and deep understanding of class content, we have to deliver an engaging 'performance' in the classroom," said Hurwitz. "I work very hard to promote a welcoming classroom environment in which a variety of ideas and ways of being are welcomed and encouraged."

PACTRANS PARTICIPATES IN THE 2021 UTC MOBILITY SUMMIT

In April 2021, the Mobility21 National University Transportation Center, led by Carnegie Mellon University, hosted The Third Annual National Mobility Summit of the US Department of Transportation University Transportation Centers. This annual event provides an opportunity for policymakers, public agencies, private industry, non-profit organizations, and UTCs focused on mobility, to come together for a day-long summit to explore the current state of many aspects of the transportation industry, current and emerging research needs, and opportunities for collaboration and partnership.

The keynote speaker was Robert Hampshire, Acting Assistant Secretary for Research and Technology. Both PacTrans director, Yinhai Wang, and PacTrans assistant director, Cole Kopca participated in this event. Mr. Kopca, co-facilitated a small group breakout discussion on "Redefining the Role of the Curb" along with Jennifer Dill, Director of the National Institute for Transportation and Communities at Portland State University. During the poster session towards the end of the summit, Mr. Kopca also gave a short presentation highlighting some of the great research PacTrans has been engaged in over the past year.



LIFETIME ACHIEVEMENT AWARD

This is the highest and most prestigious award given by PacTrans. It is presented in recognition of individuals who have had distinguished careers in transportation in the Pacific Northwest with substantial involvement in the UTC program.

RANSFORD S. MCCOURT, PE, PTOE
President, ITE
A Community of Transportation Professionals

OUTSTANDING EDUCATOR AWARD

Presented to PacTrans faculty in recognition of sustained outstanding teaching including mentoring, advising, and innovative teaching techniques.

JOE MAHONEY, PHD
Professor,
Civil and Environmental Engineering
University of Washington

OUTSTANDING RESEARCHER AWARD

Presented to investigators for outstanding research with significant outcomes, incorporating meaningful student contributions, and robust community service/leadership involvement.

CHRISTOPHER PARRISH, PHD
Associate Professor,
Civil and Construction Engineering
Oregon State University

OUTSTANDING PARTNER AWARD

Presented to partners for outstanding collaboration in research, sponsorships, mentor/internship opportunities, event participation/facilitation, or assistance with technology transfer initiatives.

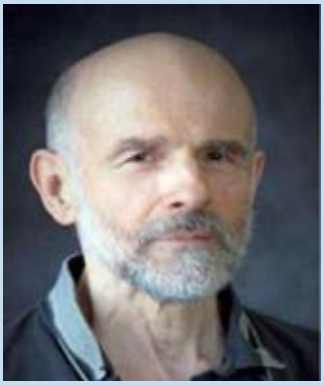
CITY OF BELLEVUE, WA

New Faculty

WASHINGTON STATE UNIVERSITY

JAKE WAGNER, PH.D.
Assistant Research Professor
School of Economic Sciences
Washington State University

Retirements



UNIVERSITY OF ALASKA FAIRBANKS

ROBERT PERKINS, PH.D.
Professor Emeritus of Civil Engineering
College of Engineering and Mines
University of Alaska Fairbanks

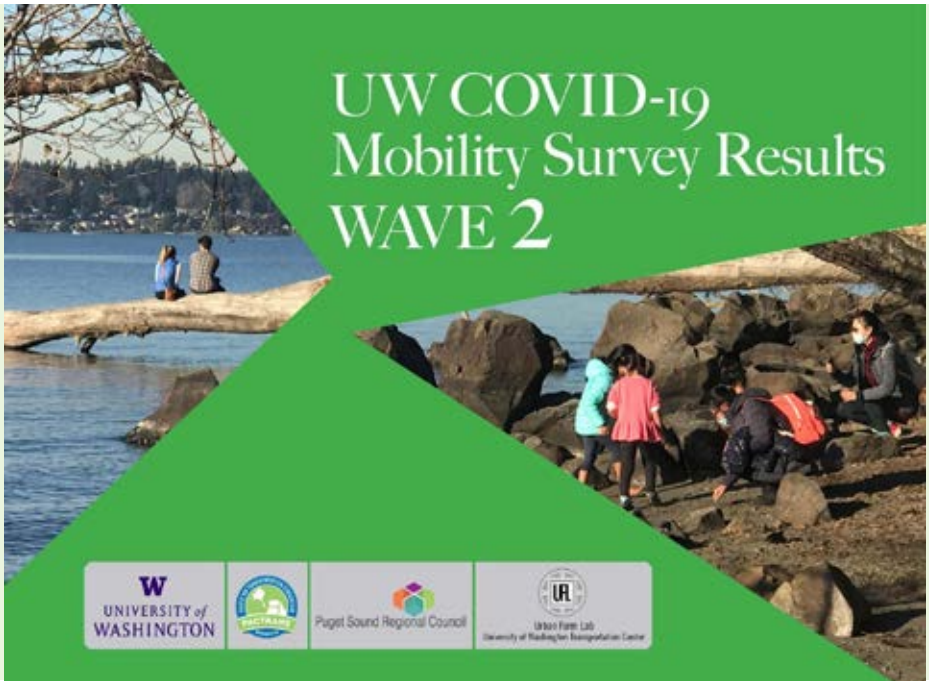
Research Highlights

PACTRANS FUNDED SURVEY REVEALS WORK, LIFESTYLE AND TRANSPORTATION HABITS

In 2020, PacTrans funded four quick call projects related to the data collection and analysis of the transportation impacts revolving around the COVID-19 pandemic. One of those projects, led by University of Washington Professor Emeritus, Anne Vernez Moudon, in partnership with the Puget Sound Regional Council, sought to explore changes in work, lifestyle, and transportation through a series of longitudinal surveys. The first was conducted in the Fall of 2020 and second in the Spring of 2021. Earlier this year, an analysis comparing the results of the two surveys was released.

The survey, in attempting to capture behavior changes due to remote-work arrangements, not only asked questions about changes in hours spent on work, but also about lifestyle changes, such as, eating out and grocery shopping, screen times, and physical activity.

In all, more than 4,500 people responded to the online survey, out of which, more than 60% of respondents were women; more than 80% of respondents had four years or more of college; and about half had a household income of more than $90,000 a year.



PACTRANS PI ERICA FISCHER WINS NATIONAL SCIENCE FOUNDATION CAREER AWARD

PacTrans PI and Assistant Professor of Civil and Construction Engineering at Oregon State University, Dr. Erica Fischer won a prestigious award from the National Science Foundation (NSF). Prof. Fischer was selected for the NSF Career Award for her proposal to create new technologies for the mass timber modular construction of buildings.

She plans on using her $560,000 award to develop innovative technologies for changing how buildings are designed, manufactured, and assembled. The building construction industry is primed for a major change to improve efficiency, believes Fischer, given the fact that construction has been done the same way for more than 100 years.

Fischer's research interests revolve around innovative approaches to improve the resilience and robustness of structural systems affected by natural and man-made hazards. This includes performance-based design approaches of structural systems to decrease the environmental impact of the built environment on the natural environment. PacTrans previously funded Fischer's project on *Agent-based Modeling of Emergency Management Networks with Public Mobilization after a Disaster.*

PACTRANS PI IDIL AKIN CO-AUTHORS JOURNAL BIOFILM

Dr. Idil Akin, PacTrans PI and Colf Distinguished Professor of Geotechnical Engineering in the Department of Civil and Environmental Engineering at the Washington State University, was awarded a National Science Foundation (NSF) grant resulting from previously funded PacTrans research. A result of this work is a recently published journal article in Biofilm titled, *Biofilm Addition Improves Sand Strength Over a Wide Range of Saturations.*

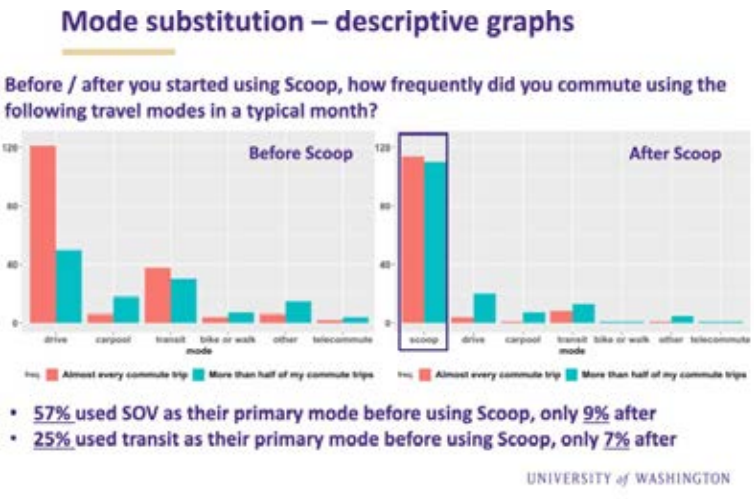
Dr. Akin and her fellow researchers used granules made from potato waste bacteria to strengthen soil, offering a new alternative to cement additives that are currently used to shore up soils for building and erosion control. They added the granules containing a bacterial slime called a biofilm to the soil, allowing a more natural and less carbon-intensive way to strengthen the soils.

In their work, the WSU research team showed that their biofilm granules were able to strengthen soils over a wide range of conditions, whether the soils were dry or wet. The material that they used also has the advantage of being a waste material, Dr. Beyenal said. The granules which are a waste product from potato processing plants contain bacteria plus a woven mat made up of molecules called polymers.

The researchers now hope to create a purer biofilm that is more environmentally friendly and doesn't include the bacteria. They also plan to test the biofilm in soils at a variety of concentrations and eventually in the field.

APP-BASED CARPOOLING COMPANY SCOOP PUBLISHES PACTRANS-FUNDED WORK ON EFFECTIVENESS OF CARPOOL INCENTIVE FUND

In late 2020, Scoop, an app-based carpooling company, published some PacTrans-funded work that was presented at the 2020 TRB Annual Meeting. The presentation was titled, Building Partnership Between Transit Agency and Shared Mobility Company: Incentivizing App-Based Carpooling in the Seattle Region, and was based on a 2018 PacTrans-funded a research project titled, Examining the Effects of King County Metro Carpool Incentive Fund, led by Dr. Qing Shen, Professor of Urban Design and Planning and Chair and Director of the University of Washington Graduate School's Interdisciplinary PhD Program in Urban Design and Planning at the University of Washington.



Research Projects

PacTrans consortium universities are dedicated to our commitment to invest in innovative mobility and safety research to address transportation issues in the Pacific Northwest. Our consortium combines unequaled data sources, unique and diverse labs and simulators, world-class researchers, cutting edge technology, and steadfast partners, to create a hotbed of ground breaking research and a robust project portfolio.

The PacTrans portfolio is composed of projects of small, medium, and large scopes. The small projects are designed to help foster pilot research on new but promising concepts and ideas. The medium and large sized projects are designed to address research issues of regional importance and require two or more institutes to collaborate on the final product.

Research proposals are subject to a peer review process that is overseen by the PacTrans Board of Directors. The proposals are evaluated to determine technical merit, alignment with regional priorities, capabilities and resources of the research team, and project scope. Upon completion of the research, a draft technical report is submitted to PacTrans and is subject to a peer review prior to publication of the final report.

To date, PacTrans has funded:

Year 1 (2012-2013): **22 research projects**

Year 2 (2013-2014): **31 research projects**

Year 3 (2014-2015): **16 research projects**

Year 4 (2015-2016): **20 research projects**

Year 5 (2016-2017): **23 research projects**

Year 6 (2017-2019): **21 research projects**

Year 7 (2018-2020): **20 research projects**

Year 8 (2019-2021): **18 research projects**

Year 9 (2020-2022): **21 research projects**

2019-2021 RESEARCH PROJECTS

Project Title	PI	Institution	Type
Development of PacTrans Workforce Development Institute (WDI)	Yinhai Wang Shane Brown Kevin Chang Eric Jessup Billy Connor	UW OSU UI WSU UAF	Multi - Education
Characterization of Underserved Population Perceptions and Mobility Needs in Connected-Vehicle and Smarter City Environments	Ahmed Abdel Rahim David Hurwitz Billy Connor Eric Jessup Jeff Ban	UI OSU UAF WSU UW	Multi - Outreach
Guidelines for using Photogrammetric Tools on Unmanned Aircraft Systems to Support the Rapid Monitoring of Avalanche-prone Roadside Environments	Ed McCormack Nathan Belz	UW UAF	Multi
Micro-Mobility Promises and Challenges in the Pacific Northwest	Haizhong Wang David Hurwitz Nathan Belz	OSU OSU UAF	Multi
Managing Increased Demand for Curb Space in the City of the Future	Kevin Chang Anne Goodchild Ed McCormack	UI UW UW	Multi
Using GNSS to Evaluate Threats to Mobility of Resources and People on Coastal Roads in USDOT Region 10	Meagen Wengrove	OSU	Single
Pilot Study: Learning Fluid-Structure Interaction via Machine Learning	Barbara Simpson	OSU	Single
UAS Image-Based Point Clouds to 3D BrIM: Deep Semantic Segmentation	Yelda Turkan	OSU	Single
River Ice Measurements for Transportation Safety in Rural Communities	Svetlana Stuefer	UAF	Single
Virtual Reality Vehicle Simulator - Phase 1	Orion Lawlor	UAF	Single
Connected-Vehicle Traffic Signal System Modeling Platform	Robert Heckendorn	UI	Single
A Hybrid Platform for Context-aware V2X Communications	Mohamed Hefeida	UI	Single
Connected Vehicle Safety Applications using V2X Under Consideration of Bicycles, Pedestrians and Persons with Special Needs	Axel Krings	UI	Single
Longitudinal Analyses of Washington State Student Travel Surveys	Anne Vernez Moudon	UW	Single
Combining Crowdsourcing and Machine Learning to Collect Sidewalk Accessibility Data at Scale	Jon Froehlich	UW	Single
Developing a Fuzzy-Logic Method for Evaluating the Accessibility of Disable People to Public Transportation in Rural Communities	Mohammadsoroush (Tommy) Tafazzoli	WSU	Single
Post-Wildfire Stability and Improvement of Hillslopes near PNW Transportation Infrastructure to Increase Mobility	Idil Akin	WSU	Single
Medicaid's Non-Emergency Transportation: The Critical Role of Mobility Services in Accessing Behavioral and Preventative Care	Bidisha Mandal	WSU	Single

2020-2022 Research Projects

PACTRANS WORKFORCE DEVELOPMENT INSTITUTE (WDI) - PHASE IV

PI: Yinhai Wang (UW)

Co-Investigators: Wei Sun (UW), Shane Brown (OSU), Billy Connor (UAF), Kevin Chang (UI), Eric Jessup (WSU)

During the Phase IV of the Workforce Development Institute (WDI), the research team will add new courses/certificate programs and improve the existing education platform. The research team will develop an online training platform and include new training courses and certificate programs that cover more topics with critical training needs. In addition, the research team will integrate previous education research products into the education platform and evaluate various methods (on-site, e-learning, hybrid, etc.) for the delivery of training services. It will assess and evaluate processes for training courses and the overall program of the PacTrans WDI. The research team proposes to 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. Finally they will develop an outreach and marketing plan of the PacTrans WDI. In order to make the institute sustainable, the research team proposes to develop an effective outreach and marketing plan. The plan will help to develop long-term collaboration with existing connections and explore new training opportunities with local DOTs and other transportation institutions.

CHARACTERIZATION OF UNDERSERVED POPULATION PERCEPTIONS AND MOBILITY NEEDS IN CONNECTED-VEHICLE AND SMARTER CITY ENVIRONMENTS - PHASE IV

PI: Ahmed Abdel-Rahim (UI)

Co-Investigator: Rula Awwad-Rafferty (UI), David Hurwitz (OSU), Billy Connor (UAF), Eric Jessup (WSU), Jeff Ban (UW)

The scope of work for this project involves two tasks. The objective of the first task is to map PacTrans Research Outcome to the Center's Theme Areas. The project PIs will review the final reports for completed projects at their institutions and interview researchers to identify the short-term and long-term impacts of the research and map the research outcome to the four Center's themes. As part of this step, the research outcome for each research will be classified into different categories: solution to existing problems, new methods and innovations, policy-focused research, national or regional focus, etc. The result of this task activities will be used to develop an integrated research outcome database. In the second project task, this database will be used to determine the content of the different outreach materials, considering the target audience and stakeholders, and the message to be advocated. Different communication tools and channels will be identified and utilized as part of the project, including detailed technical briefs (paper and web-based format), short videos, webinars, and different networking initiatives (social media, research blogs, etc.)

EVALUATION OF THE IDAHO (BICYCLE) STOP LAWS IN THE PACIFIC NORTHWEST

PI: David Hurwitz (OSU)

Co-Investigators: Kevin Chang (UI), Rhonda Young (GU)

This project seeks: 1) to clarify the anticipated safety impact of the Stop as Yield ("Idaho Stop") for all roadway users in Oregon (and its potential application in neighboring states, such as Washington, where such a law is being considered), and 2) to evaluate the historical impact this law has had in the State of Idaho since adoption in the early 1980s. This research will include both 1) an on-line expert survey sent to transportation agency staff in the region who have experience with the Idaho Stop and 2) Human-in-the-loop simulator studies using the bicycle and driving simulator at Oregon State University to collect data on likely cyclist and driver responses to varying conditions. This research directly addresses the PacTrans topic of Traffic Safety by determining how the "Idaho Stop" style laws will impact / has impacted safety-relevant behaviors of traffic crashes on Oregon, Washington, and Idaho roadways for bicyclists and drivers alike. Surrogate safety measures will be used to determine the potential risk the new law poses for bicyclist and motorist conflicts at intersections. The findings will lead to a better understanding of the implications of the new law in Oregon and if it could be adopted safely elsewhere.

DATA-DRIVEN ASSESSMENT OF POST-EARTHQUAKE BRIDGE FUNCTIONALITY AND REGIONAL MOBILITY

PI: Chris Motter (WSU)

Co-Investigators: Adam Phillips (WSU), Marc Eberhard (UW), Jeffrey Berman (UW), Brett Maurer (UW)

Improved estimates of post-earthquake bridge vulnerability and lifeline mobility are complex, because: (1) Western Oregon and Washington have more than 10,000 bridges that could be damaged; (2) these bridges are located on a wide range of site conditions; and (3) ground motions have never been recorded for an M9 earthquake in the Pacific Northwest (PNW). An overview of the research approach, including seven work tasks, as well as the databases that will be used to complete each task, is provided in the figure. Key outputs from this project will be (1) a database of bridge performance metrics for 100,000 simulated cases of bridge and intensity measure; (2) improved bridge fragility relationships for PNW retrofitted and non-retrofitted bridges; (3) a model for predicting subsurface Vs-depth profiles in the PNW; (4) assessment of post-earthquake functionality of approximately 10,000 PNW bridges following an M9 CSZ earthquake; and (5) regional assessment of network mobility, wherein the likelihood of post-event route serviceability is quantified probabilistically. The Item (5) output will be in the form of maps that show probabilistic bridge functionality and re-opening times following CSZ earthquakes. These maps will enable WSDOT and ODOT to make informed decisions on post-earthquake emergency planning routes.

THE LONG-TERM EFFECT OF EARTHQUAKES: USING GEOSPATIAL SOLUTIONS TO EVALUATE HEIGHTENED ROCKFALL ACTIVITY ON CRITICAL LIFELINES

PI: Margaret Darrow (UAF)

Co-Investigators: Ben Leshchinsky (OSU), Michael Olsen (OSU), Joe Wartman (UW)

Understanding increases in rockfall activity is critical for transportation agencies to plan for and allocate resources optimally to address maintenance needs for rock debris removal and slope mitigation. In cases where rockfall occurs in mountainous terrain along highways, road closure means delay as motorists must take longer alternate routes given the limited options. The project team will analyze a unique time series of ground-based LiDAR datasets collected for several years before and at several intervals after the 2018 Anchorage Earthquake to develop practice-oriented seismic rockfall stability guidelines and predictive tools for transportation agencies. A better understanding of rock slope response enables an improved mobility approach, safety, and commerce. In particular, we will continue to provide data-driven solutions in transportation, given that we are using advanced sensing technologies and developing robust tools to analyze these data to support cost-effective transportation decision making.

SHARED MOBILITY OPTIONS FOR THE COMMUTE TRIP: OPPORTUNITIES FOR EMPLOYERS AND EMPLOYEES

PI: Qing Shen (UW)

Co-Investigators: Xuegang (Jeff) Ban (UW), Anne Vernez Moudon (UW), Mike Lowry (UI)

This project uniquely addresses the question of how shared mobility options can resolve some of the problems associated with commuting. Our research has three key components. First, we will work with the University of Washington (UW), which is one of the largest employers in the Seattle region, to systematically and closely examine the commute-related challenges and opportunities for essential workers. Collaborating with UW Transportation Services, we will collect and analyze travel survey data to address questions regarding the distinct transportation needs of essential workers and the actual and potential roles that employers can play in providing shared mobility solutions for essential workers, especially those who do not have a car. Secondly, continuing our collaboration with the WSDOT Commute Trip Reduction program and Puget Sound Regional Council, we will recruit about a dozen employers for focus groups to gain a deeper understanding of what organizational constraints currently limit wider adoption of shared mobility for commuting and what technological and policy/management innovations may help create desirable shared mobility alternatives. As part of this research effort, we will invite researchers from Microsoft, who are developing a calendar-based App for carpooling among co-workers, to participate in our focus groups for mutually informative and inspiring dialogs. Thirdly, the University of Idaho (UI) team members will lead a study to explore how employers in small cities and rural communities can facilitate shared mobility options for commuting. We will work with the University of Idaho to design and implement a policy experiment to use student parking fee exemption as an incentive to encourage students to come to the University by carpooling/vanpooling, while offering new students an education program to help them gain a basic understanding of available alternative transportation services in the area.

PRIVACY RISK EVALUATION OF HUMAN MOBILITY DATA FOR URBAN TRANSPORTATION PLANNING

PI: Jan Whittington (UW)

Practitioners in the public and private sector have yet to resolve the pressing issue of how to condition (e.g., aggregate, suppress, modify) data to be shared or published to ensure its usefulness in analysis while preventing the re-identification of persons represented in the data. Built on literature of the re-identifiability of persons from mobility data (e.g., De Montjoye et al. 2013), the purpose of this project is to contextualize privacy risk in the built environment and to place the resulting probabilities into a tool for public agencies. This project builds upon existing studies and addresses the problems by testing three hypotheses:

(1) Linking human mobility data with built environment data increases the uniqueness of human mobility traces, thus increasing the privacy vulnerability of mobility datasets (i.e., probability of re-identification of individuals), (2) due to the differences in travel patterns, privacy vulnerability is heterogeneous across built environments, categorized by urban density, land use mixture, and property value, and user groups, which may be categorized by age, gender, and amount of travel, and (3) built environment types require different approaches to preserve privacy (i.e. different levels of generalization and suppression) to optimize the tradeoffs between privacy protection and loss of information utility in transportation planning and operations.

DEVELOPING A PORTABLE DATA ACQUISITION SYSTEM TO STUDY ROAD USER BEHAVIOR

PI: Vinod Vasudevan (UAA)

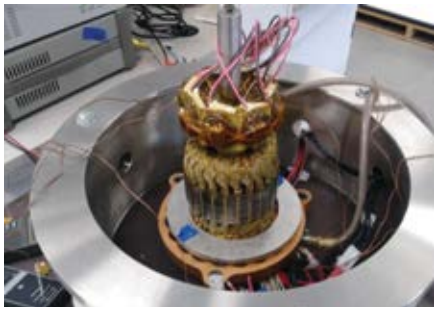
The development of PDAQS involves two steps: setting up the hardware and developing software programs to extract useful data. As the first step, the sensors need to be put together to develop the hardware setup of the PDAQS. All these sensors need power to operate. A battery and power distributor will be used to serve this purpose. Finally, a laptop computer and (or a data integrator) will collect all the data on the same timestamp for efficient post-processing.

In the second step, software programs will be developed to extract useful data. The instruments can capture objects 360° around the vehicle. The relative coordinates of all objects detected by the instrumented vehicle can be extracted using the sensors. Using the relative position coordinates, the trajectory and relative speeds of these objects can be traced. Not all the objects detected by the instrumented vehicle may be of equal significance for transportation application (e.g., detail and locations of the roadside vegetation). Therefore, the emphasis will be on the accurate extraction of useful data related to dynamic objects, such as, various road users, including pedestrians.

INTEGRATION OF MOBILE ROAD WEATHER INFORMATION SYSTEMS INTO WINTER MAINTENANCE OPERATIONS IN FAIRBANKS, ALASKA

PI: Nathan Belz (UAF)

It is our supposition that mobile road weather information system (mRWIS) technologies can be used to provide critical information about road surface conditions and inform maintenance crews with regard to remnants of previous applications as well as the best course of action for retreatment. To that end, the primary goal of this project is to integrate mRWIS into Alaska DOT&PF maintenance operations (e.g., installed on maintenance and plow trucks) for real-time tracking of plow location, road condition, and estimated friction to improve decision making regarding ant-icing treatments. A more general objective of this project is to evaluate the efficacy and reliability of mobile road weather information systems (mRWIS) and their role in monitoring anti-icing applications, particularly the longevity of the application, and determine the extent to which mRWIS can be used as a decision making tool for anti-icing operations.



ADVANCED ENERGY STORAGE SYSTEM FOR ELECTRIC VEHICLE CHARGING STATIONS FOR RURAL COMMUNITIES IN THE PACIFIC NORTHWEST

PI: Herbert Hess

In this project, we seek to build, modulate, control, and test the flywheel that we have designed. We will build a toroidal rotor for an "inside-out" field regulated reluctance motor-generator (FRRM) that has neither electrical connections nor physical shaft nor bearings. Everything is magnetically interfaced and magnetically supported. A superconducting Halbach Array supports the vertical axis rotor. An absolute encoder provides position and angle in the other five axes. A microcontroller converts this machine information and energy flow data into electrical voltage pulses applied to a stationary core of 24 windings located inside the toroid of the rotor. These modulated pulses provide both field and armature functions through an innovative current modulation. Providing energy from an external source, such as a solar panel or electrical grid, causes our FRRM to accelerate. Our FRRM is fully reversible, yielding energy to the charging system when customer demand exceeds generation capacity. With no electrical or mechanical connections, but simply magnetic levitation, our FRRM has greater energy efficiency than conventional designs. It operates with a much wider temperature range than batteries. We have all of this performance proven in simulation. The project at hand will make that performance in hardware a reality.

ECONOMIC AND HEALTH METRICS OF ACTIVE SCHOOL TRAVEL: A PRACTICAL TOOL OR TRANSPORTATION PLANNERS AND EDUCATORS

PI: Anne Vernez Moudon (UW)

The Children Walking To Health Tool builds on the recently developed Washington School Walk Score (W*2), which estimates the school-level rates of AST for more than 1,300 K-8 schools in Washington State. Input data will be the WS*2-derived percent of children in each school who are expected to use AST, while output data will be estimates of the corresponding health and economic outcomes. Used interactively, CW2H will serve to test different scenarios and examine the impact of changes in WS*2.

Obtaining the health and economic metrics will consist of "translating" rates of AST into expected health and economic outcomes. This translation will come from meta-analyses using the results of previous studies that have correlated active travel or physical activity with health outcomes and health care cost savings.

MEASURING THE IMPACTS OF COVID-19 ON THE TRUCKING INDUSTRY: A SPATIAL AND ECONOMETRIC FRAMEWORK TO CAPTURE THE IMPACTS OF THE HOURS-OF-SERVICE (HOS) EMERGENCY DECLARATION AND CONGESTION EFFECTS ON TRUCK DRIVER SAFETY

PI: Salvador Hernandez (OSU)

The goal of this research is to develop a heterogeneity-based econometric framework to capture the impacts of the hours-of-service (HOS) emergency declaration instituted by FMSCA and reduced congestions effects. This will be centered on telematics technology from EROAD and a recently completed COVID-19 National Truck Driver Survey conducted by the PI. To accomplish this, the Pacific Northwest will be used as a case study which will allow for the evaluation of truck driver safety and cross referencing it with existing state motor carrier crash databases. The findings of this study have the potential to generate truck driver safety performance measures and influencing factors to assess changes in truck driver behavior due to reduced congestion effects and regulatory rule changes during events like pandemics and/or similar system disruptions.

DEVELOPING A PROACTIVE FUZZY-LOGIC MODEL FOR OPTIMIZING WINTER ROAD MAINTENANCE MEASURES IN COLD URBAN AREAS USING REAL-TIME DATA

PI: Tommy Tafazzoli (WSU)

This research will introduce a method to comprehensively optimize winter road maintenance in urban areas where transportation quality can significantly be impacted by adverse climatic conditions. The research will aim at: 1) detecting the exiting gaps in winter road maintenance; 2) maximizing the efficiency of the investments in maintaining the quality of transportation during the cold season; and 3) contributing to the safety, comfort, and economy of the residents of the affected areas.

The method is based on creating a proactive, rather than a reactive approach that can monitor road conditions, evaluate maintenance options using a fuzzy logic model, and prioritize preventive or maintenance measures to retain the safety and serviceability of urban roads during the cold season. The proposed research will provide a comprehensive approach for optimizing maintenance measures and is expected to have the following outcomes: (1) it enables decision-makers to make comparisons between different possible scenarios based on the criticality score for maintenance; (2) it prioritizes the maintenance measures for each facility based on the fuzzy score it has received after collecting data. This mitigates bias and human judgment in selecting between various alternatives; and (3) the suggested solutions are cost-effective, sustainable and will not compromise the durability of the pavement.

ASSESSMENT OF WASHINGTON STATE BRIDGES FOR POST-EARTHQUAKE MOBILITY AND RECOVER PLANNING

PI: Adam Phillips (WSU)

Because the DHS (2019) study predicts such widespread and high levels of bridge damage, the response and recovery plan is heavily reliant on air transportation to provide resources to the affected populations. However, surface transportation modes, if available, are better suited for moving large volumes of resources and serving as critical lifelines for impacted regions of the state. The goal of this study, along with another PacTrans collaborative proposal and two WSDOT research proposals, is to create an improved map of predicted non-functional, partially functional, and functional bridges that will assist in post-earthquake emergency planning.

This research will focus on modeling and determining the functionality of bridges along the routes that connect the support bases and staging areas to the main WSDOT critical lifeline corridors of I-5/405. Much of WSDOT's research activities focus on the I-5/405 lifeline but does not directly access the functionality of the routes connecting into it. Without these secondary routes, the post-earthquake mobility of the state will be drastically reduced, emergency management plans will be difficult to enact, and long-term recovery will be impaired. The focus of this particular study is on Washington, but it is envisioned that the proposed methodology will provide a framework for future implementation in Oregon, Alaska, and British Columbia.

COST COMPARISON OF WASHINGTON SAFETY REST AREA OPERATIONS WITH OTHER STATES

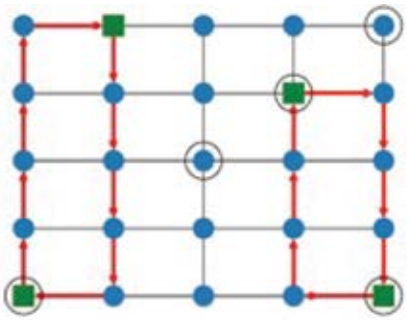
PI: Kishor Shrestha (WSU)

The main objective of this study is to compute the unit operating costs of Washington SRAs and compare them with other states. With this comparison, the Washington State Department of Transportation (WSDOT) may have an opportunity to know if they are operating the safety rest area cost effectively. The findings of this study may also provide an opportunity to WSDOT in seeking a cost-effective method. Ultimately, adopting the cost-effective method may avoid closing the safety rest areas in Washington that will support reducing highway fatality and injuries due to fatigued drivers on the highways. The project team will conduct a national survey within all states. This survey will collect detailed information regarding operating SRAs' cost. With this survey, SRA operational cost data, annual number of safety rest area visitors, and other safety rest area information will be collected. For each of the states, SRA data will be collected from 2010 to 2019. The team will also document previous studies on the area of cost comparison of unit operation cost in other states if they have any.

INFORMING PREDICTIONS FROM ABOVE WITH DATA FROM BELOW: AI-DRIVEN SEISMIC GROUND-FAILURE MODEL FOR RAPID RESPONSE AND SCENARIO PLANNING

PI: Brett Maurer (UW)

The goal of this project is to develop an AI-informed, open source, high-resolution model to probabilistically predict liquefaction regionally – at no cost to the user – both in future scenario earthquakes (to inform mitigation and planning) or immediately following an event (to inform response and recovery). This model will: (i) predict subsurface soil properties using an array of predictor variables obtained from satellite remote sensing (i.e., predict below-ground traits using above-ground information; (ii) utilize machine- and/or deep-learning algorithms; (iii) be anchored to a mechanics-based framework for predicting liquefaction via subsurface soil properties, thus physically constraining the predictions; and (iv) have rapid capabilities, providing regional predictions minutes after an earthquake. The model will first be implemented in PacTrans Region 10 using Pacific Northwest data, but will be scalable to a larger study, and transferrable globally. In addition to providing the model to the transportation industry, the project will use the model to simulate Region 10 events. These will include ruptures on the Cascadia and Aleutian Subduction Zones, as well as crustal faults in the Puget-Willamette Lowlands.



OPTIMAL CHARGING INFRASTRUCTURE DESIGN FOR BATTERY ELECTRIC BUSES

PI: Xuegang (Jeff) Ban (UW)

The objective of this project is to develop models, methods, and procedures to determine the optimal locations of charging stations for BEBs and apply them in collaboration with transit agencies. The models and algorithms developed in this research need to integrate practical considerations and constraints such as the facilities and land (e.g., where the bus layover locations are) owned by transit agencies, the capacity of electricity grid networks, etc., calling for innovative modeling methods that are both mathematically rigorous and practically feasible. As local and regional transit agencies (e.g. King County Metro) are planning to procure and deploy BEBs, strategies for charging these buses are becoming more critical, which are yet to develop at transit agencies. This project can thus help these agencies to develop a reliable, efficient, and cost-effective BEB charging system while also generating novel academic research.

PAVEMENT WINTER OPERATIONS IN COLD REGIONS

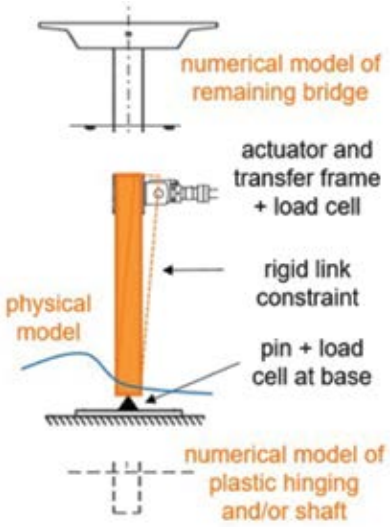
PI: Emad Kassem (UI)

The proposed study will use a new laboratory testing protocol to evaluate the performance of different deicing and anti-icing materials at different conditions for efficient winter maintenance operations. This study has two main objectives: 1) develop and evaluate a new laboratory testing protocol that can be used to evaluate the effectiveness of various deicing and anti-icing chemicals at similar conditions in the field, 2) develop guidelines and recommendations for anti-icing and deicing material selection and proper application rate. The outcome of this study will assist the transportation agencies to make informed decisions that lead to efficient winter maintenance operations.

ESTIMATING COUNTY TO COUNTY TRANSPORTATION AND TRADE FLOW

PI: Mike Lowry (UI)

Previous research conducted by the PIs has estimated commodity supply and commodity demand for each county in the United States using numerous government datasets. This research will build on that research and develop a doubly constrained gravity model that estimates both where the supply of each county's commodity output is consumed and where the place of origin for the commodities demanded in each county. Once the regionally specific input-output accounts are populated a trade model will be applied to estimate the geographic source of those commodity inputs. Deriving multiregional social accounts requires complete estimation of inter-regional foreign and domestic commodity shipments. Because complete coverage of commodity-specific trade between all ports and county-pairs is not available the PIs propose developing a trade flow general equilibrium model to estimate county-to-county and county-to-port commodity shipments for tradable commodities and services among all US counties and ports.



REAL-TIME HYBRID EXPERIMENTAL-NUMERICAL SIMULATION OF BRIDGE INFRASTRUCTURE SUBJECT TO CASCADING EARTHQUAKE-TSUNAMI HAZARDS

PI: Barbara Simpson (OSU)

Following the Tohoku earthquake, many Japanese bridges experienced uplift of the deck off the bridge piers due to the subsequent tsunami loading. However, if the connection between the pier and deck was retrofitted to resist deck uplift, then the bridge instead experienced significant damage to the pier during the tsunami, because the pier was already damaged from the earthquake (piers are usually designed to exhibit inelastic response for seismic design).

The research proposed would be the first application of hybrid simulation to tsunami hazards, including previous damage from earthquake loading. To study bridge pier response to cascading earthquake-tsunami loading, the proposed RTHS approach partitions a bridge assembly such that the physical waves and bridge pier reside in a physical sub-assembly and the remaining bridge, including damage from seismic loads, resides in a numerical sub-assembly. The hybrid physical-numerical sub-assemblies then represent a complete bridge assembly, which is impossible to test experimentally due to the capacity of existing wave facilities.

AUTOMATED LOCALIZATION AND ADA FUNCTIONAL CONDITION ASSESSMENT OF CURB RAMPS USING MOBILE LIDAR

PI: Yelda Turkan (OSU)

This project will create a novel framework for curb ramp ADA compliance assessment using 3D point cloud data to extract curb ramps and sidewalks in addition to the road surface. Curb ramps will be extracted from at least 100 intersections from mobile lidar datasets to produce both training and validation dataset identifying their key geometric characteristics. The curb ramp detection and assessment results obtained will be added to a geodatabase in GIS for easier access to the results and improved data management. The corresponding field survey data will be used as ground truth to compare against for further evaluating the effectiveness and accuracy of the proposed methods. The anticipated outcomes of this research will be to: A) develop an algorithm that enables to automatically identify curb ramps and assess their ADA compliance in mobile lidar data; B) provide a guideline on the accuracy and reliability for utilizing mobile lidar data in curb ramp assessment; and C) increase the adoption of mobile lidar technology for transportation projects. All of these factors should help assist in maintaining the U.S. transportation network in a state of good repair, thus helping ensure its safety, mobility and inclusiveness for persons with disabilities.

Education & Workforce Development Webinars

LEADERSHIP DEVELOPMENT WITH EMPHASIS ON TECHNICAL COMMUNICATIONS

PacTrans 2021 Leadership Development Webinar featured ASCE President and Distinguished Professor at Texas A&M, Dr. Jean-Louis Briaud. His presentation titled, *Leadership Development with Emphasis on Technical Communications*, focused on a handful of anecdotes and personal experiences that reinforced the importance of technical communication.

WORKFORCE MANAGEMENT IN TRANSPORTATION

In April of 2021, PacTrans was pleased to host a webinar featuring Acting Commissioner of the Alaska Department of Transportation and Public Facilities, Amanda Holland. Her presentation titled, *Workforce Management in Transportation*, featured a recent NCHRP Domestic Scan on workforce challenges in transportation. This webinar was timely as PacTrans recently established the Workforce Development Institute. Her talk focused on practices that can be quickly adopted and implemented to recruit, develop, and retain the workforce DOT's need today and for the future.

THE MODERN LANDSCAPE OF TRAFFIC SIGNAL SYSTEMS

Traditionally, traffic signal devices and management systems were developed in antiquated technologies and ranged 10-15 years behind global technology practices. In December 2020, PacTrans hosted a webinar from Executive Vice President of Q-Free ATMS, Tom Stiles, titled, *The Modern Landscape of Traffic Signal Systems: How Innovative Technologies are Inspiring Change to Age-old Practices*. In his talk, Tom made the case for innovations in the traffic signal and systems industry and the associated challenges with legacy technologies.

Students

UI STUDENT CLEAN SNOWMOBILE TEAM BRINGS HOME HARDWARE

Each year the Society of Automotive Engineers (SAE) hosts a Clean Snowmobile Challenge where student teams from around the US and Canada develop clean snowmobiles and then use them to compete in a variety of competitions. In 2020, PacTrans consortium partner University of Idaho's student team won several of these categories.

In addition to receiving fourth place overall, the UICSC performed well in several events at the competition, earning: Best Value from Continental EMITECH, 1st for In-service Emissions, 1st in Fuel Economy, 1st in Subjective Handling, and Best Design Winner from Oshkosh

"We are extremely proud of what we have accomplished and have begun building toward next year. Once again, thank you for your [PacTrans] continued support and involvement."

" Our team is continuing to prove that two-stroke engines are a viable option for clean, quiet, and fuel-efficient snowmobiles."

Students

PACTRANS STUDENT RESEARCHER RELEASES REPORT CO-AUTHORED DURING ENO FELLOWSHIP

University of Washington Graduate Research Assistant and PacTrans student researcher, Katie Idziorek, was awarded the Thomas J. O'Bryant Policy and Finance Fellowship in coordination with the ENO Student Leadership Conference.

During the course of this fellowship, she co-authored a paper with Alice Grossman, former policy analyst at the Eno Center for Transportation, titled, Toward Universal Access: A Case Study in the Los Angeles and Puget Sound Regions. This is the fourth paper in ENO's research report series examining the Case Study in the Los Angeles and Puget Sound Regions, focused on access to mobility for disabled persons.

OSU'S EILEEN CHAI RECEIVED 2020-2021 BEVERLEY SWAIM LEADERSHIP LEGACY GRADUATE SCHOLARSHIP

Each year, WTS offers a variety of scholarships to students in transportation related fields. In 2020, Oregon State University Master's student and PacTrans student researcher Eileen Chai received the 2020-2021 Beverley Swaim Leadership Legacy Graduate Scholarship.

Eileen is a first-year master's student advised by David Hurwitz, Professor of Transportation Engineering and the Eric H.I. and Janice Hoffman Faculty Scholar. She earned the honor in recognition of her many accomplishments including a stellar undergraduate GPA, membership in the honors societies Phi Theta Kappa and Tau Beta Pi, and serving as the Community Service Chair of the OSU ITE Student Chapter.

TWO UW STUDENT TEAMS MAKE FINALS OF METROLAB STUDENT CUP

Two University of Washington student teams were selected as finalists for the mobility track for the inaugural MetroLab Students Cup, and one of those two UW teams was awarded as the mobility track winner.

The MetroLab Student Cup is a competition where students from across the MetroLab member universities submitted written applications describing civic research projects they completed in collaboration with partners in their communities. Projects focused on providing new analysis, policy, or technical insights to difficult civic priorities and challenges. Twelve finalists were identified, three each among four different categories: COVID-19, Health & Resilience, Mobility, and Environment. These twelve finalists then participated in live pitch competitions, judged by civic research experts and professionals.

OSU'S MOHAMMAD RAYEEDUL KALAM SIAM RECEIVES REGION 10 MICHAEL KYTE OUTSTANDING STUDENT OF THE YEAR AWARD

Each year, PacTrans facilitates the submission and selection of the Region 10 Michael Kyte Outstanding Student of the Year Award. The Region 10 Michael Kyte Outstanding Student of the Year Award is available to any student attending a university in Region 10 (Washington, Oregon, Alaska, and Idaho) who participates in UTC funded work. Selection is based on accomplishments in three areas: (1) Technical Merit and Research, (2) Academic Performance, and (3) Professionalism and Leadership. This year, this award went to Oregon State University PhD candidate, Mohammad Rayeedul Kalam Siam.

OSU'S AMY WYMAN RECEIVES PACTRANS UTC OUTSTANDING STUDENT OF THE YEAR AWARD

Each year, every University Transportation Center has the opportunity to recognize one of its many brilliant student researchers with the UTC Outstanding Student of the Year award. Students are evaluated on accomplishments in three areas: (1) Technical Merit and Research, (2) Academic Performance, and (3) Professionalism and Leadership. This year, that prestigious award went to Oregon State University PhD candidate Amy Wyman.

OSU ITE STUDENT CHAPTER WINS GOLD AT 2021 NATIONAL TRAFFIC BOWL IMPROVING FROM BRONZE THE PREVIOUS YEAR

The Oregon State University student chapter of the Institute of Transportation Engineers (ITE) has had some incredible success in recent Traffic Bowl competitions including: 2021 Grand Champions at the ITE National Collegiate Traffic Bowl, 1st place at the 2021 Western District ITE Traffic Bowl (where the UW team took 3rd), and 3rd place at the 2020 ITE National Collegiate Traffic Bowl. These teams receive financial support and mentorship from PacTrans and its researchers and faculty.

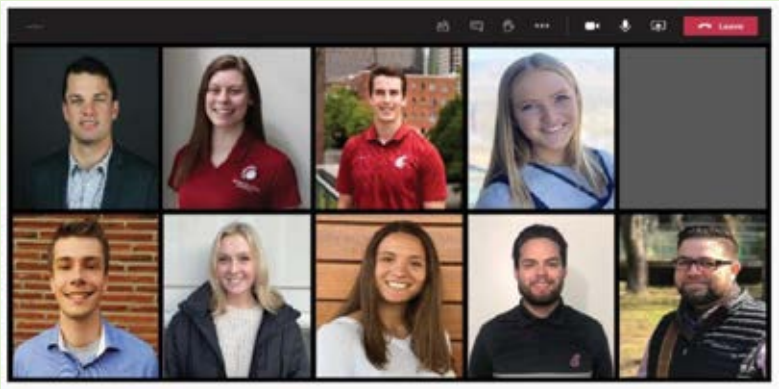
The ITE Collegiate Traffic Bowl is an annual competition of ITE student chapters from Canada and the United States. This competition features teams of up to 3 students testing their knowledge of ITE, transportation planning and engineering topics, as well as some fun categories. Since 2009 when the traffic bowl was introduced throughout Canada and the United States, a total of 115 chapters have participated in at least one traffic bowl at either section or district level events. The winners of the ITE district competitions advance to compete in the Collegiate Traffic Bowl Grand Championship, which is conducted annually at the Institute's International Annual Meeting and Exhibit.

UW STAR LAB STUDENT MEIXIN ZHU STANDS FOURTH IN SMART TRANSPORTATION-COLLISION RECOGNITION BASED ON BIG DATA OF INTERNET OF VEHICLES

Meixin Zhu, a Ph.D. student at PacTrans Director Yinhai Wang's UW STAR Lab stood fourth in the Smart Transportation Competition held earlier this year. The competition was based on the new energy vehicle operating data, collision labeling, and collision time provided by SAIC-GM-Wuling. A total of over 1,300 teams used this dataset and machine learning or deep learning methods to identify the possibility of vehicle collisions based on vehicle operating data and identify users' collision situations in time. Competitors were ranked based on the A-Score of their models.

FOUR PACTRANS STUDENTS RECEIVE ITE WASHINGTON STUDENT SCHOLARSHIPS

Earlier this year, four PacTrans Students were awarded the Institute of Transportation Engineers (ITE) Washington Student Scholarships. The Washington State Section of ITE offers scholarships to students planning on pursuing a career in transportation engineering or planning. ITE is an international educational and scientific association. It is one of the largest and fastest-growing professional transportation organizations in the world. ITE members include engineers, planners, and other transport professionals who are responsible for meeting society's needs for safe and efficient surface transportation.



Top row: Cory Condon, Meghan Smith, Hunter Hohman, Grace Lium (alternate) Bottom row: Austin Cornell, Kali Saueressig, Georgia Robinson, RJ Clemons (alternate), and Jason Peschel (coach)

WSU STUDENT TEAM WINS 1ST PLACE AT CONSTRUCTION MANAGEMENT COMPETITION

A student team from PacTrans consortium partner Washington State University took first place in the recent Associated Schools of Construction competition, the largest construction management competition in the U.S.

Despite a shift to a virtual format in 2020, almost 1,100 students from 47 universities and 19 states participated. The competition consists of ten-hour days where participants are required to solve two rounds of problems that have been generated by problem sponsors.

The WSU team, coached by associate professor of design and construction, Jason Peschel, competed in the commercial category with twelve other teams and ultimately won first place. The student team included Meghan Smith, Hunter Hohman, Kali Saueressig, Cory Condon, Austin Cornell, and Georgia Robinson with alternates Grace Lium and RJ Clemons. The students used construction management skills such as scheduling, estimating, site logistics, site safety, and technical writing to develop a proposal for a real-life construction problem.

TWO WSU PACTRANS STUDENT RESEARCHERS RECOGNIZED BY ASSOCIATION FOR FACULTY WOMEN

Early in April 2021, two PacTrans student researchers and Graduate Students at the Washington State University, Ayumi Manawada and Chelsea Pardini were awarded the Karen P. DePauw Leadership Award and the Harriette B. Rigas Award, respectively, by the Association for Faculty Women(AFW).

Founded in 1975, Washington State University's Association for Faculty Women is a broadly inclusive group that promotes successful and satisfying careers for women by creating opportunities for members to connect in welcoming supportive and empowering environments. The AFW solicits nominations from faculty members who work directly with a student to ensure that the highest quality students are considered each year for the awards, which come with a $1000 prize. Nominees and awardees represent a wide range of disciplines and colleges.

A Look Back at the Past 12 Years of Michael Kyte Award Winners

In 2009, in honor of Michael Kyte, then a Professor at the University of Idaho, PacTrans formed the Region 10 Michael Kyte Outstanding Student of the Year Award. This award is given annually to a student attending a university in Region 10 (Washington, Oregon, Alaska, and Idaho) who participates in UTC funded work. Selection is based on accomplishments in three areas: (1) Technical Merit and Research, (2) Academic Performance, and (3) Professionalism and Leadership. PacTrans takes great care and pride in the education and training of our students who are the workforce and researchers of the future. To commemorate the twelfth anniversary of this award, we have decided to take a look back at the previous award winners and see where they are now.

MOHAMMAD RAYEEDUL KALAM SIAM

Mohammad Rayeedul Kalam Siam received the Michael Kyte Region 10 Outstanding Student of the Year Award in 2020. Currently located in Corvallis, Oregon, Mohammad is a Ph.D. candidate in the School of Civil & Construction Engineering at Oregon State University.

RUIMIN KE

Ruimin Ke received the Michael Kyte Region 10 Outstanding Student of the Year Award in 2019 while working on his PhD from the University of Washington. Ruimin recently accepted a position as an Assistant Professor at the University of Texas at El Paso. He previously served as a research associate at the University of Washington, Seattle.

MAGED MOHAMED

Maged Mohamed received the Michael Kyte Region 10 Outstanding Student of the Year Award in 2018 while working on his PhD from the University of Idaho. Currently located in Butte, Montana, Maged is a Visiting Assistant Professor at the Civil Engineering Department at the Montana Technological University.

ALIREZA MOSTAFIZI

Alireza Mostafizi received the Michael Kyte Region 10 Outstanding Student of the Year Award in 2017 while working on his PhD from Oregon State University. Currently located in Corvallis, Oregon, Alireza is the Director of Data Engineering at Intermx.

MASOUD GHODRAT ABADI

Masoud Ghodrat Abadi received the Michael Kyte Region 10 Outstanding Student of the Year Award in 2016 while working on his PhD from Oregon State University. Currently located in Roseville, California, Masoud is an Assistant Professor in the Department of Civil Engineering at California State University, Sacramento (CSUS).

ANTHONY MULLIN

Anthony Mullin received the Michael Kyte Region 10 Outstanding Student of the Year Award in 2015 while working on his PhD from the University of Alaska Fairbanks. Unfortunately, Anthony passed away in 2017.

JENNIFER WARNER

Jennifer Warner received the Michael Kyte Region 10 Outstanding Student of the Year Award in 2014 while working on her Master's degree from Oregon State University. Currently located in Hershey, Pennsylvania, Jennifer is a Civil Engineer (Traffic) at Michael Baker International.

JONATHAN COREY

Jonathan Corey received the Michael Kyte Region 10 Outstanding Student of the Year Award in 2013 while working on his PhD from the University of Washington. Jonathan was most recently a professor of Civil Engineering at the University of Cincinnati.

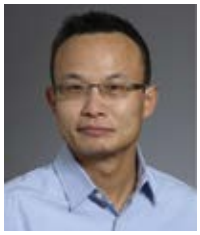
KRISTINA CURRANS

Kristina Currans received the Michael Kyte Region 10 Outstanding Student of the Year Award in 2012 while working on her PhD from Portland State University. Currently located in Tucson, Arizona, Kristina is an Assistant Professor of Urban Planning at the University of Arizona.

ERICA WYGONIK

Erica Wygonik received the Michael Kyte Region 10 Outstanding Student of the Year Award in 2011 while working on her PhD from the University of Washington. Currently located in Boston, Massechusets, Erika is the Director of Resource Systems Group, Inc.

YAO-JAN WU



Yao-Jan Wu received the Michael Kyte Region 10 Outstanding Student of the Year Award in 2010 while working on his PhD from the University of Washington. Currently located in Tucson, Arizona, Yao-Jan is an Associate Professor at the University of Arizona.

YEGOR MALINOVSKIY

Yegor Malinovskiy received the Michael Kyte Region 10 Outstanding Student of the Year Award in 2009 while working on his PhD from the University of Washington. Currently located in Kirkland, Washington, Yegor is the CTO at IDAX Data Solutions.

PacTrans Fellows

HELENA BREUER (OSU)

Helena Breuer graduated cum laude from Virginia Tech with a B.S. (2019) and M.S. (2020) in Civil Engineering. She studied under Hesham Rakha, where her thesis explored the replaceability of public transit trips by ride-hailing in the City of Chicago. Starting at a young age, Lena enjoyed observing differences between driver behavior and attitudes. These interests have evolved into her two primary research interests: the social and psychological derivation of driver/user attitudes and how network elements are cognitively processed and their resulting effects in driver decision-making processes. Outside of her career, Lena enjoys road biking, running, and listening to true-crime podcasts.

GRIFFIN DONNELLY (UW)

I am originally from Hillsborough, California. I attended Santa Clara University and graduated in the Spring of 2020 with a Bachelor's degree in Civil Engineering and a minor in Mathematics. At Santa Clara, I became interested in the intersection of Civil Engineering and Operations Research. At the University of Washington, I hope to contribute to research in traffic operations and logistics by connecting and applying concepts between transportation and industrial engineering.

EBUKA DAMIAN UMEIBE (UW)

Ebuka grew up in Nigeria, graduated from Madonna University in 2016 with a bachelor's degree in Civil Engineering. He then worked for a construction company that focused on road/bridge construction for three years and grew interest in Traffic signal control systems and Urban transit systems planning with the goal of tackling the congestion problem faced on the network systems in order to develop a more efficient less congested network system. Other than his career, Ebuka loves running, playing soccer and travelling.

THOMAS VALDRIZ (UW)

Thomas graduated from University of California, Berkeley in 2014 with a bachelor's degree in Geography. Post-graduation, Thomas worked in local government as a planner and sustainable transportation program manager, working with his community to develop traffic calming, Complete Streets, and master planning projects. Through his Master of Civil Engineering program at the University of Washington, Thomas hopes to further his career and continue developing solutions to diverse transportation challenges. Outside of his work and educational pursuits, Thomas enjoys backpacking, rock climbing, and exploring Seattle through food.

THREE PACTRANS STUDENT RESEARCHERS AWARDED EISENHOWER FELLOWSHIPS

In November 2020, three PacTrans student researchers received Dwight David Eisenhower Transportation Fellowship Program (DDETFP) awards.

Amy Wyman (photo left), at Oregon State University, under the direction of David Hurwitz; Cole Kopca (photo center), at the University of Washington, under the direction of Yinhai Wang; and Brian Staes (photo right), at Oregon State University, under the director of Robert Bertini, were the three recipients from our consortium partner universities.

"The Dwight David Eisenhower Transportation Fellowship Program (DDETFP) awards fellowships to students pursuing degrees in transportation-related disciplines. This program advances the transportation workforce by helping to attract the nation's brightest minds to the field of transportation, encouraging future transportation professionals to seek advanced degrees, and helping to retain top talent in the U.S. transportation industry.

From its initial support of graduate research fellowships in 1983, to the current program's inception in the Intermodal Surface Transportation Efficiency Act of 1991, the DDETFP has awarded

over $50 million to the brightest minds in the transportation industry. From this investment, fellows have pushed for innovative change in multimodal areas from highway infrastructure to aviation to maritime, making the industry more effective and efficient. Fellows pursue careers in academia, private industry, and public service, becoming leaders across the nation."

Technology Transfer

PACTRANS SUPPORTED RESEARCH HELPS NATHAN BELZ TESTIFY REGARDING OFF-ROAD VEHICLE USE

This year, PacTrans PI and Associate Professor of Civil Engineering at the University of Alaska Fairbanks, Dr. Nathan Belz, was invited to testify to the Alaska House Transportation Committee about four-wheeler and snow machine use on public roads in the State. Prof. Belz was invited by the chair of the House Transportation Committee, Rep. Grier Hopkins, due to his profound knowledge on the subject, acquired through research funded jointly by PacTrans and the Alaska Department of Transportation & Public Facilities back in 2017. This research evaluated safety issues related to off-highway vehicle and snowmachine use on and near roads in Alaska.

Alaska Governor, Mike Dunleavy and his administration are proposing to allow the use of off-road vehicles on Alaska's roads. The proposal is raising issues about safety and how to enforce this change in the more populated areas of Alaska. Currently, off-road vehicles are only allowed to cross roads. Prof. Belz, in his testimony, has asked that the proposed changes be withdrawn. The proposal will "certainly lead to an increase in the number of serious injuries and fatalities on our roadways. This is not in line with the State of Alaska Strategic Highway Safety Plan," Belz said in an eight-page analysis submitted in response to the Dunleavy plan.

Prof. Belz has been a long time researcher for PacTrans, having led seven PacTrans-funded research projects mostly focusing on various aspects of roadway safety issues unique to the State of Alaska. In 2018, he received the PacTrans Outstanding Researcher Award. More broadly, he has over 10 years of research experience specific to rural transportation issues. He also currently serves as the Assistant Director of the Center for Safety Equity in Transportation, a Tier 1 USDOT University Transportation Center, led by UAF.

UNCREWED AIRCRAFT SYSTEMS IN TRANSPORTATION: RESEARCH-TO-OPERATION PEER EXCHANGE

Over the course of PacTrans' existence, we have funded a number of projects exploring various applications of uncrewed aircraft systems (UAS), or drones. One of these PIs, OSU Professor Christopher Parrish, has also taken the lead on facilitating a larger regional and national dialogue about unresolved challenges, best practices, and other aspects surrounding the implementation of UAS in DOT workflows. So, for example, using previous PacTrans Technology Transfer Success Story funding, Dr. Parrish hosted a UAS in Transportation workshop back in 2018.

Dr. Parrish leveraged new PacTrans Technology Transfer Success Story funding, to host the 2020 Oregon UAS Summit, back in October of 2020. The event drew a total of 174 participants over the two-day period, including over 24 DOTs, 15 consultants, 3 vendors, and 3 universities. The Summit covered topics on:

1. Best practices for starting a successful UAS program;
2. Operational aspects of UAS for traffic network monitoring, including regulations, safety, planning, and operational procedures;
3. Practical considerations when selecting a lidar or SfM based UAS platforms;
4. Direct georeferencing via GNSS-aided insertional navigation systems (INS);
5. Comparison of post-processed kinematic (PPK) and real-time kinematic (RTK) GNSS on drones;
6. Qualitative and quantitative accuracies of point clouds created from UAS-acquired data; and
7. Examples of state-of-the-art UAS platforms leveraging machine learning and artificial intelligence to increase safety and productivity for inspection and mapping applications.

PACTRANS PARTNERS UW'S URBAN FREIGHT LAB LAUNCHES LAST-MILE DELIVERY PILOTS IN DOWNTOWN SEATTLE

PacTrans' partner, The Urban Freight Lab, housed at the University of Washington's Supply Chain Transportation Logistics Center, made headlines earlier this month with the deployment of one of the nation's first zero operating emissions, last-mile delivery pilots in the Uptown neighborhood of Seattle. This work was done in collaboration with the Seattle Department of Transportation (SDOT) as well as tech and delivery companies like REEF, BrightDrop, Coaster Cycles and AxleHire.

SIMULATION ENVIRONMENT TO OPTIMIZE PUBLIC INVESTMENTS IN ELECTRIC VEHICLE CHARGING INFRASTRUCTURE

A research team at the University of Washington, led by UW Professor Don MacKenzie, developed a decision support system (EVI-DSS) to guide the WSDOT's infrastructure development process. EVI-DSS is a model-view-controller application capable of supporting multiple users concurrently. It employs a PostgreSQL database as a model, two R Shiny web-apps as views and a NodeJS server for managing analysis execution requests.

To promote wider distribution and rapid dissemination of the program, leveraged PacTrans Technology Transfer Success Story funding to cleanup, optimize, package, and disseminate the code into an easy to use format, so that agencies can deploy it locally to benefit from its use. The team also deployed it at the University of Washington as a test and support instance, and hosted several webinars/workshops to educate potential users of its capabilities and functionalities.

TECHNOLOGY TRANSFER WEBINARS

Effective Technology Transfer

Translating academic research into practice is a long and difficult road that is generally unfamiliar to academic researchers. Last November, PacTrans facilitated a webinar titled, Effective Technology Transfer, that featured a PacTrans Technology Transfer Advisory Board member and Owner/Managing Director of Connected Transportation Systems and Networks Consulting, Hamed Benouar, and Co-founder/Strategic Business Developer at Sensus Networks, Amine Haoui. Dr. Benouar and Dr. Haoui have extensive experience with the technology transfer process and shared about those experiences in this presentation. They focused on the process, experiences, and lessons learned about how to take good university research to business/commercialization.

Modeling Tsunami Loading on Bridges using OpenSees PFEM

In December of last year, PacTrans facilitated a webinar that was part of a Technology Transfer Success Story funding project. The presenters were Professor Michael H. Scott and Research Associate Minjie Zhu from Civil and Construction Engineering at Oregon State University. The original work, funded by the Oregon Department of Transportation, was titled, *Analytical Tools for Resilience of Lifeline Highway Bridges to Tsunami.* Based on the promising results of that work, they were successful in securing Success Story funding and part of that funding's deliverable included a webinar titled, *Modeling Tsunami Loading on Bridges using OpenSees PFEM*. In this presentation, Drs. Scott and Zhi summarized the tsunami threat posed by the Cascadia Subduction Zone (CSZ) to the transportation infrastructure of the Pacific Northwest, summarized tsunami loading equations developed via a pooled fund study of the five western state DOFs (OR, WA, CA, AK, HI), and concluded with a tutorial on how to use OpenSees to model fluid-structure interaction for tsunami loading on bridge superstructures.

TECHNOLOGY TRANSFER WEBINARS CONTINUED

Developing Design Guidelines for Commercial Vehicle Envelopes on Urban Streets

UW Research Associate Professor Ed McCormack and then OSU Graduate Research Assistant Hisham Jashami, presented their work on a completed PacTrans Multi-Institutional research project titled, *Developing Design Guidelines for Commercial Vehicle Envelopes on Urban Streets*. In this webinar, they observed that commercial vehicles using urban curbside loading zones are not typically provided with a consistent envelope, or a space allocation adjacent to the vehicle for delivery operations. This research aimed to improve the understanding of safe envelopes and conflict points with other transportation infrastructure users.

Exploring Weather-Related Connected Vehicle Applications for Improved Winter Travel

WSU Professor Xianming Shi and then UW Graduate Research Assistant Ziyuan Pu, presented their work on a recently completed PacTrans Multi-Institutional research project titled, *Exploring Weather-related Connected Vehicle Applications for Improved Winter Travel in Pacific Northwest*. In this webinar, they observed precise and timely road weather messages are necessary for road maintenance decisions and a high level-of-service trip of road users. This talk discussed the development of a road surface friction prediction model based on Long-Short Term Memory (LSTM) neural network using the data collected by an on-board road surface sensing device.

UAS Applications in Transportation

OSU Professor Christopher Parrish, presented his work on a recently completed PacTrans Multi-Institutional research project titled, *An Airborne Lidar Scanning and Deep Learning System for Real-time Event Extraction and Control Policies in Urban Transportation Networks*. In this webinar titled, *UAS Applications in Transportation*, Dr. Parrish expanded his content to include PacTrans work on a suite of different applications of UAS in the transportation field including bridge inspection, traffic network monitoring, construction site monitoring, surveying and mapping, and landslide site monitoring. He discussed results of these studies, lessons learned, recommendations for operational use of UAS by transportation agencies, and concluded with a look ahead at anticipated developments in this rapidly-evolving technology.

PACTRANS SUCCESS STORIES

Late last year, PacTrans put out its annual call for Success Stories which is an RFP for supplemental funds specifically for PIs to engage in technology transfer activities beyond the scope of their funded research projects. Common application of these funds has included websites, promotional materials, workshops, webinars, and even commercialization/patenting of research methods and results. PacTrans further encourages PIs to think outside the box and try to identify the most effective way(s) that can communicate their meaningful research findings with the practicing transportation communities that would most benefit from newly developed technologies and techniques.

These proposals are vetted by our board and then put through review by our Technology Transfer Advisory Board before selections are made. This year, a total of seven proposals were selected for funding from a pool of ten proposals. The following are brief summaries of the activities that were funded:

Vo-Norvana: A Practical Software Tool for Quick Point Cloud Processing

PI: Michael Olsen (OSU)

Lidar and Structure-from-Motion (SfM) technology have been widely used for collecting 3D point cloud data in a high resolution and accuracy for a variety of transportation applications. In this team's previous and current projects, they exploited such technology for modeling infrastructure information, evaluating conditions of curb ramps, and so forth. During the research, they developed a framework, named Vo-Norvana, to automate a substantial part of data processing, which is a great bottleneck in utilizing point cloud data given its large volume and complexity. The team has filed a patent application for one of the key concepts in the Vo-Norvana framework. This research has made an impact in both academia and industry. However, to be able to let our research outcome have practical use in transportation applications, a user-friendly software application needs to be developed. The team will utilize PacTrans Success Story funding for the tasks of streamlining their processing method into a software application.

Enhanced Intersection Signal Control System with Pedestrian and Cyclist Crossing Time Assurance

PI: Wei Sun (UW)

In order to improve the safety conditions of non-motorized road users, the original project "Extending the SR-522 SPaT Challenge to Active Transportation Users" integrates data from traffic control system signal phase and timing (SPaT), and utilizes the Mobile Unit for Sensing Traffic (MUST) to communicate with pedestrians and bicyclists along a corridor by way of a mobile app. With the success of the original research project, this technology transfer activity will utilize MUST to add capabilities so that pedestrians and cyclists can indicate their presence, request right of way, and receive traffic signal information through the app. All users will be able to send/receive better quality information on their location within a crosswalk, bicycle lane, pathway, or vehicle travel lane. In addition, MUST sensors will communicate the requested information to the traffic controller and ensure safe crossing time for pedestrians and cyclists through green signal extension when necessary. This solution will improve intersection operations as well as help improve the safety conditions of all non-motorized road users, particularly those with vision impairments and other disabilities.

Predict Near-term Traffic Performance like Weather Forecast

PI: Yinhai Wang (UW)

Measuring traffic performance is critical for many transportation related endeavors, however, most existing traffic performance metrics only consider a single traffic parameter and measure the performance of individual corridors. To deal with these challenges, the STAR Lab at the University of Washington recently developed a Traffic Performance Score (TPS) that incorporates multiple parameters for measuring network-wide traffic performance. An interactive web-based TPS platform (http://tps.uwstarlab.org/) has also been developed that provides real-time and historical spatial-temporal traffic performance analysis.

The continuing work proposes to expand the TPS platform by providing informative functions, namely a traffic prediction function. In this traffic prediction module, segment-based and network-wide traffic prediction will be realized simultaneously. The models will incorporate traffic event data, weather data, etc., to enhance the prediction accuracy in special traffic scenarios. In addition, formal outreach activities, like TPS platform tutorial, workshops or webinars, will be carried out with the PacTrans funding. The practical advantages of the functions on the proposed platform and the real-time usage states will be broadcasted and promoted by social media to attract more public users.

Truck Parking Events Monitoring using Mobile Unit for Sensing Traffic (MUST) Sensors

PI: Yinhai Wang (UW)

Based on the report from Federal Motor Carrier Safety Administration (FMCSA), the total number of large trucks involved in fatal crashes increased 33% from 2010 to 2017 across the U.S. (FMCSA, 2019). Further, a strong correlation has been found between the hours of driving and fatigue-related crashes. Freeway rest area truck parking spaces are a natural place for drivers to take breaks. However, supply of parking spaces in freeway rest areas are not enough to meet the increasing demand. It is therefore vital to maximize the efficiency of the spaces that do exist. The Washington State Department of Transportation (WSDOT) worked with the University of Washington (UW) and Sensys Networks on an online truck parking information system, supported by spot-based parking sensors, accessible through mobile applications, to improve the truck parking conditions. Specifically, this project provided real-time truck parking information and predicted short-term truck parking space availability to truck drivers

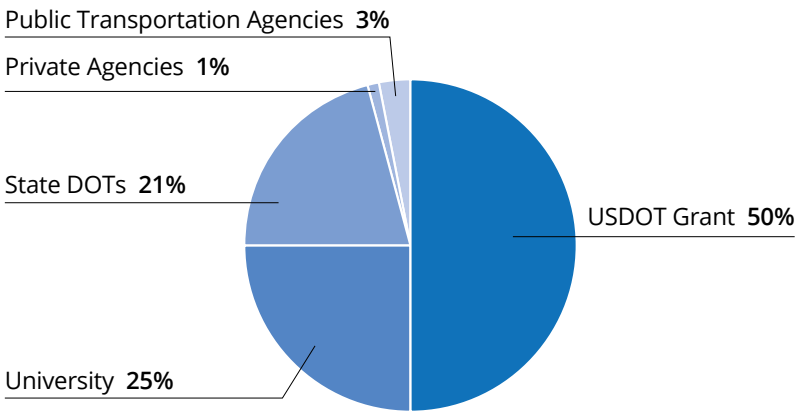
With the success of the original research project, the proposed technology transfer activity is to monitor truck parking events using the Mobile Unit for Sensing Traffic (MUST) sensor in the studied parking area. By integrating multiple sensing and communication modules, including video and thermal cameras, Wi-Fi and Bluetooth sensing, environmental sensing and Long Range (LoRa) and 3G/4G communication modules, MUST is capable of monitoring truck parking events and activities. Previously, the MUST sensor has been implemented for monitoring parking space, non-motorized and motorized traffic, and road infrastructure status. This project proposes to utilize MUST sensors to monitor truck parking events and activities of the studied parking area. The monitoring of truck parking events and activities will help transportation agencies to better operate and manage the parking lots.

Funding and Expenditures

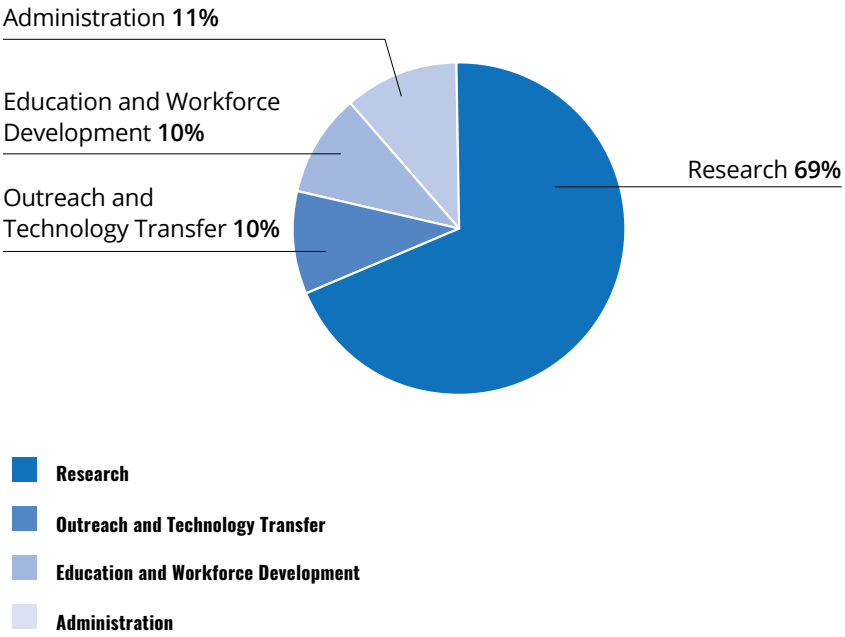
CENTER THREE

Funding Sources — FAST Act

$13M USDOT funds + $13M match funds



FAST Act Projected Expenditures 2017-2021



NEWSLETTERS

The PacTrans Newsletter features highlights of research, student achievements, events, and news pertaining to the Pacific Northwest Transportation Consortium and its partners. The newsletter is published quarterly and is posted to the PacTrans website and distributed to the newsletter list.

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