PACIFIC NW TRANSPORTATION CONSORTIUM
PACTRANS
REGION 10

2019 – 2020

Annual Report

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Letter from the Director

With your great support and care, PacTrans continued its outstanding track record over the past year as the region's research engine, applied technology showcase, workforce development bae, education leader, information center, and collaboration platform. I hope you enjoy, in the pages that follow, reviewing many of the great works that we were privileged to support in this, our fourth year of the FAST Act grant award. Several key highlights from the 2019 - 2020 fiscal year include:

Perhaps the most impactful influence of the past year was the onset of the COVID-19 pandemic. With the input of our board of directors and advisory board, and the hard work of our center staff, PacTrans efficaciously adapted to this unprecedented situation and made efforts to understand and address the impacts of COVID-19. The impossibility of in-person meetings since mid-March, presented the opportunity for a new PacTrans webinar series, many of which are summarized in this report. PacTrans also made funds available for a special research call for proposals to address early questions as well as to collect perishable data revolving around the pandemic.

It is also exciting to report the remarkable progress we have made toward establishing the PacTrans Workforce Development Institute (WDI). After several years of preparation, the PacTrans WDI is scheduled to launch by the end of 2020.This Institute is critical in addressing the transportation workforce challenges in the Pacific Northwest. Through the PacTrans educational research team's effort and our collaborations with the four state DOTs in Region 10, seven training courses have been identified in response to the urgent local workforce development needs. Two of them will be offered in the autumn of 2020, one directly addresses Washington State DOT's needs and the other to the needs of Alaska DOT & Public Facilities.

Another major highlight was our devoted involvement in, and facilitation of, various conferences, workshops and symposia. The 2019 PacTrans | CSET Region 10 Transportation Conference drew hundreds of practitioners and academics from around the Pacific Northwest, where we showcased many of our funded research projects, heard from industry leaders about emerging research needs, and cultivated stronger relationships with the transportation industry. PacTrans consortium partner institutions also sent one hundred faculty and students to the 2020 TRB Annual Meeting to present work, host workshops, and participate in committee meetings.

Our researchers successfully concluded twenty PacTrans funded research projects while others began work on a total of twenty-two new research projects that are leveraging over $1.3 Million in non-federal funds. PacTrans also funded seven new success story technology transfer projects with the goal of utilizing robust research results to produce new outputs geared toward practical implementation and impacts.

As usual our exceptional students had another fantastic and productive year, specifically our student chapters of Institute of Transportation Engineers (ITE). The student chapter from Oregon State University won the 2020 ITE Student Traffic Bowl, the 2020 Western District Student Chapter Award, the Community Impact Award, and the Inclusive Excellence Award; and one of their Master's students won the 2020 Western District Outstanding Student Award. The ITE Student chapter from Gonzaga won the 2020 Western District Student Chapter Momentum Award. We are also very excited that our partner, Boise State University, sent two students to Southern California to attend an ITE Student Conference, so that they are better prepared to establish their own student chapter in the coming year.

PacTrans has had another very successful and rewarding year, and I sincerely hope you enjoy reading in the following pages about the activities and accomplishments that we have seen since our last update. Our goal is a report that is informative and useful to both internal and external readers. We also hope that it will bring to light, every key milestone we have reached with your great support. We welcome any suggestions or feedback you may have on our work and highly appreciate your continued support!

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,

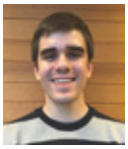
(206) 616-2696, yinhai@uw.edu

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

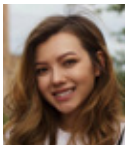
Cole Kopca, Assistant Director, (206) 685-6648, ckopca@uw.edu

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



Leona Vaughn, Student Communications Intern

BOARD OF DIRECTORS

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

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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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Anne Freeman, Program Administrator of Research and Library Services, Washington State Department of Transportation

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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Alaska Department of Transportation and Public Facilities

Hamed Benouar
Managing Director
CTSN Consulting

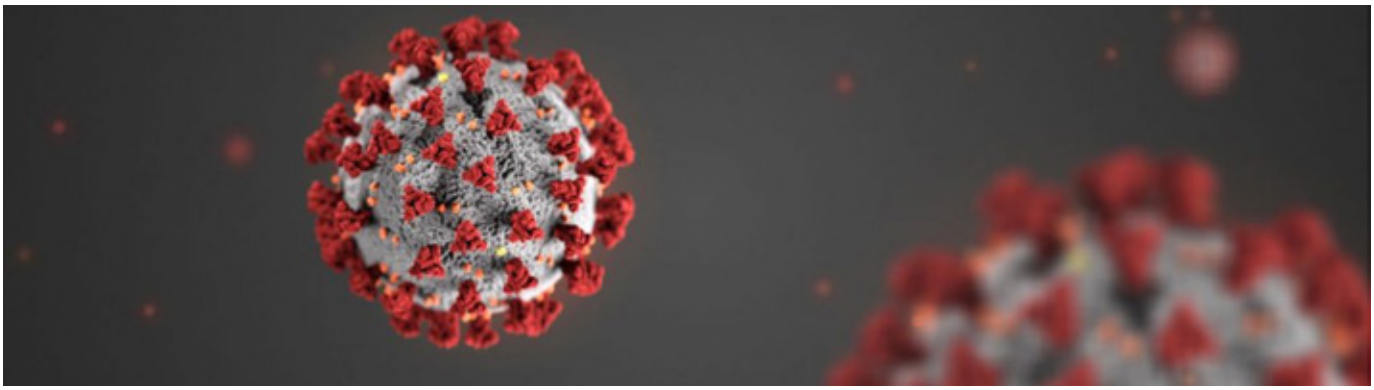
Gareth Robins
Director of Analytics
EROAD

Chris Herman
Director of Trade and Transportation
Washington Ports Association

Highlights from 2019–2020

PACTRANS RESPONSE TO COVID-19 PANDEMIC

Early this spring, as reality began to set in about the severity and timeline of the COVID-19 pandemic and ensuing quarantining/stay at home orders, PacTrans' Board of Directors met to identify a number of adaptations to our normal activities that we would implement over the coming months. Three general categories of activities presented themselves as needing to be addressed: research, seminars, and student support.



Research

The first major addition to our current operations was the addition of a request for proposals that was outside the normal PacTrans research cycle. The call was specifically for quick projects related to transportation mobility and safety in response to COVID-19. Leadership provided several general topics suggestion including: protection guidelines from COVID-19 when using public transportation services, taxi, or ride-hailing services, collection or acquisition of "perishable" mobility, safety, and/or behavior data related to COVID-19, analysis of and insight from the collected (perishable) data related to COVID-19; but did not limit submissions to those specific suggestions.

Seminars

During normal circumstances, PacTrans endeavors to facilitate a handful of seminars each quarter, that are open to both faculty and students, but also to the community at large. These seminars have been geared toward a variety of priorities including: workforce development, technology transfer, leadership development, and knowledge sharing, among others. During this time of COVID-19 with physical distancing requirements and campuses shutting down, PacTrans board still found it incredibly important that we continue to use this mechanism to support our researchers, our students, and our partners. We therefore launched a PacTrans Webinar series with new webinars every two to three weeks, utilizing the Zoom webinar platform to deliver this content to hundreds of attendees. For more information and recordings of the webinars, please visit our website at: http://depts.washington.edu/pactrans/category/education-and-workforce-development/webinar/

Student Support

Since its inception, PacTrans has offered a graduate student fellowship each year to a handful of students interested in pursuing a Master's Degree in a transportation related field before either entering or returning to practice. This fellowship offers students a world class education along with internship experience while being connected with our partner network. This year, with the onset of COVID-19 during the 2020 – 2021 school year admissions process, many students and prospective students are having to weigh new options with regard to shrinking job markets, primarily virtual education, and so on. Because all courses have moved to remote learning for the remainder of the spring and summer quarters, and most of our consortium partner universities will likely have a hybrid approach come fall, PacTrans faculty are developing alternative education plans to provide convenience to students while ensuring education quality. This included, for example, an extension in the PacTrans Graduate Fellowship offer deadline.

PACTRANS HOSTS 2020 ANNUAL TRANSPORTATION CONFERENCE

Last October, the Pacific Northwest Transportation Consortium (PacTrans) held its seventh annual conference on Friday, October 11, 2019 at the University of Washington (UW). The conference focused on emerging mobility and safety issues in the Pacific Northwest, the theme being, "Bridging Innovations and Practice for Enhanced Mobility and Safety". PacTrans partnered with the Center for Safety Equity in Transportation (CSET) again to put together this conference, which returned to Seattle, Washington after being held at the University of Alaska Fairbanks last year. A special thanks this year goes out to the Washington State Department of Transportation for generously sponsoring the event.

A variety of transportation-focused topics were discussed, with the sessions being split into two different tracks: mobility and safety. The mobility track sessions covered research that works towards the improvement of connected and autonomous mobility, controversies surrounding technology in transportation, and recent advancements in shared mobility. The safety track sessions explored research dedicated to improving transportation in rural areas, issues surrounding traffic safety in indigenous communities, and a workshop for defining isolation in a transportation context. Guided by this year's theme, a total of 22 posters were presented at the conference's annual poster session by PacTrans members and participating students.

2020 TRANSPORTATION RESEARCH BOARD (TRB) ANNUAL MEETING

The Transportation Research Board (TRB) 99th Annual Meeting was held this past January 12-16, 2020, at the Walter E. Washington Convention Center in Washington, D.C. The event attracted more than 13,000 transportation professionals from across the country. Those professionals hosted more than 5,000 presentations in nearly 800 sessions and workshops, addressing topics of interest to policy makers, administrators, practitioners, researchers, and representatives of government, industry, and academic institutions. This year's meeting was themed *A Century of Progress: A Foundation for the Future*.

With policy makers, administrators, practitioners, researchers, and representatives of government, industry, and academic institutions in attendance, the TRB annual meeting continues to be an amazing platform for PacTrans to demonstrate our abilities, expertise, innovation, and research as one of the country's leading regional University Transportation Centers (UTCs).

Other events we've participated in this year:

PACTRANS PARTNERS UP ON PANDEMIC URBANISM SYMPOSIUM

In late May, PacTrans partnered with a number of current and recently graduated doctoral students from the University of Washington's College of the Built Environment, who organized an event titled, "*the Pandemic Urbanism Symposium.*"

This one-day, virtual event brought together more than 50 academics, researchers, practitioners, and activists to share their thoughts on the emerging state of pandemic urbanism. With over 1200 registrants, the symposium offered three plenary sessions and eight breakout sessions on a variety of subjects, all geared at answering questions such as: What does COVID-19 mean for city life? What are the implications of this pandemic for urban form, mobility, sociability, and politics?

PacTrans assisted with the promotion of this event, both for the call for proposals for presentations, as well as for attendees to the general event. One University of Washington, PacTrans student researcher, Parastoo Jabbari, was successfully selected to present during the breakout session on mobility. She presented recent longitudinal survey results having to do with perceptions of shared mobility before and during the COVID-19 quarantine/physical distancing orders.

PacTrans' role also included utilization of our Zoom Webinar account and a staff person to host one of the two breakout session virtual rooms. For more information on the event, visit their website: http://pandemicurbanism.com/

PACTRANS DIRECTOR SELECTED FOR ASCE FELLOW

PacTrans director and UW professor of Civil & Environmental Engineering, Dr. Yinhai Wang, was selected to become a fellow of the American Society of Civil Engineers (ASCE) last December. In addition to being PacTrans' director, Dr. Wang also founded UW's Smart Transportation Applications and Research (STAR) Lab in 2003. The lab serves as a resource for students to rely on, allowing them to further delve into the world of transportation through problem solving, instrument and software training, and networking with transportation agencies offering real-world research opportunities.

The ASCE is the nation's oldest engineering society. Since it was founded in 1852, the society has played a leading role for civil engineering, an industry responsible for creating and operating our world's built environment as much as it is dedicated to protecting and restoring its natural environment.

DR. ANNE GOODCHILD RECEIVED CEE DEPARTMENT MENTORING AWARD

This year's CEE Department Mentoring Award goes to Dr. Anne Goodchild. Goodchild is a UW professor in the Transportation Engineering group within CEE, as well as an adjunct professor of Industrial & System Engineering.

Goodchild currently serves as the director of the Supply Chain Transportation & Logistics Center, and the academic director of the Master of Supply Chain Transportation & Logistics degree program.

This recognition of Goodchild's exceptional work was made possible by the multiple, and thoughtful, student nominations that were made on her behalf.

PacTrans Awards

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 education in the Pacific Northwest.

Robert D. Layton, PhD, PE
Professor Emeritus, Civil and Construction Engineering
Oregon State University

EDUCATOR OF THE YEAR

The Educator of the Year Award is presented annually to a PacTrans faculty member in recognition of sustained outstanding teaching, including mentoring, advising, and innovative teaching techniques.

Shane Brown, PhD, PE
Associate Professor, Civil and Construction Engineering
Oregon State University

EXCELLENCE IN TECHNOLOGY TRANSFER

This Excellence in Technology Transfer Award is presented annually to investigators for effective partnerships and collaboration with outside industry, innovative marketing of newly developed techniques and technologies, or successful implementation of research results.

Michael Lowry, PhD, PE
Associate Professor, Civil and Environmental Engineering
University of Idaho

RESEARCHER OF THE YEAR

The Researcher of the Year Award is presented annually to investigators for outstanding research with significant outcomes, incorporating meaningful student contributions, and robust community service and leadership.

Xuegang Ban, PhD
Associate Professor, Civil and Environmental Engineering
University of Washington

PacTrans Welcomes New Faculty

Kevin Houser

OREGON STATE UNIVERSITY

Kevin Houser (PhD, PE, FIES, LC, LEED AP) is a Professor at Oregon State University with a joint appointment as Chief Engineer at Pacific Northwest National Laboratory. He is also editor-in-chief of LEUKOS, the journal of the Illuminating Engineering Society (IES), and co-founder of Lyralux, Inc. He has published more than 125 publications about light and lighting. He's won the CIBSE Leon Gaster and Walsh Weston Awards, IES Taylor Technical Talent Award three times, the IES Presidential Award, and is a Fellow of IES. His recent work focuses on human perceptual and biological responses to optical radiation and the application of that knowledge to the spectral design of light sources and the built environment. His university teaching includes courses on lighting design, research methods, color science, and light sources. Interests also include the effective communication, dissemination, and critical consumption of scientific research.

Chuan Hu

UNIVERSITY OF ALASKA FAIRBANKS

Dr. Hu is currently an Assistant Professor in the Department of Mechanical Engineering, University of Alaska Fairbanks. Prior to joining UAF, he was a Postdoctoral Fellow at Department of Mechanical Engineering, University of Texas at Austin, Austin, TX, USA, from August 2018 to June 2020, and a Postdoctoral Fellow in the Department of Systems Design Engineering, University of Waterloo, Waterloo, ON, Canada from July 2017 to July 2018. His research interest includes: 1) decision-making, motion planning and control of autonomous vehicles; (2) vehicle system dynamics and control, estimation, and mechatronics; (3) human-vehicle interaction, trust dynamics, shared control, and ADAS.

Retirements

Greg Miller, PhD

UNIVERSITY OF WASHINGTON

Greg Miller received his BSCE from the University of Washington in 1980, and then went on to earn his MSCE (1981) and PhD (1983) degrees from Northwestern University in Evanston, Illinois, returning to the University of Washington as a faculty member at the end of 1983. His research and instruction have focused primarily in the areas of applied mechanics and computational methods, with applications including structures, geotechnical systems, and transportation infrastructure. His technical expertise centers primarily around numerical methods, software development, and image-based damage characterization. He and his graduate students have produced a number of software packages that have been widely used in both professional and educational contexts. He has served in both local and national leadership roles, serving most recently as Vice Dean in the Office of Research and Faculty Affairs (ORFA), Interim Dean of Engineering, and Department Chair of Civil and Environmental Engineering from 2009 to 2020. He has received various awards both for research and for education, most notably a National Science Foundation Presidential Young Investigator Award in 1987, a University of Washington Distinguished Teaching Award in 1994, and a David B. Thorud Leadership Award in 2017. Professor Miller was a PacTrans PI a number of years ago.

Steven Kramer, PhD

UNIVERSITY OF WASHINGTON

Steve Kramer received his BS, M.Eng., and PhD degrees from the University of California, Berkeley in 1977, 1979, and 1985, respectively. Kramer joined the geotechnical group in the University of Washington Department of Civil Engineering in 1984. He taught a wide range of undergraduate and graduate courses in geotechnical engineering, and advised numerous graduate students on Masters and Ph.D. research projects. His primary research interests included soil liquefaction, site response analysis, seismic slope stability, and hazard analysis. He continues to conduct research work in the area of performance-based earthquake engineering, specifically the integration of probabilistic response analyses with probabilistic seismic hazard analyses. Kramer is the author of the book, Geotechnical Earthquake Engineering, and of numerous technical papers and reports. He has been the recipient of the Presidential Young Investigator Award from the National Science Foundation, the Arthur Casagrande Professional Development Award from ASCE, a Walter Huber Research Prize from ASCE, the 2009 and 2017 Norman Medals from ASCE,

the 2018 H. Bolton Seed Medal from ASCE, and the 2018 Nabor Carillo Lecture Award from the Mexican Society of Geotechnical Engineering. He was named as a Distinguished Member of ASCE and elected to the National Academy of Engineering in 2020. Kramer was a Senior Research Scientist in the International Centre for Geohazards at the Norwegian Geotechnical Institute (NGI) in 2003, and is also a member of the faculty of the European School for Advanced Studies in the Reduction of Seismic Risk (the ROSE School) at the University of Pavia in Italy.

Leroy Hulsey

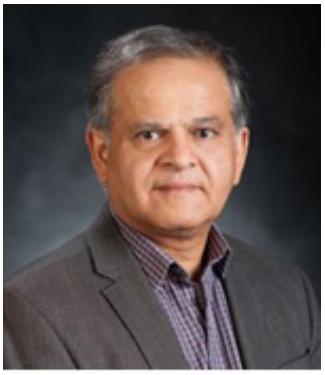
UNIVERSITY OF ALASKA FAIRBANKS

Dr. Hulsey focuses on working with students to achieve a high quality education. His research is in the fields of bridge engineering and effects of temperature extremes on structural systems like composite wall panels for buildings. His work blends a strong experimental component with the fundamentals of theory. Dr. Hulsey has expertise in mathematical modeling using state-of-art methods in finite element, finite difference and theoretical solid mechanics. Dr. Hulsey has University and corporate experience. Before coming to the University, Dr. Hulsey owned and ran three high-tech engineering-research corporations. He has extensive teaching and research experience. He taught at the University of Missouri Rolla, North Carolina State University and the University of Alaska Fairbanks (UAF).

Fouad Bayomy, PhD, PE, Life Member of ASCE

UNIVERSITY OF IDAHO

Professor Emeritus of Civil and Environmental Engineering at the University of Idaho specialized in construction materials and pavement systems. Dr. Bayomy obtained his Ph.D. from Ohio-State University in 1982 and joined the UI in 1991. His nationally recognized research in transportation infrastructure covered several areas such as: pavement design and performance evaluation systems, laboratory and field non-destructive testing, highway maintenance management systems, construction materials, and computer applications in pavement engineering. Dr. Bayomy has been an active member of the UI's National Institute for Advanced Transportation Technology (NIATT) and led the research in the Center for Transportation Infrastructure. His research funds covered agencies such as the US Department of Transportation, Federal Highway Administration, Idaho Transportation Department, and several other federal, state, and local agencies. Dr. Bayomy plans to continue working in his transportation research after retirement.



Sunil Sharma, PhD, PE

UNIVERSITY OF IDAHO

Professor Emeritus of Civil and Environmental Engineering at the University of Idaho. Dr. Sharma obtained his Ph.D. in Civil Engineering from Purdue University, 1986. He Joined the University of Idaho in 1986. His research interest includes computer applications in civil engineering, engineering behavior of saturated and unsaturated soils, stability of slopes and excavations, geotechnical and earthquake engineering applications, groundwater and seepage in soils. Dr. Sharma taught classes mainly focusing on topics related to geotechnical engineering and served as the Civil Engineering Department Chair from 2003 to 2009. Dr. Sharma has been an active member of the UI's National Institute for Advanced Transportation Technology (NIATT) faculty and served as a principal investigator and co-principal investigator for several research projects funded by US Department of Transportation, Federal Highway Administration, Idaho Transportation Department, and several other federal, state, and local agencies. Dr. Sharma plans to stay active in research.

Axel Krings, PhD

UNIVERSITY OF IDAHO

Axel W. Krings is a Professor Emeritus of Computer Science at the University of Idaho. He received his Ph.D. (1993) and M.S. (1991) degrees in Computer Science from the University of Nebraska - Lincoln, and his M.S. (1982) in Electrical Engineering from the FH-Aachen, Germany and has been at the University of Idaho since 1995. Dr. Krings has done research extensively in the area of computer and network survivability, security, fault-tolerance, real-time scheduling, intelligent transportation systems, and connected and autonomous vehicle security and operations. His work has been funded by the department of Energy, Idaho National Lab, US Department of Transportation, Department of Defense and the National Institute of Standards and Technology. Axel has been very actively engaged in PacTrans research, education and outreach activities in the smart mobility technology and the security of connected and autonomous vehicle communication and data exchange.

Research Projects

PacTrans consortium universities are dedicated in 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

2018-2020 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** **Rula Awwad-Rafferty** **David Hurwitz** **Billy Connor** **Eric Jessup** **Jeff Ban**	UI UI OSU UAF WSU UW	Multi - Outreach
Quantifying Impact of Rockfall on Mobility of Critical Transportation Corridors	**Keith Cunningham** **Ben Leshchinsky** **Michael Olsen** **Joe Wartman**	UAF OSU OSU UW	Multi
A Hierarchical priority-based Control of Signalized Intersections in Semi-Connected Corridors	**Ali Hajbabaie** **Sameh Sorour** **Ahmed Abdel Rahim**	WSU UI UI	Multi
The Impact of Shared Mobility Options on Travel Demand	**Anne Vernez-Moudon** **Jeff Ban** **Mike Lowry** **Qing Shen**	UW UW UI UW	Multi
Agent-based Modeling of Emergency Management Networks with Public Mobilization after a Disaster	**Erica Fischer**	OSU	Single
Application of Augmented Reality and Tangible Interfaces to Minimize Work zone Effects on Mobility through Participatory Planning	**Joseph Louis**	OSU	Single
Efficient Extraction and Evaluation of Complex Pavement Markings from Mobile Laser Scan Data	**Micheal Olsen**	OSU	Single
Integrating Driving Simulator Experiment Data with a Multi-agent Connected Automated Vehicles Simulation (Ma-CAVS) Platform to Quantify Improved Capacity	**Haizhong Wang**	OSU	Single
Taming and Tapping the Bike Share Explosion	**Mike Lowry**	UI	Single
Deterioration of Green Conflict Paint for Bicycle Facilities	**Emad Kassem**	UI	Single
Fusion of Airborne and Terrestrial Sensed Data for Real Time Monitoring of Traffic Networks	**Mohamed Hefeda**	UI	Single
A Connected Vehicle-Based Adaptive Vehicle Routing Algorithm	**Yinhai Wang**	UW	Single
Examining the Effects of King County Metro Carpool Incentive Fund	**Qing Shen**	UW	Single
Development of 3D Printed Materials for Rapid Fabrication of Pedestrian and Bicycle Infrastructure to Increase Mobility	**Dawn Lehman**	UW	Single
Taming and Tapping the Bike Share Explosion	**Ron Pimentel**	WSU	Single
Inspiring Transportation Careers with K–12 Curriculum Activities	**Xianming Shi**	WSU	Single
Smart and Environmentally Friendly Winter Maintenance Solutions for Safe Winter Mobility	**Somayeh Nassiri**	WSU	Single
Synthesis of Best Practice for Design and Construction of Roadways and Airports Over Permafrost	**Billy Connor**	UAF	Single
Measuring Dispersal and Tracking of Anti-Icing and Deicing Chemicals using In-Situ Hyperspectral Data – Phase II: In-Situ Terrestrial Field Data Collection	**Nathan Belz**	UAF	Single

2018-2020 Research Projects

PACTRANS WORKFORCE DEVELOPMENT INSTITUTE (WDI) - PHASE III

PI: Yinhai Wang (UW)

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

To further ensure and strengthen the advantages of developed WDI in dealing with Region 10's specific workforce development needs, the WDI is currently collaborating with Washington State Department of Transportation (WSDOT) to deliver training services to address WSDOT's immediate workforce development needs. Specifically, the WSDOT representatives have identified three top priority subjects that need training, i.e., the MUTCD, human factors, and data analysis and tools. The PacTrans WDI team will design, develop, and deliver three short-term training courses in respond to these training needs. Besides onsite training courses, the team will also provide online course offering to WSDOT's professionals. In addition, the team will develop a training service model that aims to collaborate between WDI and WSDOT to provide demand responsive and flexible training services to address the long-term training needs. The team will develop course evaluation procedures with evaluation methods and indicators regarding the course content, effectiveness, and instructors, etc. Based on the course evaluation results, the team will identify areas of improvement of the current course offerings and propose suggestions for future course development and delivery.

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

PI: Ahmed Abdel-Rahim (UI)

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

The main focus of Year-3 activities is to develop outreach materials to disseminate the findings of Year-1 and Year-2 activities to different audiences. The primary objective of the outreach materials and activities is to inform different stakeholders (policy makers, transportation system operators, and different groups of the general public) about: 1) opportunities in smart mobility applications that can positively impact the underserved populations, and 2) institutional, cultural, technological, and social barriers that might impact the outreach of smart mobility applications to the underserved population.

The Lead University, will work with other universities, based on the outcome of Year-1 and Year-2 activities to identify: (1) the target audience, (2) the message content to each audience group, and (3) the message delivery tool (short videos, webinars, news articles, websites, on-line platforms, etc.) Each university in the PacTrans consortium will be responsible for developing a set of the identified outreach materials.

MANAGING INCREASING DEMAND FOR CURB SPACE IN THE CITY OF THE FUTURE

PI: Kevin Chang (UI)

Co-Investigators: Anne Goodchild (UW), Ed McCormack (UW)

The strategies employed by city officials and transportation professionals for managing curb space have not always kept pace with change. They lack the conceptual approaches and analytic methods needed to manage scarce curb space in the new world of on-demand transportation, one to two hour e-commerce goods deliveries, rising cycling and transit usage, and autonomous and cooperative vehicle technologies. These trends are happening in cities where the lack of curb space capacity is already a significant problem. For this particular project, the research team will: conduct a thorough scan and document previous studies that have examined curb space management, identify emerging urban policies developed in response to growth, review existing curb management policies and regulations, develop a conceptual curb use policy framework, review existing and emerging technologies that will support flexible curb space management, and evaluate curb use policy frameworks by collecting curb utilization data and establishing performance metrics and simulating curb performance under different policy frameworks. Lastly, researchers will develop outreach materials to support curb utilization practices.

GUIDELINES FOR USING PHOTOGRAMMETRIC TOOLS ON UNMANNED AIRCRAFT SYSTEMS TO SUPPORT THE RAPID MONITORING OF AVALANCHE-PRONE ROADSIDE ENVIRONMENTS

PI: Ed McCormack (UW)

Co-Investigators: Nathan Belz (UAF)

The research team will work directly with avalanche professionals from the Alaska Department of Transportation and Public facilities and the Washington State Department of Transportation to determine a methodology for operational use of SfM on UAS for the purpose of monitoring avalanches in areas of high risk. This research will use avalanche-prone area test areas in both Washington and Alaska and will initially fly these areas before snowfall to familiarize the project team with the area, create a GPS based flight profile, and record the altitude of the snow-free ground. The second set of flights, guided by the flight profile recorded earlier, will occur when there is snow and will be used to explore avalanche risk based on capturing snow depth and snow surface conditions.

This project will use these flights to evaluate what products derived from SfM can be useful to the DOTs and the ability of DOT staff to use this technology on a routine basis to support avalanche monitoring. This research will evaluate the capabilities of SfM operating in less than perfect conditions including capturing images in times of poor visibility, the processing time required for useful output, computing requirement, and the repeatability of the results over time.

MICRO-MOBILITY PROMISES AND CHALLENGES IN THE PACIFIC NORTHWEST

PI: Haizong Wang (OSU)

Co-Investigators: David Hurwitz (OSU), Nathan Belz (UAF)

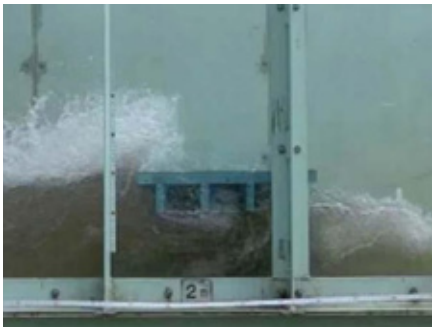
The goal of this research is to develop a framework that can be used by transportation agencies to evaluate the potential impact shared micro-mobility services may have on their respective communities. The framework will include details on 1) estimating current micro-mobility vehicle miles travelled, 2) projecting future micro-mobility vehicle miles travelled, and 3) implementation strategies including rider education and infrastructure development suggestions. These details will help agencies combat issues such as congestion, emissions, and emergency relief. The research will also produce qualitative and quantitative models to capture and predict phenomena related to switching modes.

These goals will be achieved through 1) stated preference and revealed preference survey questionnaires, 2) micro-mobility stakeholder workshops; and 3) data-driven micro-mobility behavior analysis administered in Oregon and Alaska. The qualitative and quantitative results will be integrated into a useful framework for communities and municipalities of different sizes interested in adopting or expanding micro-mobility services.

UAS IMAGE-BASED POINT CLOUDS TO 3D BRIM: DEEP SEMANTIC SEGMENTATION FOR 3D AS-IS BRIDGE MODEL GENERATION

PI: Yelda Turkan (OSU)

The current BrIM development process for existing bridges is labor intensive, time consuming, prone to errors, and state DOTs may not have the resources or personnel time to develop 3D BrIM for all the bridges they maintain and operate. In order to overcome the challenges associated with the development of 3D BrIMs, this research project will develop a novel data collection and analysis framework that enables rapid collection of 3D geometrical information from existing bridges in the form of 3D dense point clouds, and converts them into 3D BrIM in an automated and efficient manner. 3D point clouds will be obtained by applying Structure from Motion (SfM) algorithms to the images collected using an Unmanned Aerial System (UAS). In the next step, these 3D point clouds will be automatically segmented and classified into different structural components using deep learning algorithms. In the final step, the labeled point clouds will be automatically converted to 3D BrIM. Overall, this study will develop a framework that will make it much more convenient and faster to develop and implement 3D BrIM, which can improve the current bridge inspection and management practice significantly in terms of efficiency and safety, thus help improve public mobility.



PILOT STUDY: LEARNING FLUID-STRUCTURE INTERACTION VIA MACHINE LEARNING

PI: Barbara Simpson (OSU)

Model reduction is desired, if not indispensable, for many parametric and/or computationally expensive applications. This research will explore machine learning algorithms designed to estimate the tsunami loading on bridges based on structural properties and flow conditions. Machine learning enables "reduced" models that represent the essence of the original full dimensional numerical model. If provided enough data, the algorithms can infer physical assumptions and discover input (initial conditions) and output (bridge response) relationships, resulting in a smaller model with fewer, less expensive numerical equations. Because the "reduced model" is computationally

inexpensive, it can replace the original simulation for parametric problems, resulting in optimization and statistical solutions that are currently not feasible. Moreover, if properly designed, machine learning architectures can retain the relevant physics, e.g., satisfying momentum and mass balance. A high performance GPU computing cluster at OSU will be utilized in order to perform model reduction on experimental and simulation based data of tsunami loading on bridges.

USING GNSS TO EVALUATE THREATS TO MOBILITY OF RESOURCES AND PEOPLE ON COASTAL ROADS IN USDOT REGION 10

PI: Meagan Wengrove (OSU)

Our objective is to develop a new technique to assess the hazard intensity of coastal erosion hotspots to existing and planned coastal roadways by continuously monitoring coastal water levels and wave heights using a new remote sensing technique with land-based GNSS. The proposed technique will measure nearshore water levels and wave heights using land-based and easily mobilized Global Navigation Satellite System (GNSS), which is an all-weather, continuous, global radio satellite system. GNSS is a remote sensing technique. GNSS is easy to install and maintain. GNSS can continuously monitor during storms without being in destructive sea-states (like tide gages and coastal buoys), or depending on optical clarity (like cameras).

VIRTUAL REALITY VEHICLE SIMULATOR PHASE 1

PI: Orion Lawlor (UAF)

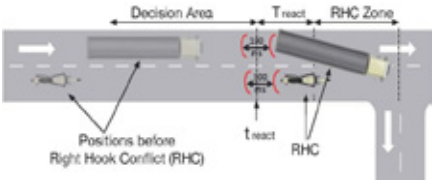
Several previous projects have incorporated virtual reality (VR) technology to improve driver safety. The most broadly applied projects incorporate 360 video, which allows drivers to view accident sites. More specialized projects, such as those training heavy equipment operators, allow actual interactive use of the vehicle. This project seeks to use VR technology to improve the safety of nontraditional vehicles.

The goal of this project is to provide a single integrated hardware/software platform capable of training operators of ATVs, bicycles, and snowmobiles to use their vehicles safely. We'll do this by using modern virtual reality (VR) technology to put people "in the driver's seat" virtually, so they can safely experience accidents like skids and rollovers, and see a slow-motion replay to understand and visualize the physical cause of each accident, and the effect on a driver with or without a helmet, with the aim of preventing that kind of accident.

RIVER ICE MEASUREMENTS FOR TRANSPORTATION SAFETY IN RURAL COMMUNITIES

PI: Svetlana Stuefer (UAF)

This research focuses on exploring new river ice measurement techniques applicable in rural Alaskan communities. We will work with the city of Tanana, a rural Alaskan community, located at the confluence of the Yukon River and Tanana River. Residents of Tanana make a huge effort every year to build and maintain an ice road across the Yukon River. This ice road connects Tanana to the state road system that ends on the opposite side of the Yukon River. The goal of our project is to work with community members to develop a set of river ice measurements that provide information for safe traveling during the winter season.



CONNECTED VEHICLE SAFETY APPLICATIONS USING V2X UNDER CONSIDERATION OF BICYCLES, PEDESTRIANS AND PERSONS WITH SPECIAL NEEDS

PI: Axel Krings (UI)

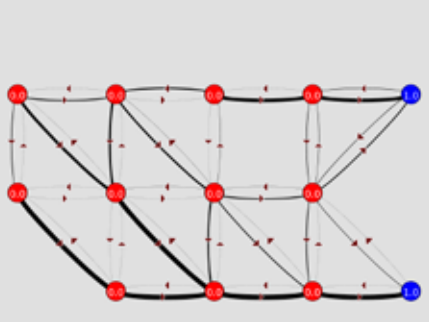
The current research effort investigates the feasibility and reliability of bicycle Safety Applications (SA) that use the same basic communication capabilities as vehicles, thus allowing vehicle-to-bicycle (V2B) communication. However, just like in the case of SA for vehicles, their reliability of SA may be affected by natural phenomena that degrades communication and malicious act. This may affect the accuracy of data in general, as in the case of GPS errors and timing errors, but it may be the result of malicious act like jamming of the communication.

In the context of the project a bicycle safety application to reduce accidents due to Right Hook Conflict is designed and implemented. The bicycle safety application uses information that is exchanged in periodic beacon messages emitted by all vehicles, including bicycles. There are several issues that are being investigated, as they have the potential to negatively affect the SA. First, the impact of GPS errors and their impact on the potential short distances between bicycles and vehicles are studied. Second, the mitigation to malicious act and benign message omissions are investigated. This is supported by field experiments with off-the-shelf communication equipment. For this purpose vehicles were equipped with Arada LocoMate Classic OBUs and the bicycle with a mobile Arada LocoMate ME.

A HYBRID PLATFORM FOR CONTEXT-AWARE V2X COMMUNICATIONS

PI: Mohamed Hefeida (UI)

This project aims to design and implement a hybrid context-aware Vehicle-to-everything (V2X) communication platform that incorporates different wireless communication technologies under a unified architecture. The platform will expand transportation network capabilities, extend accessibility of transportation information, establish a strong interface for the transportation network with other infrastructures (e.g. cellular networks), which will open new horizons for various applications. Adopting an application-driven architecture requires multimodal operation. The proposed platform will collect information from various sources, such as Advanced Traffic Signal Controllers (ATCs), Road Side Unites (RSUs), and Global Positioning System (GPS). This data will be fused, analyzed, and prioritized according to the context in which it's being used. For example, expanding real-time accessibility to traffic data beyond the vicinity of incidents can greatly improve efficiency of traffic controllers as well as vehicles' operation (e.g. autonomous braking). This platform will facilitate incorporating vehicles (properly equipped) as active communication beacons that not only have the ability to relay transportation information, but can also generate very useful transportation-related data. This will enable data-driven optimizations, improving efficiency of transportation networks, while extending their accessibility to a plethora of commercial applications that were otherwise not feasible due to the transportation networks' limited communication abilities.



CONNECTED-VEHICLE TRAFFIC SIGNAL SYSTEM MODELING PLATFORM

PI: Robert Heckendorn (UI)

In this research we will simulate traffic and the decision making of the RSI including signaling. We will also augment the NIATT advanced driving simulator for display of signaling data. The implementation will use not only software from a popular real-time traffic simulator (VISSIM) to simulate traffic flow, but hardware in the form of real traffic controllers in the RSI and a real vehicle outfitted as a driving simulator. Specifically, our aims are:

Aim 1: Experiment with physical displays in the driving simulator for displaying information from the RSI. This will allow experimentation with effective in-cab use of connected vehicle information. We will begin with signaling information delivered by the RSI. The simulator will be incorporated in the overall simulation found in Aim 2.

Aim 2: We will construct an enhanced traffic simulator using the VISSIM traffic simulator creating BSMs to virtual RSUs. Use that information in a signaling optimizer, we will construct and feed the control signals to real hardware controllers which will feed back into the VISSIM. This will allow us to experiment with signaling control at both the macro level of all traffic and at the individual level of a driving simulator.

LONGITUDINAL ANALYSIS OF WASHINGTON STATE STUDENT TRAVEL SURVEYS

PI: Anne Vernez Moudon (UW)

Data from the three waves of Student Travel Surveys will be combined with data developed in previous research regarding (i) school sociodemographic characteristics; (ii) school neighborhood walkability (street infrastructure and land use); (iii) Washington SRTS projects (2005-today); and (iv) state-wide vehicular collision data (2001-2017) to address three questions:

1. Is neighborhood walkability around schools associated with higher rates of students walking to school?
2. Do rates of walking and biking to school increase following the completion of SRTS projects?
3. What is the relationship between higher rates of students walking and biking to school rates of collision between youth and vehicles near schools?

This research will serve to asswess the effect of past SRTS programs on rates of walking and biking to school and to guide WSDOT in selecting strategies that will increase the safety of AST.

COMBINING CROWDSOURCING AND MACHINE LEARNING TO COLLECT SIDEWALK ACCESSIBILITY DATA AT SCALE

PI: Jon Froehlich (UW)

This project is developing new data collection approaches using a combination of remote crowdsourcing, machine learning, and online map imagery. Our overarching goal is to transform the way in which sidewalk accessibility information is collected and visualized to ultimately improve pedestrian infrastructure and how people move about a city. Our newest effort, called Project Sidewalk , enables online crowdworkers to remotely label pedestrian-related accessibility problems by virtually walking through city streets in Google Street View. Rather than pulling solely from local populations, our potential pool of users scales to anyone with an Internet connection. To train, engage, and sustain users, we apply basic game design principles such as interactive onboarding, mission-based tasks, and progress dashboards. We recently completed an 18-month deployment in Washington DC: 1,153 users provided over 255,000 geo-located sidewalk accessibility labels and audited 3,000 miles of DC streets. With simple quality control mechanisms (e.g., majority vote), we found that minimally trained remote crowd workers could find and label 92% of accessibility problems in street view scenes, including missing curb ramps, obstacles in path, surface problems, and missing sidewalks. To our knowledge, this is the largest and most granular open dataset of sidewalk accessibility data ever collected.

MEDICAID'S NON-EMERGENCY MEDICAL TRANSPORTATION: THE CRITICAL ROLE OF MOBILITY SERVICES IN ACCESSING BEHAVIORAL AND PREVENTATIVE HEALTH CARE

PI: Bidisha Mandal (WSU)

The goal of this project is to examine rural-urban differences in NEMT utilization for accessing behavioral health services (including mental health and substance abuse treatment) and preventative services (including primary care and specialist visits) among Medicaid beneficiaries.

Specifically, administrative medical claims data are used to:

(1) Determine demand for NEMT services in the state of Washington

(2) Identify the most prevalent medical conditions among NEMT users

(3) Estimate the cost of NEMT services

(4) Estimate emergency department use for the medical conditions identified in objective (2)

For each of the above objectives, I'll explore differences between rural and urban Medicaid enrollees.

The benefits of using an administrative claims database is that it is a single source of data on NEMT use and health care utilization for all Medicaid enrollees over multiple years. Findings from this study can help inform healthcare delivery and service improvements for low-income populations who are eligible for NEMT benefits. In areas with high demand of NEMT services, initiatives to develop community capacity to offer medical care and prevention programs could be considered.

POST-WILDFIRE STABILITY AND IMPROVEMENT OF HILLSLOPES NEAR PNW TRANSPORTATION INFRASTRUCTURE TO INCREASE MOBILITY

PI: Idil Akin (WSU)

We will use a distributed physically-based probabilistic model to identify slopes susceptible to wetting-induced shallow landslides. The model will be an updated version of level-one stability analysis, LISA, developed by the researchers at the Rocky Mountain Research Station, Moscow ID. The model will use Monte Carlo simulation to calculate wetting-induced shallow landslide probability using a suction stress based infinite slope stability analysis.

We will also investigate environmentally-friendly alternatives for surficial stabilization of wildfire-burnt slopes. Different polymers and biopolymers will be sprinkled on the surface of wildfire-burnt soil compacted in rainfall tanks. Rainfall will be applied under controlled laboratory conditions using a sprinkler system. Soil will be dried after each wetting cycle using a light source. Erosion reduction and shear strength increase after multiple wet-dry cycles will be measured and used to evaluate the effectiveness of surficial application of the environmentally-friendly stabilizers.

DEVELOPING A FUZZY-LOGIC METHOD FOR EVALUATING THE ACCESSIBILITY OF DISABLE PEOPLE TO PUBLIC TRANSPORTATION IN RURAL COMMUNITIES

PI: Mohammadrorush (Tommy) Tafazzoli (WSU)

While the literature has suggested multiple accessibility factors for disabled groups, there is not a comprehensive evaluation system that can score a transportation facility considering all accessibility indicators. Additionally, the existing methods do not adequately evaluate the accessibility based on meeting the demands of different types of disabilities.

This research will introduce a method to evaluate the accessibility of public transportation services for disabled people in rural areas. The proposed approach will fill the gap of the existing evaluation methods by 1) transforming the existing transportation-quality evaluation to an accessibility-quality evaluation focused on disabled people in rural areas 2) evaluating accessibility for four major disability types, and 3) introducing a fuzzy-logic assessment that generates a quantitative score for the evaluation.

The research is expected to have the following benefits: 1) detecting the accessibility issues based on the disability type that leads to meeting the demands of people from various disability groups (not just wheelchair users), 2) maximizing the efficiency of the investments in improving the accessibility by prioritizing different measures based on scores with universal interpretations and, 3) contributing to the health, vitality, well-being, and economic independence of disabled people living in rural areas.

Education and Workforce Development

UW PH.D. CANDIDATE RECEIVES OUTSTANDING STUDENT OF THE YEAR AWARD

Each year, PacTrans awards a student researcher with the Michael Kyte Region 10 Outstanding Student of the Year Award. This year's award went to UW Ph.D. candidate, Ruimin Ke.

To be eligible, the student must be a researcher who has worked on UTC funded research within a UTC that has a consortium member located in Alaska, Idaho, Oregon, or Washington state.

The award is given based on several criteria including: technical merit and research, academic performance, and professionalism and leadership.

This award was presented, as it always is, during the Region 10 Reception at the TRB Annual Meeting.

UNIVERSITY OF WASHINGTON GRADUATE STUDENT SELECTED FOR ENO CONFERENCE

It was announced earlier this summer that UW Ph.D. candidate, Katherine Idziorek, is this year's recipient of the Thomas J. O'Bryant Policy and Finance Fellowship. This opportunity will allow Idziorek the chance to immerse herself in transportation policy making, be involved in the development of Eno research, and participate in Eno's Future Leaders Development Conference next year.

Idziorek is a student in the International Ph.D. program in Urban Design and Planning. Her research interests include social infrastructure, and is currently focused on using that, along with social networks, to aid in the formation of resilient communities.

"One aspect of that is understanding what disaster preparedness means for acute disasters, like the pandemic we are currently experiencing, but also chronic disasters, like systemic inequities and poverty," Idziorek said in an article on Eno's website.

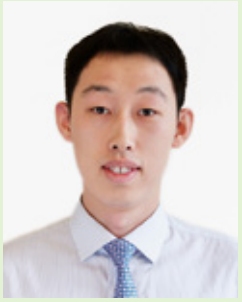
U OF IDAHO MASTER'S STUDENT AWARDED WOMEN IN TRANSPORTATION SW IDAHO LEADERSHIP SCHOLARSHIP

University of Idaho and PacTrans supported graduate student, Nuzhat Yamin, is this year's recipient of the Women in Transportation (WTS) SW Idaho Leadership Scholarship. The WTS Scholarship recognizes and awards women in pursuit of a career in transportation based on their transportation goals, academic standing, and leadership abilities. Along with the $1,500 scholarship, Yamin will also advance to the national scholarship competition, where she will have the opportunity to win an additional $5,000.

Yamin originally obtained an undergraduate degree in electrical engineering from the Bangladesh University Engineering and Technology. She later attended the University of Idaho and is currently working towards a doctorate degree in the Department of Electrical and Computer Engineering.

Yamin's research is focused on the improvement of communication schemes in smart vehicles on highways and has done work on intelligent transportation systems.

PACTRANS GRADUATE STUDENT RESEARCHER AWARDED DEPARTMENT CHAIR'S AWARD



This year's CEE Department Chair's Award was awarded to Dr. Zhiyong Cui. Many educators have been challenged this year, as most of us have moved to an online platform in order to continue learning and teaching in response to the COVID-19 pandemic. This award recognizes that Cui has not only been able to adapt to these changes, but also excel in creating an environment in which students can succeed academically, even from home. Cui is a recent graduate of the UW, earning his PhD in Intelligent Transportation and Machine Learning this year. He was one of two individuals being recognized for this award, the other recipient being Dr. Mohammad Malakoutian.

HIGH SCHOOLERS GET HANDS-ON AND VIRTUAL TRANSPORTATION ENGINEERING EXPERIENCE AT OSU'S SUMMER TRANSPORTATION INSTITUTE

Figure 1: Students survey the surrounding environment.

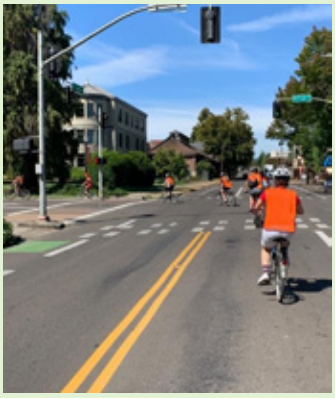


Figure 2: Students arrive back to campus from the bicycling tour.

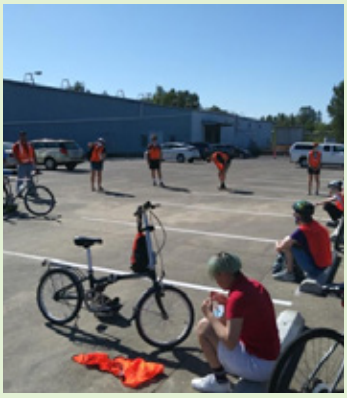
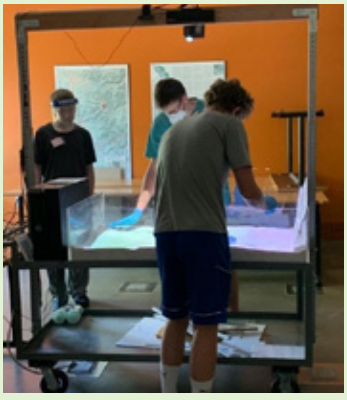


Figure 3: Local engineers, Josh Bjornstedt and Gregg Wilson, discuss the development of a new multi-use path.



Figures 5 and 6: Students manipulate the sandbox and observe the effects on the projection.

A handful of Oregon state high school students were given the opportunity to gain a better understanding of transportation engineering through OSU's Summer Transportation Institute, a program that the university, partnered with FHWA, put together and held late last August.

Following the belief that the best way to expose students to the transportation domain is to go outside and experience it, and the program contained two field trips: a campus walking tour and a bicycling tour of areas of transportation interest in Corvallis.

The walking and bicycling tours encouraged student awareness of transportation elements which can go unnoticed, and observation of applications of the concepts discussed in prior OSU institute modules.

Staff also incorporated a variety of hands-on, technology-oriented activities into the morning sessions. For many tactile learners, hands-on experience is a very effective way to solidify information. Students were excited to work with high quality, real-world equipment in transportation settings. Such activities included a Thursday morning spent working with drones and total station equipment, as well as a high-tech sandbox.

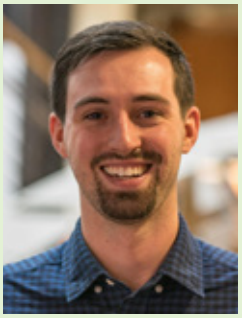
Adhering to guidelines laid out by the governor of Oregon's office in response to the COVID-19 pandemic, there were 10 students in total who participated in the program—nine who attended the in-person portion of the camp, and one who was able to join in on the virtual portion.

PacTrans was able to contribute funding that supported some of the program's instructional staff and a portion of the classroom materials.

OSU STUDENT CHAPTER TAKES HOME SEVERAL AWARDS

2020 Western District Student Chapter Award

Student Chapter President, Cadell Chand, was awarded this year's Western District Student Chapter Award and was responsible for leading this year's submission of the annual report that was recognized. Chand is a recent graduate, obtaining his MS degree in Civil Engineering with a transportation focus earlier this year. Early this summer, he joined Fehr & Peers in their Tacoma, WA office as a full-time member of their team.



2020 Western District Outstanding Student Award

This year's Outstanding Student Award was given to Travis Larson. Another recent graduate of OSU, Larson received his MS degree in Civil Engineering, his thesis titled, *"An Evaluation of Dynamic Passive Pedestrian Detection with a Framework for Future Applications."* Up until his graduation, he had been a part of the Hurwitz Research Group since 2019 and has since gained a full-time position at DKS Associates in their Salem, OR office, which he began working this past July.

2020 ITE Student Traffic Bowl

OSU earned the first place title at this year's ITE Student District Traffic Bowl, beating out Cal Poly SLO and UCLA for the top spot. The Traffic Bowl traditionally takes place at the ITE Annual Meeting which, due to the pandemic and the need for social distancing, was held virtually. The event was also held jointly between the Western and Mountain Districts.

Dam Distinguished Awards

The OSU ITE Student Chapter was recognized for two Dam Distinguished Awards this year: the Community Impact Award and the Inclusive Excellence Award.

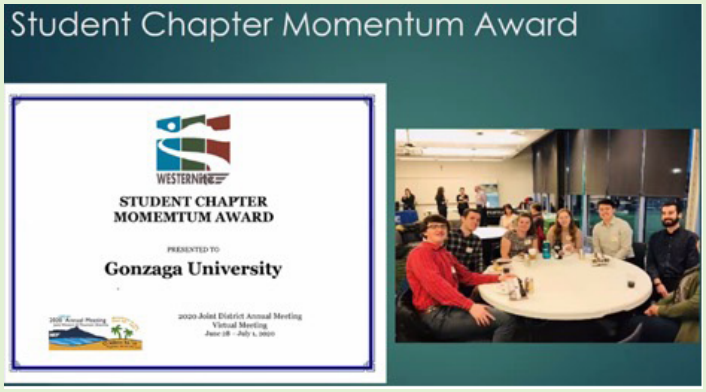
The Community Impact Award is traditionally given to, "a club that has made the greatest impact in a community off-campus," according to the Dam Distinguished Awards page. It was given to OSU ITE for their collaboration with the City of Corvallis' transportation department, in which they helped gather two-hour traffic counts at eight different intersections along Circle Boulevard, as well as performed traffic analysis with the collected data to help assess planned roadway modifications in the area.

The Inclusive Excellence Award recognizes the amount of diversity and inclusion that is promoted within the club. This year, OSU ITE was involved with a number of events related to promotion of diversity and inclusion, including: an Implicit Bias Training, which all officers were required to participate in; organizing a panel on coming out in a professional environment as a part of OSU's Coming Out Day; organizing a meeting between all CEE club leaders, the first of its kind, in order to improve inter-club cooperation; leading a K-12 Women in STEM outreach event that emphasized the need for more female representation in the field; and holding multiple other social events.

BSU STUDENTS ATTEND STUDENT LEADERSHIP SUMMIT

Two Boise State University students, Carmen Pemsler and Tryston Sellers, were able to attend the 2020 Student Leadership Summit at UCLA earlier this year with financial support from PacTrans. These same two students will be taking the reins on BSU's ITE Student Chapter this year.

"The conference itself had a major impact on Carmen and I," said Tryston Sellers, the chapter's president this upcoming academic year, in an email. "We had very little knowledge about ITE or the transportation industry before attending the conference. I personally instantly fell in love with the community and decided right then that I want a job in transportation. Overall we were able to learn unique activities being performed by other chapters, some great team building exercises, and some of the big problems being tackled in the transportation industry."



GONZAGA ITE STUDENT CHAPTER RECEIVED THE "MOMENTUM AWARD" BY THE ITE WESTERN DISTRICT

This year's Western ITE's Student Chapter Momentum Award goes to Gonzaga University. First established this year, the award commemorates students for the great amount of momentum or improvement they have shown over the course of the year.

A chapter may be recognized for the growth they've made in their administration, technical knowledge, networking, K-12 outreach, new member recruitment, diversity and inclusion, training or professional development, field trips or technical tours, service projects, and/or leadership development, according to Western ITE.

Gonzaga University will be rewarded with a plaque, a cash prize of $1,000 to help fund their travel to the Western District Annual Meeting, and submitted for consideration in the ITE International competition.

WSU ENGINEERING STUDENT PLACES SECOND IN NATIONAL COMPETITION

WSU senior, Robbie Englehart, placed second in the 2019 Mastercam Wildest Parts Competition, winning himself a $1,500 cash prize and marking this the fourth year in a row that a WSU mechanical engineering student has placed within this competition's top three.

Englehart earned the second place title with his oil pan, which he built with the help of WSU's Formula Society of Automotive Engineers powertrain team and instructor Robert "Kurt" Hutchinson, who supervised Englehart in the creation of his invention, using a computer numeric control (CNC) and a manufacturing software by Mastercam.

"We have lots of talented students but every now and then we get exceptional ones like Robbie who go above and beyond," Hutchinson told the *WSU Insider*. "He's a great guy and really involved in the Cougarshop."

OSU ITE STUDENT CHAPTER TEAM WINS FIRST PLACE IN THE ATSSA TCD CHALLENGE

Members of OSU's ITE student chapter received first place in the Traffic Control Device (TCD) Challenge, a competition held by the American Traffic Safety Services Association (ATSSA). The winners were awarded at the Transportation Research Board Annual Meeting last January. ATSSA's TCD Challenge, titled, "Connected and Autonomous Innovations for Improving Work Zone Safety," invited engineering students from all over the country to design a traffic control solution using connected and/or autonomous technology.

"Being able to co-host this competition with TRB not only allows ATSSA to present a pressing issue within the industry and conjure potential solutions, it also provides us the opportunity to encourage young minds to get more involved within the roadway safety industry and look ahead to possible future innovations," said Eric Perry, ATSSA director of Innovation & Technical Services, on the ATSSA blog. "This year, challenge winners addressed a serious concern within the industry and we hope their ideas resonate with all those involved with roadway safety," Perry said on the blog.

Their entry, titled, "Connected Temporary Traffic Control Devices," earned them not only first place, but also a chance to join the other top three finalists in New Orleans, where they presented their work at ATSSA's 50th Annual Convention & Traffic Expo at the end of last January, along with a cash prize of $1,500 and a plaque commemorating their achievement.

REGIONAL TRANSPORTATION SEMINARS

Towards a Safer Urban Transportation System in the Era of Connected & Autonomous Vehicles and Big Data with Professor Kaan Ozbay

Last October, Prof. Kaan Ozbay was featured as our Fall Regional Transportation Seminar speaker on UW's Seattle campus, leading a discussion on urban transportation systems, and the potential to make them safer using connected and autonomous vehicle technology.

In the last several years, C2SMART researchers have been developing novel predictive and operations approaches to improve traffic safety, especially in urban areas. Most of the innovation in these research and deployment efforts are fueled by the availability of big data generated by connected and autonomous vehicles (CAV) as well as ubiquitous mobile devices and sensors deployed throughout the urban areas. In the first part of the talk, it was argued that in an era of disruptive change experienced by all of our transportation systems, there is a need for a comprehensive cyber-physical testbed to develop, verify, and validate novel traffic safety strategies. To support this broad argument, C2SMART's cyber-physical testbed, which is built around the concept of, "city as the lab," was described. In the second part of the talk, the development of predictive safety analytics functions and pro-active traffic safety management approaches with a focus on New York City were presented. The role of the cyber-physical test bed in these research efforts was emphasized.

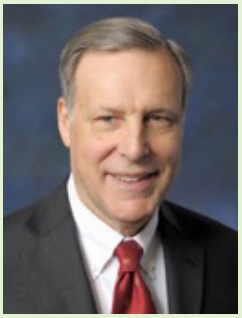
Prof. Ozbay joined Civil and Urban Engineering at NYU Tandon School of Engineering and Center for Urban Science and Progress (CUSP) as a tenured full Professor at NYU in Aug. 2013. He is currently the Director of the C2SMART Center (Tier 1 UTC funded by USDOT). Prior to that, he was a tenured full Professor at Rutgers University's Department of Civil and Environmental Engineering, where he joined as an Assistant Professor in July 1996. In 2008, he was a visiting scholar at the Operations Research and Financial Engineering (ORFE) Department at Princeton University. Prof. Ozbay has more than 30 years of expertise in transportation and traffic engineering. His research interests in transportation cover a wide range of topics, including the development of simulation models of large networks with connected and autonomous vehicles, advanced technology and sensing applications for Intelligent Transportation Systems, and modeling and evaluation of traffic incident and emergency management systems, among others.

Critical Scenario Generation for Accelerated Testing of Autonomous Vehicles with Professor Henry Liu

This past February, PacTrans hosted its Winter Regional Transportation Seminar featuring a talk from Henry Liu, a Professor in the Department of Civil and Environmental Engineering at the University of Michigan, Ann Arbor, a Research Professor at the University of Michigan Transportation Research Institute and the Director for the Center for Connected and Automated Transportation (USDOT Region 5 University Transportation Center). His talk was titled, *Critical Scenario Generation for Accelerated Testing of Autonomous Vehicles*.

Testing and evaluation is a critical step for the development and deployment of autonomous vehicles (AVs), and yet there is no systematic framework to generate testing scenarios. Given an operational design domain (ODD) of an autonomous vehicle, the testing scenario library is defined as a set of critical scenarios that can be used to accelerate AV testing and evaluation. In his talk Professor Liu provided a general framework for the testing scenario library generation (TSLG) problem. Each scenario is evaluated by a newly proposed measure, scenario criticality, which can be computed as a combination of maneuver challenge and exposure frequency. To search for critical scenarios, an auxiliary objective function is designed, and a multi-start optimization method along with seed-filling is applied.

PacTrans Leadership Development Seminar featuring Robert Skinner



This past March PacTrans hosted a Leadership Development Seminar featuring former Executive Director of the Transportation Research Board (TRB) of the National Academies of Sciences, Engineering, and Medicine, Robert Skinner. His long and distinguished career in transportation included time spent as a travel demand modeler, transportation planner, researcher, policy analyst, and executive director of the Transportation Research Board from 1994 to 2015.

Reflecting back, Skinner was invited to the UW campus early last March to discuss some of the lessons -- the takeaways -- from this career that he wished someone told him at the outset. They included task-specific items related to topics such as mathematical modeling/forecasting, approaches to policy analysis, the nature of the transportation enterprise, and research policy in transportation.

Skinner's talk also focused on more broadly applicable lessons related to such topics as communication skills, within-field career choices, involvement in professional organizations, and leadership.

PACTRANS WEBINAR SERIES

Online Teaching and Learning

Early last June, PacTrans presented another addition to its webinar series. This one focused on online teaching and learning, a new territory for most students and educators, but for some, the digital space is a familiar one. The webinar featured Elisabeth McBrien, an instructional designer for OSU's Ecampus, and Ed McCormack, a research associate professor and director of the Sustainable Transportation Online Master's Degree at UW. The webinar was also moderated by OSU's Michael H. Scott, a professor of Civil & Construction Engineering.

Over these past months, many of us have been thrust into the world of online teaching and learning. It appears that this will continue, to one degree or another, into the foreseeable future. Thus far, we have navigated these waters with varying degrees of success. But we forget that many of our colleagues have been engaged in online teaching and learning for years.

This webinar brought together several experienced online teachers to engage in a discussion on the subject of online content delivery. They shared what they have learned over the years, what works, and what doesn't.

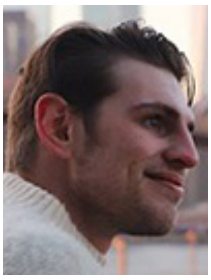
Eric Shimizu's on Managing Sudden Change

In the wake of this global pandemic brought on by COVID-19, PacTrans hosted a webinar featuring Eric Shimizu last April titled, "*Managing Sudden Change,*" a presentation directed at those anxious about COVID-19, those anticipating grief, those worried about the future, or those just trying to see the proverbial glass as half-full.

Two years ago, Shimizu's life changed completely after suddenly losing his wife from an aneurysm just after her 50th birthday, leaving behind three kids: Ryan, 19, a Freshman at UW; Sydney, 16; and Ty, 13.

Through sharing this personal story, Shimizu hoped to provide insight on some of the habits, knowledge, and perspective he has gained from his experience in managing sudden change and that it may be of value to anyone feeling uncertain or insecure due to changes and news coverage associated with COVID-19.

PacTrans Fellows



Michael Berlinger

Michael graduated from Georgia Institute of Technology in 2014 with a Bachelor of Science in Chemical Engineering. Following graduation, he worked at The Coca-Cola Company for four years, where he focused on project management and data science. Michael transitioned into transportation engineering to find innovative, data-driven solutions to optimize transit in urban environments. By focusing his talents, he hopes to lower emissions by providing alternatives to vehicle-based transportation. Outside of his studies, Michael likes to spend time with his dog, trying to find the best cup of coffee around.

Joanne Lin

Joanne grew up in Taiwan, graduated from National Cheng Kung University in 2019 with a bachelor's degree in Civil Engineering. During her time pursuing Master's at UW, she grew interest in the transportation field of Urban Transit System Planning. She wants to promote the adoption of transit systems in people's daily life to lower emission as well as to improve traveling experience. Other than her schoolwork, she enjoys watching movies and playing volleyball.

Ian Nisbet

Ian grew up in Olympia, Washington and graduated from Saint Martin's University in 2016 with a bachelor's degree in Mechanical Engineering. He then started working for a local municipality in Traffic Engineering and became interested in Intelligent Transportation Systems and the impact autonomous vehicles will have on the existing transportation system. Outside of his career, Ian enjoys traveling, playing golf, and working on his car.

Aleah Olsen

Aleah was born and raised in Tigard, Oregon She just completed her third year at Oregon State University and is currently pursuing a bachelor's degree with a major in Civil Engineering and a minor in Spanish. She discovered her interest in transportation engineering after taking various professional school courses and wants to further explore the discipline.

Mahsa Sheykhsoltan

Mahsa graduated from UCLA in 2019 with a bachelor's degree in Civil Engineering and a minor in Urban Planning. She became interested in transportation after observing the effects of urban sprawl and congestion in Los Angeles. She hopes to pursue a career in transportation engineering and planning to develop sustainable and equitable solutions to rising transportation challenges. Outside of school and work, Mahsa enjoys movies, museums, and exploring new cities.

Technology Transfer

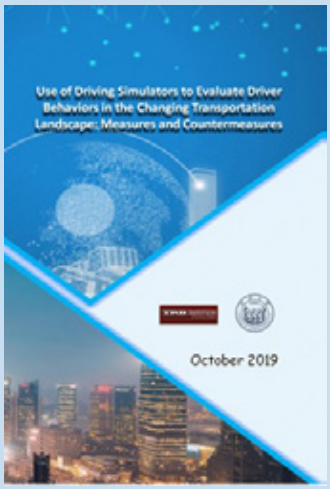
PACTRANS SHOWCASES MULTI-CAMERA CAR TRACKING AND RE-IDENTIFICATION SYSTEM (MCCTRIS) FOR TRANSPORTATION APPLICATIONS

In early January, PacTrans researchers and staff attended the Consumer Electronics Show in Las Vegas. The US Department of Transportation hosted a booth in the Smart Cities section of the show and one component of their booth offered several University Transportation Centers the opportunity to showcase technologies they have been developing.

PacTrans Director, Yinhai Wang, along with two of his graduate student research assistants, Frank Hao and Ruimin Ke, as well as PacTrans assistant director, Cole Kopca, all attended to showcase the Multi-camera Car Tracking and Re-identification System (McCTris) for Transportation Applications.

Recent advances in Multi-Camera Multi-Target (MTMC) tracking and re-identification research have brought new potential for the future surveillance system. MTMCT technology enables the surveillance cameras in different locations to detect and track the same objects without vehicle license plate information through a linked network. This demonstration showcased MTMC tracking and re-identification as well as highlighting all of the potential traffic related metrics that could be gathered by harnessing the power of this technology.

OSU PARTICIPATES IN INTERNATIONAL WORKSHOP ON DRIVING SIMULATIONS AND BEHAVIORS



PacTrans associate director and OSU professor of civil and construction engineering, David Hurwitz, took part in organizing the, "Use of Driving Simulators to Evaluate Driver Behaviors in the Changing Transportation Landscape: Measures and Countermeasures," an international workshop held in China late last October.

"The goal of the workshop is to describe in detail how scenarios are constructed for the different measures of driver behaviors appropriate for a given use case and how scenarios are developed to evaluate the different countermeasures for those use cases where drivers are at an increased risk of crashing."

Hurwitz was featured as a speaker on the first day of the two-day event. Leading a discussion on, "Vulnerable road users: Bicyclists," Hurwitz focused on bicycle simulator configurations and cited example study designs, performance measures, and findings used in the evaluation of mixing zones, bicycle lane pavement markings, and commercial loading zones during his talk. Hurwitz acted as the session chair during the morning session on day two of the workshop.

DEVELOPMENT OF UAF TRAFFIC, A TRAFFIC COUNTING APP

Counting traffic at intersections is a valuable tool for communities to enable data-driven improvements, yet the commercial offerings of counting hardware or software do not address the rich variety of vehicles often seen in rural Alaska. Enter: UAF Traffic, an app easily installed on an Apple iPad to enable anyone to collect traffic data. This project combines gamification and hardware design principles with audio and visual feedback to aid a user in recording data.

UAF Traffic is not a video game. The project wanted to embrace gamification, incorporating elements from game design in non-game contexts. The user interface offers audio and visual feedback when moving vehicles towards their intended destination. Adding these components retains its professional polish while offering important feedback to the user.

The normal audience for traffic counting might be a traffic engineer or city planning personnel, but an app like UAF Traffic could be used to introduce high school students to civil engineering and computer science. The project attempts to see how one can incorporate this app into the STEM curriculum to teach rural communities how to understand or improve traffic patterns. It aims to show students how to use recording, analyzing, and reporting data to make informed decisions on transportation issues. The app is available for free through the App Store for iPhone and iPad.

SMART LOCKERS SAVE BELLTOWN FROM DWELLING AND DELIVERY EMISSIONS

Belltown residents will have an easier time receiving their packages with the launch of a smart locker system by the University of Washington's Urban Freight Lab (UFL) in Seattle's Belltown neighborhood last August.

UFL's U.S. Department of Energy-funded project is part of a three-year study focused on "measuring emissions associated with moving goods," based on "local delivery vehicle travel patterns," according to the Belltown lockers website. Their goal is to decrease city delivery emissions and dwell time, while increasing the "productivity of load/unload parking spaces," according to a press release. This project is also in partnership with the City of Seattle, King County Metro, Sound Transit, CBRE, Puget Sound Clean Air Agency, and the City of Bellevue.

UPS, FedEx, and other major carriers can now drop packages off at UFL's Belltown locker location, which is easily accessible, contactless, and available 24/7, so users can retrieve their items safely and at their own convenience. Belltown locals are invited to sign up for free online, order their packages to the Belltown pick-up location, and retrieve their items within seven days of delivery.

For this project, UFL is working in collaboration with Parcel Pending by Quadient, and parking magnate REEF. This isn't the first time the UFL and Parcel Pending have teamed up; as part of an initial pilot program in 2018, the two introduced an open-network locker system to the Seattle Municipal Tower, a project that was partially funded by PacTrans.

UAF CO-HOSTS SAFE CYCLING TRAININGS

Last year, UAF co-hosted two cycling safety courses with the League of American Bicyclists.

The Smart Cycling Course and League Certified Instructor course sought to improve cycling safety in Fairbanks and rural communities in Alaska by creating educators and advocates.

Scholarships were provided to offset the cost of certification for attendees. An application process was announced and required participants to write an essay describing how they plan to use their training to improve safety in RITI communities.

PACTRANS TECHNOLOGY TRANSFER WEBINAR PRESENTS: LEARNING FROM NETWORK-WIDE TRAFFIC SENSOR DATA

Last May, PacTrans Director and UW professor of transportation engineering, Dr. Yinhai Wang, spoke on, "*Learning from Network-wide Traffic Sensor Data: Vehicle Travel and Traffic Performance Changes under the Influence of COVID-19*," at a PacTrans hosted webinar.

The COVID-19 pandemic has caused a profound impact on our daily lives. Over the past several months, Washington State implemented several countermeasures against COVID-19, including state-wide school closures on Mar. 13, shutting down all restaurants and bars on Mar. 15, a stay home and stay safe order on Mar. 23, etc. These measures have affected travel demand and road transportation conditions across our network.

Quantifying travel and traffic performance changes associated with these countermeasures is extremely valuable for transportation professionals and policy makers. With support from PacTrans, the Smart Transportation Applications and Research (STAR) Lab at the University of Washington recently developed an online platform called Traffic Performance Score (TPS) Website, that quantifies and visualizes traffic performance in real time or at predetermined times at either the segment or network level for the central Puget Sound area freeway network. In this webinar, Wang shared interesting observations on vehicle travel and traffic performance changes under the influence of COVID-19 using the publicly accessible functions with this online tool.

PACTRANS WEBINAR ON CITY OF BELLEVUE PARTNERSHIP TOWARD VISION ZERO

Pushing university research products into practice is an important task for PacTrans and other University Transportation Centers. Partnerships with transportation agencies and private companies are often critical for the success of technology transfer.

Early September, PacTrans hosted a webinar that showcased one such example partnership and the benefits. UW professor Yinhai Wang, director of PacTrans and STAR Lab; Franz Loewenherz, Principal Transportation Planner for the City of Bellevue; and Noah Budnick, Senior Director of Programs and Operations at Together for Safer Roads shared their collaborative efforts in applying cutting edge technologies for smarter mobility and safer roads, describing applications of artificial intelligence and computer vision technologies for urban traffic data collection and network-wide conflict analysis using existing surveillance video cameras to support vision zero in the City of Bellevue.

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 you 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 fifteen proposals. The following are brief summaries of the activities that were funded:

Chris Parrish (OSU)

Unmanned Aircraft Systems in Transportation: Research-to-Operation (R2O) Peer Exchange— Recognizing the expanding use of UAS across state DOTs, US DOT's FHWA has declared UAS to be one of their Every Day Counts 5 (EDC5) Innovation topics for 2019-2020. In support of the FHWA EDC5 UAS Innovation topic, ODOT is planning a one-day Peer Exchange to gather interested parties, including state and local transportation agencies, vendors, and consultants to collaborate on UAS opportunities and share lessons learned from current UAS operations. The ODOT organizers of the event have expressed great interest in extending the Peer Exchange to include an additional day focused on: 1) sharing the results of the recent PacTrans multi-institution project on UAS and lidar for traffic network monitoring with State DOTs and industry and university partners from throughout the Pacific Northwest, and 2) facilitating the transition of the procedures developed in the PacTrans research to operational use. To meet these goals, this Success Stories project will plan, organize and present a PacTrans UAS Research-to-Operations (R2O) Workshop, as a one-day extension to the ODOT/FHWA Every Day Counts Peer Exchange. Focus areas will include: 1) comparison of post-processed kinematic (PPK) and real-time kinematic (RTK) GNSS on drones; 2) direct georeferencing via GNSS-aided insertional navigation systems (INS); 3) operational aspects of UAS for traffic network monitoring, including regulations, safety, planning, and operational procedures; and 4) auto-extraction of features of interest from UAS data using machine learning. To facilitate multi-directional information exchange, participating State DOTs will be invited to deliver presentations on their UAS projects and programs, followed by open discussion of lessons learned and solutions to operational challenges.

David Hurwitz (OSU)

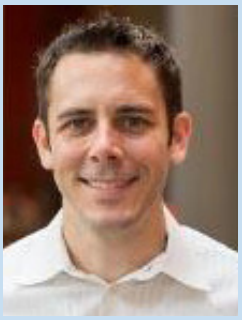
Advancement of a Heavy Vehicle Driving Simulator—Professor Hurwitz and his team will engage OSU Media services to help us produce high end videos documenting the capabilities of the new lab equipment, the research team in the driving and bicycling simulator laboratory, and the threads of research that the new tools will allow us to contribute to. Specifically, they will produce one 2.5 to 3-minute video to be disseminated via OSU COE, OSU CCE, and PacTrans via website and other means. Additionally, we will produce three 30 second videos that are more targeted which will be intended to be distributed via social media (e.g. facebook, twitter, linkedin).

Haizhong Wang (OSU)

An Integrated Web Platform to Communicate the Risks of the Cascadia Subduction Zone in the Pacic Northwest—Professor Wang and his team will be making the already developed Agent-Based Tsunami Evacuation Model (ABTEM) accessible to the professionals, city ocials, and policy and decision makers, through and online web platform. The output will be a cloud-based and open-source web platform to be used by city engineers/planners, emergency managers, community leaders and practitioners for evacuation planning purposes. Upon the completion of this project, users will be able to critically assess the effectiveness of current and future evacuation strategies, and analyze the evacuation options for their study site by simply providing necessary inputs as GIS data layers to the platform and specifying behavioral characteristics of the evacuees.

Michael Olsen (OSU)

Extraction and Classification of Pavement Marking Program—In previous work, this project team has developed the Road Marking Extractor (RoME) tool to extract near-linear pavement markings from mobile lidar data. In current Pactrans-funded research, the team has expanded the capabilities of the RoME tool to implement complex marking extraction (e.g., insertion lanes, arrows, text), improved noise filtering, deep learning-based classification, and rigorous tests on real-world data in various noise and road conditions. Professor Olsen's team believes the developed algorithm has great potential for supporting the extraction of road marking for many transportation agencies worldwide. This tech-transfer project will achieve this goal by improving the current research tool into a fully-functional prototype tool that can extract and classify various types of road markings. The prototype tool will then be ready for a start-up company to develop into a commercial product. The tool has high potential to streamline the production of a key later of HD maps using lidar data as well as support departments of transportation with maintaining high-quality markings at the levels needed for autonomous vehicles.



Don MacKenzie (UW)

Simulation environment to optimize public investments in electric vehicle charging infrastructure—Washington is anticipating considerable investment in DCFC infrastructure over the next several years. Given that funding is finite and DCFC stations are expensive, public investments must be made where they can generate the biggest impact on EV adoption and travel. Through an ongoing PacTrans-funded project, the team developed a decision support system to guide 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. While the examples in the documentation and elsewhere use data from the state of Washington, EVI-DSS can be used for any geography, small or big. It is planned to release EVI-DSS as an open-source system, so various public and private agencies can benefit from its use. To promote wider distribution and rapid dissemination of the program, Professor MacKenzie's team is cleaning, optimizing, packaging, and disseminating the code into an easy to use format, so that agencies can deploy it locally to benefit from its use.

Joe Wartman (UW)

Development of Workshop Curricula to Support Professional Use of the Rockfall Activity Index (RAI) and the RAMBO Software Platform—Having implemented the RAI system into an easy-to-use software platform (RAMBO), the research team is utilizing funds to promote the use of the system and to train transportation professionals to use the new software platform properly. Accordingly, Professor Wartman and his team are developing an RAI/RAMBO training curriculum (including a basic user manual and presentation materials) that will be presented for the first time at an upcoming instructional workshop hosted by the Oregon Department of Transportation (ODOT). The workshop is slated to take place in Portland in early 2020. The workshop will focus on training ODOT personnel, who recently adopted the RAI system to assess five problematic rock slopes sites across the state. The training curricula developed in this project will be made openly available online and will serve as a template for teaching the platform to transportation agencies in the Pacific Northwest, and other parts of the U.S.

Yinhai Wang (UW)

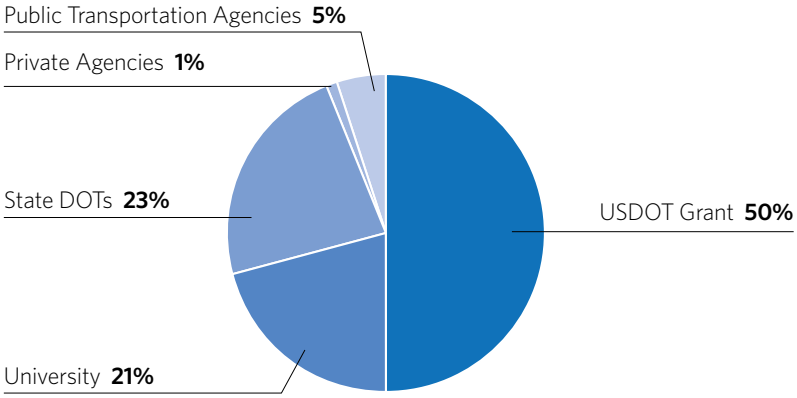
Curb Space Monitoring and Management using Mobile Unit for Sensing Traffic (MUST) Sensors—Downtown Bellevue, WA, is situated on a street grid with oversized "superblocks," fewer streets compared to other downtowns of a similar size, and scarce on-street parking. In recent years the city has experienced unprecedented job and population growth. In addition to handling traditional traffic pressure, a new wave of TNC rideshare and freight delivery services have emerged, adding operational and safety challenges to the system. Besides, numerous companies – such as Amazon, Microsoft, Expedia, and Facebook – offer commuter shuttle service for their employees. These services require dedicated curb space for loading and unloading passengers. Limited dynamic curb space, coupled with an increasing TNC user base, has strained the limited roadway system in Bellevue. Safe areas for freight and passenger loading, such as 3-minute or 15-minute zones, are currently extremely limited downtown. To demonstrate the feasibility and reliability of the MUST sensor in curb space monitoring and management, the MUST sensors will be installed on 106th Avenue NE in Downtown Bellevue to set up a testbed for obtaining unprecedented information to better understand car vs truck occupancy and dwell times at the curb space. The information provided by the MUST sensor must help in answering the real-time status of curb space usage in such a complex environment. By starting with the testbed in Bellevue, leveraging the information of the MUST sensor will point us to where we need to go next with curbside management policies and practices. This pilot will demonstrate the utility of the MUST sensor in curb space management to the public, thereby triggering the industrialization and commercialization of the product offering.

Funding and Expenditures

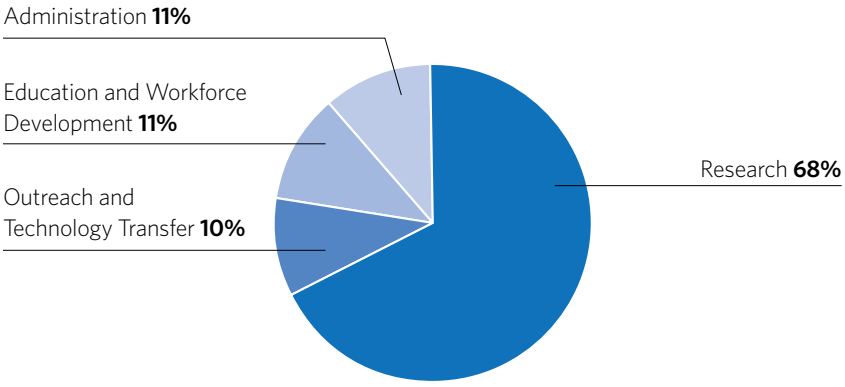
CENTER THREE

Funding Sources – FAST Act

$10.4M USDOT funds + $10.4M match funds



FAST Act Projected Expenditures 2017-2020



- **Research**
- **Outreach and Technology Transfer**
- **Education and Workforce Development**
- **Administration**

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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