Annual Report

2021 – 2022

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Letter from the Director

Time seems to have gone faster during the pandemic. Work from home saved commuting time, but also made education and field research work more challenging. Despite these challenges, PacTrans researchers and staff worked very hard to find creative ways to ensure everything stayed on track and schedule.

Looking back at this past year, the most exciting thing to share is the launch of two PacTrans' spinoff companies, AIWaysion, Inc. and EZDataMD, LLD, both carry PacTrans' research products into practice. AIWaysion licensed two patents invented by the University of Washington's STAR Lab and commercialized the Mobile Unit for Sensing Traffic (MUST) technology for connected mobility and smart safety applications. Over the past months, AIWaysion has been increasingly recognized and received seed investment. Furthermore, AIWaysion received a US Department of Transportation's Small Business Innovation Research (SBIR) award and was a finalist for the 2022 Edition of International Road Federation (IRF) Startup Label. Its product has been used in multiple states for a variety of applications. The example set by these two startup companies will guide future PacTrans researchers to push more products into practice.
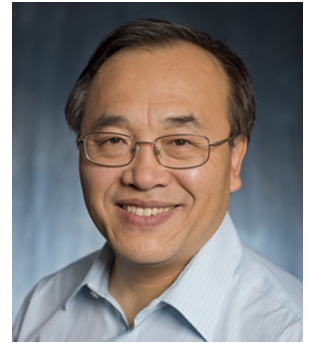
I am also excited to report that the PacTrans Workforce Development Institute (WDI) was launched in February 2021 and has delivered multiple training courses to working professionals, such as Manual on Uniform Traffic Control Devices (MUTCD), data analytics tools, human factors, etc. PacTrans WDI made another milestone this past summer by delivering its first K-12 training course in partnership with the University of Washington (UW) Summer Youth Program. This course aimed to cultivate interest in transportation engineering and focuses on autonomous car introduction with middle school students'. Students learn fundamental transportation knowledge from working professionals, visit research labs on the UW campus, and build their own autonomous cars using the First LEGO League's toolkit. This first offering was very successful as all twenty-five available slots were taken, with many more students on the waitlist.

Another major highlight was our devoted involvement in, and facilitation of, various conferences, workshops and symposia. PacTrans co-hosted the 2022 National Travel Monitoring Exposition and Conference (NaTMEC) with Idaho Transportation Department, played a leadership role in organizing the American Society of Civil Engineers' 2022 International Conference on Transportation and Development, the National Science Foundation's AI in Transportation Workshop, the 2021 IEEE International Smart Cities Conference, etc. PacTrans research and technology were presented and demonstrated at these events.

Our faculty and students' efforts have been recognized by numerous awards. For example, two faculty members received NSF Career Awards. PacTrans students received the Outstanding Graduate Student Award and Best Student Paper award from the Institute of Transportation Engineers (ITE) Western District, Best Graduate Student Poster Award from the Transportation Research Board (TRB) AKD10 committee, Best Dissertation Award from IEEE Intelligent Transportation Society, Outstanding Younger Member Award from ASCE, etc. Our student teams also performed great and received multiple awards from the Clean Snowmobile Challenge, Hyperloop Competition, Steel Bridge Competition, etc. The Vision Zero Video Analytics project PacTrans partnered with the City of Bellevue, Together for Safer Roads, Transoft, etc. won the 2021 National Roadway Safety Award from the Federal Highway Administration.

PacTrans has had a very successful and rewarding year despite challenges caused by the pandemic. You can find more great stories and examples in the pages that follow. I hope you will enjoy reading this report. I know we could not have accomplished all these without your strong support. Your dedication and help are highly appreciated!

Sincerely yours,

Yinhai Wang, Ph.D., P.E., F.ASCE, F.ITE
PROFESSOR, CIVIL & ENVIRONMENTAL ENGINEERING
DIRECTOR, PACIFIC NORTHWEST TRANSPORTATION CONSORTIUM

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

MANAGEMENT STRUCTURE

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

The PacTrans Board of Directors includes the PacTrans center director; associate directors of research, education, and outreach (each from the UW) ;and associate directors from all five

consortium universities. The Board of Directors meets in person on a quarterly basis to discuss matters pertaining to PacTrans research, education, outreach, and technology transfer.

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

PACTRANS OPERATIONS TEAM

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

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

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

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

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

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

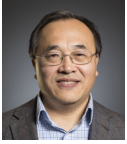**John Ash,** PacTrans STAR Lab Manager, jeash@uw.edu

Tasha Thakkar, Student Communications Intern

Wei Sun, PacTrans Research Associate

BOARD OF DIRECTORS

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

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

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

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

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

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

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

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Ryan Anderson Northern Region Director 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 2021–2022

PACTRANS HAS LARGE PRESENCE AT ASCE ICTD 2022 CONFERENCE

This past June, the American Society of Civil Engineers (ASCE) held their International Conference on Transportation and Development (ICTD) in collaboration with the WSDOT's Innovation & Partnerships in Transportation Conference. The conference had over 1,000 registrants and offered a unique opportunity for public agencies, private industry, and research institutes to share their vision, exchange experience, collaborate on research, and showcase practical solutions on smart and integrated mobility solutions.

PacTrans Director, Yinhai Wang, Co-Chaired the conference planning committee with WSDOT Secretary, Roger Millar. Professor Wang also presented PacTrans work in the University Transportation Centers (UTC) Technology Transfer Workshop, and he organized a National Science Foundation (NSF) Funding Workshop that featured Yueyue Fan and Daan Liang, both NSF directors.

Other PacTrans involvement included: (1) PacTrans researchers made dozens of presentations of funded work in both podium and poster presentations, (2) PacTrans helped organize a demo from the First Tech Challenge (FTC) 18225 Team (this high school-aged state champion robotics team presented their demo during the first evening's welcome reception), (3) the University of Washington College of Engineering and Department of Civil and Environmental Engineering were conference sponsors and so had an exhibitor booth where PacTrans was showcased, (4) PacTrans helped organize a visit from a handful of students from the Ocosta School District to take part in the poster presentation of a project titled, "Drones for Improving Traffic Safety of the RITI Communities in Washington State," and (5) PacTrans Assistant Director, Cole Kopca, acted as the younger member representative on the conference planning committee, planned and facilitated each of the younger member activities, and received the T&DI Outstanding Younger Member Award during the awards luncheon.

PACTRANS CO-HOSTS NATMEC 2022 WITH ITD

PacTrans had the pleasure of partnering with the Idaho Transportation Department (ITD) to co-host the 2022 National Travel Monitoring Exposition and Conference (NaTMEC) this past summer. The conference provides a wonderful opportunity to meet with federal, state, local transportation professionals as well as industry leaders who have common interest in travel monitoring.

NaTMEC 2022 had a stellar line-up of workshop presenters who shared their experiences on Travel Monitoring best practices and innovations including the recent updates on the new FHWA Traffic Monitoring Guide. PacTrans students had 19 lighting talks presentations that helped disseminate the outcome of different PacTrans research projects to the NaTMEC 2022 audience. Professor Ahmed Abdel-Rahim, PacTrans Associate Director at the University of Idaho and Margaret Pridmore from Idaho Transportation department served as the co-chairs for the conference. Due to pandemic impact, the 2022 NaTMEC was virtual. It was a hard decision to make. However, it became quickly apparent it was the necessary decision when so many were reluctant to speak at this event in person. PacTrans and ITD are eternally grateful to the Federal Highways Administration that we will indeed be given a second chance, so look for NaTMEC 2024, in person, in the heart of Boise, Idaho.

The 2022 NaTMEC Conference theme, "We Travel Together," represents the spirit of adventure and investigation within the travel monitoring group. As a team of professionals, we strive to provide information to decision makers to ensure safer roads, less congestion, and economic vitality. After all, whether we are delivering goods to the other side of the country, driving our child to school, commuting by bicycle, or just out for a walk in our neighborhood...we are impacting our transportation system. In short, we travel together. The NaTMEC Planning Committee has worked hard to produce this very successful conference. Professor Yinhai Wang, Director of PACTRANS and Professor of Electrical and Computer Engineering, University of Washington gave the conference keynote speech at the opening session. The conference had a total of 27 sessions with 87 presentations, 3 workshops, a poster session, and a very vibrant vendor exhibition.
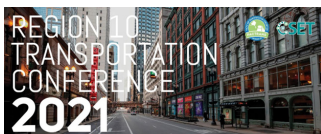
PACTRANS HOSTS 2021 REGION 10 TRANSPORTATION CONFERENCE VIRTUALLY

Last October, PacTrans organized the 2021 Region 10 Transportation Conference co-hosted by the Center for Safety Equity in Transportation Tier 1 UTC. The event was held virtually, with an opening event on Friday, October 15 and carrying into the following week. During that following week, the conference hosted Webinar Week with one webinar each day on various topics surrounding the conference theme, Envisioning Post-Pandemic Transportation Safety and Mobility.

Roughly 175 attendees from industry, agencies, and academia heard from nineteen different presenters on various topics surrounding issues of mobility and safety. Specific topics included climate change, social equity in transportation, new commuting patterns, new funding mechanisms, new technology applications in rural settings, and more. The virtual conference also showcased a virtual poster session, where a handful of our UTC funded researchers created short videos to highlight their great work.

PACTRANS 2021 STUDENT CONFERENCE RECAP

The Pacific Northwest Transportation Consortium 2021 Student Conference took place on November 8 and 9, 2021. Even though the event occurred virtually over Zoom, it still provided students with a great opportunity to become more involved in the transportation world. Through the combined efforts from that year's sponsors, the PacTrans Consortium, and the wonderful guests who devoted their time, student attendees were able to hear directly from professionals in the field and ask questions about the wide variety of topics that were presented.

The 2021 student conference was sponsored by two organizations: Coral Sales Company, and Fehr & Peers, to whom PacTrans is immensely grateful for their support and willingness to help advance students in transportation. Student attendees were provided with the opportunity to interact with a representative from each sponsor during an information session where they were able to hear about the type of work done in the transportation world. In addition to this session, the 2-day conference featured many speakers from various areas of transportation as well as the annual poster competition for students.

As mentioned, the 2021 conference featured many excellent speaker presentations throughout the two-day event, with an opening ceremony from Dr. Robert Bertini of Oregon State University. The first speaker on day 1 was Damian Casados of Coral Sales Company. Damian presented on advancing students in the field and the need for transportation engineers in today's world. The second presentation was given by Jake Wagner of Washington State University. With a background in economics and an interest in transportation, Jake presented on efficient routing in the timber industry around the Pacific Northwest. The third speaker was Riannon Zender, a P.E from J.U.B Engineering in Coeur d'Alene, Idaho. Riannon presented on urban transportation planning, specifically the process involved with funding, planning, traffic modeling, and project implementation. The fourth and final speaker of the first day was Tim Graciano of Convoy Inc. Tim is the Head of Data Science at Convoy and gave a presentation on an introduction to digital freight marketplaces. Cadell Chand of Fehr and Peers opened the second day of the conference as the first speaker and presented about the redesign of a US101 interchange project and the associated challenges. Dr. Avipsa Roy from University of California, Irvine was the final conference speaker and presented on big data analytics in transportation research.

On the second day of the event, PacTrans hosted the annual poster competition which allowed students the opportunity to both present their research and hear from others in the field. Despite the challenges associated with the virtual conference design, student participants were allowed to share their screens to present their research to attendees. A large thank you is due to the sponsors of the event, Coral Sales Company and Fehr & Peers, which provided cash prizes for the top 3 presentations. The winners of this year's event are- Antonio Campos of Gonzaga in third place, Peter Yu of UW in second place, and Shuyi Yin of UW in first place.

PACTRANS MAKES SUBSTANTIVE CONTRIBUTION TO TRB ANNUAL MEETING AS IT RETURNS TO IN-PERSON

The Transportation Research Board (TRB) 101th Annual Meeting returned in-person this past January 9-13, 2022, at the Walter E. Washington Convention Center in Washington, D.C. The event offered nearly 450 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 *Innovating an Equitable, Resilient, Sustainable, and Safe Transportation System*. 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).

This year, PacTrans researchers took part in over 90 lecturns, poster sessions, workshops, and committee meetings. PacTrans assisted with travel support for students going to present their research. In all, roughly 35 students from PacTrans partner institutions participated in the annual conference.

PacTrans Annual 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 in the Pacific Northwest with substantial involvement in the UTC program.

CHRIS BELL
Professor Emeritus
A Community of Transportation Civil and Construction Engineering
Oregon State University

OUTSTANDING RESEARCHER AWARD

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

ANNE GOODCHILD
Professor, Civil and Environmental Engineering, University of Washington

Founding Director, Supply Chain & Transportation Logistics Center, Urban Freight Lab

Academic Director, Supply Chain & Transportation Logistics Master's Degree Program

EXCELLENCE IN TECHNOLOGY TRANSFER AWARD

Presented to investigators for effective partnerships and collaboration with outside industry, innovative marketing of newly developed techniques and technologies, or successful implementation of research results.

JOSEPH WARTMAN
Professor
Civil and Environmental Engineering
University of Washington

OUTSTANDING EDUCATOR AWARD

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

DAVID S. HURWITZ
Professor,
Civil and Environmental Engineering
Oregon State University

OUTSTANDING PARTNER AWARD

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

DIANE GRANT
Owner and President
Coral Sales Company

FACULTY ACCOLADES

- UW's Yinhai Wang received 2021 College of Engineering Outstanding Faculty Award
- UW's Jon Froehlich received 2021 College of Engineering Outstanding Faculty Award
- UW's Anne Goodchild received ITE Innovation Award
- OSU's Barbara Simpson earns NFS CAREER Award
- OSU's John Gambatese Elected to National Academy of Construction
- OSU's David Hurwitz received UMass College of Engineering Outstanding Young Alumni Award
- WSU's Xianming Shi received the Environmental Leadership Award from the Salt Symposium Award Committee
- WSU's Idil Akin earns NFS CAREER Award

New Faculty

UNIVERSITY OF WASHINGTON

ANGELA KITALI, PH.D.
Assistant Professor
School of Engineering and Technology
University of Washington Tacoma

UNIVERSITY OF ALASKA FAIRBANKS

DR. NIMA FARZADNIA
Assistant Professor
College of Engineering and Mines
University of Alaska Fairbanks

UNIVERSITY OF IDAHO

SUZANNA LONG
Dean
College of Engineering
University of Idaho

Retirements

UNIVERSITY OF WASHINGTON

JOE MAHONEY
Professor Emeritus
Civil and Environmental Engineering
University of Washington

UNIVERSITY OF WASHINGTON

TIM LARSON
Professor Emeritus
Civil and Environmental Engineering
University of Washington

Research Projects

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

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

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

To date, PacTrans has funded:

Year 1 ....(2012-2013):**................22** research projects
Year 2 ....(2013-2014):**................31** research projects
Year 3 ....(2014-2015):**................16** research projects
Year 4 ....(2015-2016):**................20** research projects
Year 5 ....(2016-2017):**................23** research projects
Year 6 ....(2017-2019):**................21** research projects
Year 7 ....(2018-2020):**................20** research projects
Year 8 ....(2019-2021):**................18** research projects
Year 9 ....(2020-2022):**................21** research projects
Year 10 ....(2021-2022):**................19** research projects
Year 11 ....(2022-2023):**................17** research projects

2020-2021 RESEARCH PROJECTS

Project Title	PI	Institution	Type
Development of PacTrans Workforce Development Institute (WDI)	Yinhai Wang	UW	Multi - Education
	Shane Brown	OSU	
	Kevin Chang	UI	
	Eric Jessup	WSU	
	Billy Connor	UAF	
Characterization of Underserved Population Perceptions and Mobility Needs in Connected-Vehicle and Smarter City Environments	Ahmed Abdel Rahim	UI	Multi - Outreach
	David Hurwitz	OSU	
	Billy Connor	UAF	
	Eric Jessup	WSU	
	Jeff Ban	UW	
Shared Mobility Options for the Commute Trip: Opportunities for Employers and Employees	Qing Shen	UW	Multi
	Jeff Ban	UW	
	Anne Vernez Moudon	UW	
	Mike Lowry	UI	
The Long-Term Effect of Earthquakes: Using Geospatial Solutions to Evaluate Heightened Rockfall Activity on Critical Lifelines	Margaret Darrow	UAF	Multi
	Ben Leshchinsky	OSU	
	Michael Olsen	OSU	
	Joseph Wartman	UW	
Data-Driven Assessment of Post-Earthquake Bridge Functionality and Regional Mobility	Chris Motter	WSU	Multi
	Adam Phillips	WSU	
	Marc Eberhard	UW	
	Jeffrey Berman	UW	
	Brett Maurer	UW	
Evaluation of the Idaho (Bicycle) Stop Laws in the Pacific Northwest	David Hurwitz	OSU	Multi
	Kevin Chang	UI	
	Rhonda Young	GU	
Automated Localization and ADA Functional Condition Assessment of Curb Ramps using Mobile Lidar	Yelda Turkan	OSU	Single
Real-time Hybrid Experimental-numerical Simulation of Bridge Infrastructure Subject to Cascading Earthquake-tsunami Hazards	Barbara Simpson	OSU	Single
Measuring the Impacts of COVID-19 on the Trucking industry: A Spatial and Econometric Framework to Capture the Impacts of the Hours-of-Service (HOS) Emergency Declaration and Congestion Effects on Truck Driver Safety	Sal Hernandez	OSU	Single
Integration of Mobile Road Weather Information Systems into Winter Maintenance Operations in Fairbanks, Alaska	Nathan Belz	UAF	Single
Developing a Portable Data Acquisition System to Study Road User Behavior	Vinod Vasudevan	UAA	Single
Estimating county to county transportation and trade flow	Mike Lowry	UI	Single
Pavement Winter Operations in Cold Regions	Emad Kassem	UI	Single
Advanced Energy Storage System for Electric Vehicle Charging Stations for Rural Communities in the Pacific Northwest	Herbert Hess	UI	Single
Optimal Charging Infrastructure Design for Battery Electric Buses	Jeff Ban	UW	Single
Economic and Health Metrics of Active School Travel: A Practical Tool for Transportation Planners and Educators	Anne Moudon	UW	Single
Privacy Risk Evaluation of Human Mobility Data for Urban Transportation Planning	Jan Whittington	UW	Single
Informing Predictions from Above with Data and Below: AI-Driven Seismic Ground-Failure Model for Rapid Response and Scenario Planning	Brett Maurer	UW	Single
Cost Comparison of Washington Safety Rest Area Operations with Other States	Kishor Shrestha	WSU	Single
Assessment of Washington State Bridges for Post-Earthquake Mobility and Recover Planning	Adam Phillips	WSU	Single
	Chris Motter	WSU	
Developing a Proactive Fuzzy- Logic Model for Optimizing Winter Road Maintenance Measure in Cold Urban Areas Using Real-Time Data	Tommy Tafazzoli	WSU	Single

2021-2022 Research Projects

LIDAR, DRONES AND BRIM FOR RAPID BRIDGE INSPECTION AND MANAGEMENT

PI: Yelda Turkan (OSU)

Co-Investigators: Paolo Calvi (UW)

The mobility of people and goods is highly dependent on the health of a nation's transportation system. Timely inspection and effective maintenance and management of bridges is crucial in order to avoid any issues that may have a negative impact on public mobility.

However, current bridge inspection practices inhibit the collection and analysis of information regarding the status of bridges in an efficient and timely manner.

This problem is exacerbated by the large number of bridges in the U.S. combined with the limited number of inspectors available. For example, in Oregon, there are more than 6,000 bridges and only about 25 inspectors employed by the DOT, thus requiring a substantial number of subcontractors to carry out the work.

In this study, we will develop a framework that will make it much more convenient and faster to inspect and manage bridges, which can improve the current practice significantly in terms of efficiency and safety, thus helping to improve public mobility.

EFFICIENT AND DATA-DRIVEN PAVEMENT MANAGEMENT SYSTEM USING ARTIFICIAL INTELLIGENCE

PI: Billy Connor (UAF)

Co-Investigators: Emad Kassem (UI)

Pavement management systems are used by transportation agencies to assist pavement engineers to determine cost-effective strategies for pavement preservation and maintenance at the network level. A large amount of data is collected every year as part of the pavement management program. Such data include road location, geometry, roughness, cracking, rutting, texture, skid resistance, traffic level, pavement structure, material properties, and others. This information is processed using traditional analytical-based methods to predict future pavement conditions and program pavement preservation and rehabilitation treatments at the network level.

The traditional analytical-based tools used in the pavement management systems do not use the complete information instead they focus on one aspect of the data (e.g., surface distresses or skid condition). Nevertheless, due to the increasing complexity and scale level of collected data, the current methods may not be able to provide an accurate pavement condition assessment and optimal preservation/rehabilitation treatments. Recently, Artificial Intelligence (AI) has been used, as a powerful tool, to examine large data sets that are often very challenging to be analyzed by traditional methods and derive helpful correlations and models. Such models can be used to assist scientists and engineers in making informed decisions.

DEVELOPING BETTER CURB MANAGEMENT STRATEGIES THROUGH UNDERSTANDING COMMERCIAL VEHICLE DRIVER PARKING BEHAVIOR IN A SIMULATED ENVIRONMENT

PI: Anne Goodchild (UW)

Co-Investigators: Ed McCormack (UW), David Hurwitz (OSU), Andisheh Ranjbari (UW)

This research will use a quarter-cab truck simulator to design a human-in-the-loop simulation experiment to investigate the behavior of commercial vehicle drivers under various parking and delivery situations. The research findings will improve our understanding of the commercial vehicle driver parking behavior and interactions between commercial vehicles and other road users in an urban environment.

This study will focus on an 8-block study area in Seattle, Washington, the city with the largest population density in the PacTrans region.

The rapid expansion of e-commerce, accelerated even more by the impacts of COVID-19, has flooded many American cities with delivery trucks.

The latest travel survey from the Puget Sound region in Washington State reported that 15-34% of people do some level of online shopping activity, and yet according to a 2018 travel activity report for Washington, trucks already constitute 34-44% of all vehicular traffic in urban areas.

As e-commerce and urban deliveries spike, there is an increasing demand for curbside loading/unloading space.

PACTRANS WORKFORCE DEVELOPMENT INSTITUTE (WDI) - PHASE V

PI: Yinhai Wang (UW)

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

Specifically, the research team will focus on the following tasks:

- Enhancing the online platform for e-learning courses, promotion and outreach activities. The research team will enhance the PacTrans WDI online training platform. The online platform will serve as a comprehensive learning platform to support the promotion, registration, and e-learning activities.

- Developing and delivering new training courses. The research team will continue developing new training courses and certificate programs that cover more topics with critical training needs. Specifically, the PacTrans WDI has delivered/scheduled to deliver the following training courses:

  —Understanding and Applying the Manual on Uniform Traffic Control Devices

  —Incorporating Human Factors into Roadway Design and Crash Diagnostics

  —Transportation Engineering Project Management

  —An Introduction to School Zone Safety

  —Geospatial Analysis for Transportation Planners and Practitioners

- Developing the assessment and evaluation guidebook for training courses and the overall program. The research team will develop a guidebook including course development processes with carefully designed learning outcomes and associated learning activities, active learning strategies, reliable assessment and evaluation processes of learning, and overall program and course evaluation.

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

PI: Ahmed Abdel-Rahim (UI)

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

The main goal of year 5 outreach project is to highlight and communicate the outcome and impact of PacTrans research in these four theme areas to different stakeholders to influence their opinions, behavior, and policy preferences.

This goal becomes more significant when the collective outcome of PacTrans research clearly shows potential positive impact for transportation system efficiency and safety. This goal will be achieved through several outreach products and networking initiatives

ENABLING A NEW DATA SCIENCE FOR URBAN ACCESSIBILITY FOR ALL

PI: Jon Froehlich (UW)

Sidewalks are a unique form of public infrastructure: they provide a safe, off-road pathway for pedestrians, help interconnect mass transportation services like bus and rail, and support commerce and

recreation. For individuals with a mobility disability, sidewalks play a crucial role in independence, quality of life, and overall physical activity.

However, unlike their road counterparts, there is a lack of high-quality sidewalk datasets and fast, inexpensive, and reliable sidewalk assessment techniques. This limits how sidewalks and sidewalk accessibility can be studied in cities.

In our work, we are exploring complementary sidewalk auditing approaches that are fast, reliable, and low-cost using a combination of remote crowdsourcing, machine learning, and online map imagery.

Previously, we received PacTrans funding for Project Sidewalk, a web tool that enables online users to remotely label sidewalks and identify accessibility problems by virtually walking through city streets

similar to a first-person, immersive video game.

SUPPLEMENTING FIXED-ROUTE TRANSIT WITH DYNAMIC SHARED MOBILITY SERVICES: A MARGINAL COST COMPARISON APPROACH

PI: Qing Shen (UW)

This research addresses a key research need regarding how public transit agencies should respond to the rapid growth of shared mobility services, while leveraging unique policy innovations implemented in the Seattle metropolitan region. It develops a novel theory-and-data-driven approach for public transit agencies to evaluate the cost-effectiveness of incorporating app-based shared mobility to supplement fixed-route transit.

Based on the economic concept of marginal cost, this research aims to deepen our understanding of when, where, and how public agencies should utilize shared mobility modes. Using data from King County Metro (KCM)'s Via to Transit program, it will build operational agent-based models for KCM and other public transit agencies to estimate the marginal costs of delivering mobility services, including both traditional and shared mobility options.

ENHANCING SAFETY AND ACCESSIBILITY FOR ACTIVE USERS AT SIGNALIZED INTERSECTIONS UNDER THE SIGNAL PHASING AND TIMING (SPAT) CHALLENGE

PI: Yinhai Wang (UW)

The objective of this project is to enhance both safety and accessibility for non-motorized road users (henceforth referred to as active users) at signalized intersections in urban areas, primarily Seattle at first, but with plans to extend throughout the region later.

In essence, an approach to facilitate user movements at signalized intersections using video/ sensing technology inputs will be developed in order to:

1. detect active users waiting to cross a roadway and actuate the signal for them

2. detect any active users crossing the roadway, alerting drivers of active users' presence via an alert in a mobile application (app), and potentially extending the crossing phase for them as needed/possible.

For this project, the team will make use of sensing technology developed in the PI's lab, notably the Mobile Unit for Sensing Traffic (MUST sensor), as well as previous app development experience.

MEASURING, MANAGING, AND REDUCING PAVEMENT MACROTEXTURE AND ROUGHNESS TO IMPROVE CYCLISTS' SAFETY AND RIDE QUALITY

PI: Erdem Coleri (OSU)

According to recent research studies (Circella et al., 2016), travel behavior of young adults has started to significantly change within the last decade and non-motorized means of transportation have started to be used more often.

Surface texture and roughness of bikeways directly affect the bicyclists' ride quality (Li et al., 2013). Texture and/or roughness requirements for bike paths and shoulders need to be established to improve cyclists' comfort. Aggregate embedment depth and macrotexture for chip seals need to be controlled during construction to achieve smoother pavement surfaces that are more suitable for bicycles.

This research would have three objectives: i) determine the impact of pavement-related factors on cyclists' ride quality; ii) identify routes with lower ride quality; and iii) provide suggestions and guidelines to improve user comfort.

ASSESSING THE FEASIBILITY OF UTILIZING UAS-BASED POINT CLOUD IN PAVEMENT SMOOTHNESS/ROUGHNESS MEASUREMENT

PI: Erzhuo Che (OSU)

This project will develop a framework to obtain pavement roughness metrics (e.g., IRI) from UAS acquired lidar and structure from motion point clouds, validate the viability of assessing pavement roughness using UAS-based point cloud data, and provide general guidelines for UAS data collection and processing targeting extraction of pavement information.

The proposed project will help save cost and time for transportation agencies to monitor the pavement condition in certain areas by deploying UAS or re-using the UAS data have been collected on a regular basis. The anticipated outcomes include: 1) propose an end-to-end workflow that can be used for extracting IRI from UAS data; 2) develop a comprehensive accuracy assessment framework that can be used for various applications; 3) provide recommendations to transportation agencies and other groups for UAS data collection that can ensure the UAS data can be used for pavement roughness evaluation. All of these outcomes will help ensure the safety and mobility of the transportation network.

MITIGATING WILDFIRE IMPACTS ON MOBILITY USING GIS, FIRE SIMULATION, AND OPERATIONS MODELING

PI: Joseph Louis (OSU)

This research will pursue the following four tasks to enhance the understanding of the impact of wildfires on Oregon's transportation network:

- Wildfire simulation to identify areas of damage: A dynamic fire simulation tool called Wildfire Analyst, integrated into ArcGIS software, will be used to create realistic simulations of wildfire spread through Oregon's forest under changing environmental conditions.

- Debris spread and other damage estimation: The wildfire simulation combined with current vegetative cover in the forest will be used to estimate the amount of debris created as well as the damage to transportation infrastructure.

- Quantification of road clearance/travel times based on equipment availability: A discrete event simulation-based framework will be used to determine productivity and recovery times for affected areas based on equipment availability and the extent of the damage.

- Equipment allocation prioritization to minimize road clearance times: The recovery times and damage estimates will be used in the AnyLogic simulation software, also integrated into ArcGIS software that is commonly used by transportation agencies, to enable decision makers to perform what-if scenarios.

IOT PLATFORMS FOR SMART CITY IMPLEMENTATION IN RURAL AND URBAN COMMUNITIES: A COMPARATIVE REVIEW

PI: Rick Sheldon (UI)

Transportation agencies in urban, sub-urban, and rural communities have plans or are amid developing initial Smart City projects. The major component of these projects comprises the Internet of Things (IoT). IoT enables collecting data flows and exchange to enable the analytics needed to manage and achieve the end goals of any smart city project.

Many agencies find that IoT Platform (IP) selection is very challenging compounded by limited technical resources and are struggling to implement vital concepts aimed at enabling more effective and sustainable mobility. Representative IP solutions have proprietary

"vendor-specific" features that lock agencies into specific vendors' solutions. IPs developed by smaller vendors, while they come with strong customer support and a high degree of openness, face many challenges in terms of interoperability and scalability.

The objective here is a comprehensive review to establish an improved understanding among transportation agency policy makers and professionals concerning IP operational characteristics focused strengths, weaknesses, and future directions.


IMPACT OF AUTONOMOUS AND CONNECTED TRUCK PLATOONS IN THE PACIFIC NORTHWEST ON TRANSPORTATION INFRASTRUCTURE

PI: Ahmed Ibrahim (UI)

The operational characteristics of freight shipment will significantly change after the implementation of Autonomous and Connected Trucks (ACT). This change will have major impacts on mobility, safety, and infrastructure service life. Truck platooning is one of truck arrangements that will become feasible in the near future with the connected vehicle technology. It allows and enables trucks to be connected with themselves and with the surrounding infrastructure. The advantage of platooning is reducing traffic congestion, and improving transport and fuel efficiency.

The main goal of this study is to investigate various truck platooning configurations on load rating of existing bridges' super and substructures. A proposed matrix will be presented in the approach section.
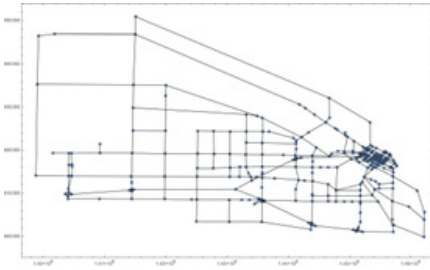
USING MACHINE LEARNING TO CUSTOMIZE TRAFFIC PREDICTION FOR HIGH PERFORMANCE TRAFFIC ANALYSIS AND OPTIMIZATION

PI: Robert Heckendorn (UI)

Traffic optimization is a complex system without reliable and situation specific closed form formulas for optimization. This means a simulation plays a critical role in any advancement in traffic optimization.

With the advent of specialized hardware and high performance bus and memory architectures, machine learning has shown near magical improvement in the last 10 years. Evidence of this is plainly visible on the cell phones we use everyday such as speech recognition and classification of your picture library by subject. We will apply this technology to learning and predicting the behavior of traffic on individual road segments allowing us to quickly assess the arrival times and create a fast simulator suitable for traffic optimization.


ELUCIDATING SNOW HEIGHTS FOR AVALANCHE ASSESSMENT FROM AUTOMATED DATA PROCESSING FROM UAS AND NEW WINTER HAZARDS STATION

PI: Billy Connor (UAF)

Our focus is on Atigun Pass, where the Dalton Highway crosses the Brooks Range, the most northern mountain range in the North America Content, and well above the Arctic Circle. Atigun Pass is a unique environment because blowing snow is the principal factor in creating avalanche conditions. Blowing snow at the pass also generates snowdrifts that block the road, occasionally occupying the small M&O crew for days on end.

The redistribution of snow by blowing snow is a significant force in creating avalanche conditions and generating snowdrifts on the Atigun Pass Road. We aim to create two new tools to optimize the effort in keeping the road free of snow. The first tool applies UAS (unmanned aircraft system) in conjunction with in-house developed software to elucidate snow surface height (digital elevation models). The software will keep track of hazardous snow features such as a hanging cornice or how much snow loaded is in a gully above a road. The second tool is a new Winter Hazard Station (WHZ). We placed the WHZ near the pass, close to the brunt of peak wind conditions—the WHZ measures; local meteorological conditions, direct blowing snow, and sampling through delayed-camera views.
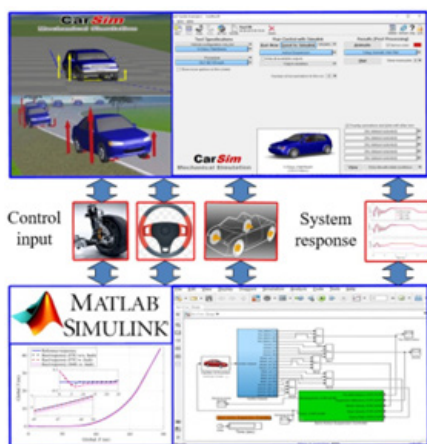
DATA-DRIVEN MOTION CONTROL OF AUTONOMOUS VEHICLES IN GPS-UNRELIABLE ENVIRONMENTS

PI: Chuan Hu (UAF)

In this project, a novel data-driven strategy will be proposed for AV motion control when a GPS signal is not reliable. In recent years, data-driven approaches such as reinforcement learning (RL) and adaptive dynamic programming (ADP) algorithms have been widely adopted in solving dynamic programming problems. However, there is seldomly any related application in AV control systems when a GPS signal is not reliable, where technical difficulties occur due to the unavailability of the vehicle location, orientation and certain critical vehicle states.

An AV's complex operation environment, external disturbances, system nonlinearities, modeling and non-structural uncertainties also lead to challenges for reliable motion control.

To this end, this project will develop an enhanced ADP approach for AV motion control when the GPS signal is not reliable, based on the estimation results for the sideslip angle and tire-road friction coefficient. The dependable inputs will be signals collected/measured from on-board sensing results.

PARKING PLANNING TOOLS TO IMPROVE EFFICIENCIES, AID RECOVERY, AND PREPARE FOR THE POST-COVID ENVIRONMENT

PI: Danna Moore (WSU)

Pullman Transit is the leading rural transit system throughout Washington and within the region, providing over 1.4 million rides annually. In addition to serving Pullman residents, Pullman Transit also

provides contracted service to Washington State University, and Pullman Public Schools.

Project Goals:

- Develop a spatial transit demand model to empower local transit planners with the information they need to make informed transit planning decisions.

- Analyze the effects of crisis shocks, such as the COVID-19 pandemic, to evaluate transit system performance and provide operational guidance under extreme conditions.

- Identify transit service gaps to improve transit accessibility and meet community needs.

PLANNING TOOLS FOR TRANSIT MANAGERS TO IMPROVE EFFICIENCIES & PREPARE FOR THE POST-COVID ENVIRONMENT

PI: Jake Wagner (WSU)

Washington State University Transportation Services is a self-sustaining unit responsible for managing the parking and transportation facilities and operations at WSU. They manage over 8,300 parking spaces, covered garages, paved lots and unpaved gravel lots.

Project Goals:

- Analyze parking revenues and costs at WSU to identify high margin opportunities for revenue growth and catalog existing shortfalls in cost recovery

- Identify parking lot management strategies (lot locations, payment types, prices, level of service, etc.) to improve operational efficiencies and provide a path towards financial sustainability.

- Develop a transferable parking demand model that can be used to conduct scenario analyses and evaluate the effects of proposed parking policies.
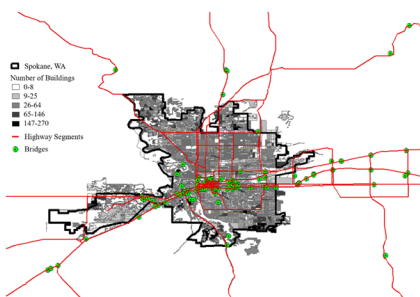
AGENT-BASED MODELING FRAMEWORK FOR WILDFIRE EVACUATION IN DAMAGED TRANSPORTATION SETTINGS

PI: Ji Yun Lee (WSU)

Wildfires pose an increasing threat to residents in the Pacific Northwest (PNW) region as more people are moving to the wildland-urban interface. In addition, increasing frequency and magnitude of wildfires induced by climate change will greatly intensify wildfire threat to human and economic losses in the PNW region. While many state- and local-level initiatives are underway to mitigate wildfire risks, it is not possible to completely remove such risks due to substantial inherent uncertainties. In this case, evacuation is the most important and effective method to reduce human losses during a wildfire event.

The main goal of this study is to support effective evacuation planning by developing an agent-based modeling framework for wildfire evacuation in damaged transportation settings. The framework will predict traffic conditions during an evacuation and identify the critical parts of the transportation network for pre-fire risk mitigation actions aimed at improving mobility during a wildfire evacuation.

Education & Workforce Development

## PACTRANS WDI PARTNERS WITH UW YOUTH & TEEN PROGRAM TO DELIVER TWO-WEEK COURSE ON AUTONOMOUS CARS

This summer, the PacTrans Workforce Development Institute worked with the UW Continuum College's Youth and Teen Program to develop and offer a two-week course to middle school students called, Introduction to Autonomous Cars. In this course, students learned principles of automation using LEGO Education Spike kits. To better connect what they were learning through these hands-on activities, the course also featured a series of guest speakers and UW lab visits where professionals presented on a variety of transportation related topics.

PacTrans Assistant Director, Cole Kopca, co-taught this course with a recent high school graduate, Erik Ma. Erik, until graduating, was part of the FTC 18225HD robotics team that has successfully won the state competition the past two years in a row. Erik was the primary developer of the hands-on exercises and robotics components while Cole coordinated the guest speakers/visits and handled the transportation components of the course.

Lego Education Spike Kits come with a "Hub" (basically a CPU and battery), four motors (two small and two medium), and four sensors (two color, one distance, and one pressure). They also come with all of the wheels, axels, and other components necessary to build a "vehicle." The software used to communicate with the hub is incredibly intuitive with drag-and-drop code, and the desktop program comes with a plethora of supplemental training exercises and how-to videos.

Students spent the first week going through exercises to learn about how to use all of the various components to make a vehicle perform tasks, and then spent the second week putting together final projects. Final projects required students to identify a real world vehicle and identify three common tasks that vehicle needs to accomplish on a regular basis. While their vehicles did not need to visually resemble their identified vehicle type, they had to build a vehicle and program it to do all three of those tasks in an automated fashion. The final day of the course, friends and family were invited to watch the eight teams present their final projects.

PacTrans WDI would specifically like to thank: Dongho Chang (Washington State Department of Transportation), Eric Shimizu (DKS & Associates), Daniel Lai (City of Bellevue), Yinhai Wang (UW STAR Lab), FTC HD18225 team, Linda Boyle (UW Human Factor and Statistical Modeling Lab), and Ben Estroff (UW Husky Robotics Team).
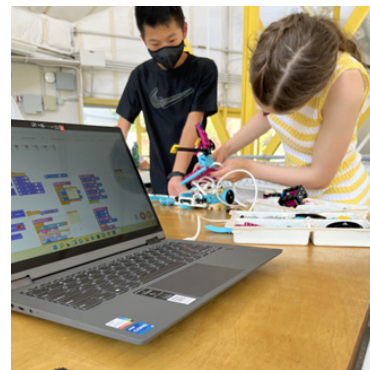
OSU HOSTS THIRD ANNUAL NATIONAL SUMMER TRANSPORTATION INSTITUTE
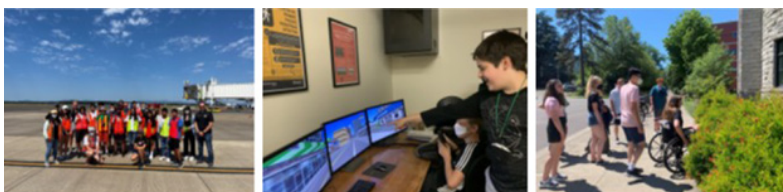
This summer, PacTrans consortium partner, Oregon State University, hosted their third annual National Summer Transportation Institute (NSTI). In all, twenty-one high-school age students had the opportunity to spend a week on the OSU campus, learning about a variety of transportation related disciplines, free of charge.

The NSTI Program is an initiative developed by the Federal Highway Administration (FHWA) to introduce high school students to transportation-related careers via elaborately designed, hands-on learning experiences.

Professor Hurwitz, in collaboration with the School of Civil and Construction Engineering (CCE), launched its first NSTI offering in the summer of 2020 with a week-long transportation summer camp delivered in a hybrid format. The second STI camp was delivered in July 2021 using a similar week-long hybrid format, with the exception that two day-long field trips were delivered fully in-person.

These camps typically include a variety of field trips, university lab visits, and classroom learning/exercises.

Education & Workforce Development Webinars

FRED MANNERING

This past March, PacTrans hosted Fred Mannering for a webinar titled, *Risk Compensation and the Effectiveness of Vehicle Safety Features*. Dr. Fred Mannering is the Executive Director of the Center for Urban Transportation Research and a Professor in the Department of Civil and Environmental Engineering at the University of South Florida. "In the past decade, there have been incredible advancements in vehicle safety technologies. The expectation would be that the introduction of these features would greatly reduce the likelihood of accidents in general and injury-causing accidents in particular. But aggregate accident data do not show this. From 2011 to 2020 fatalities on US highways rose by 19% and fatalities per mile driven rose by nearly 25%." In his webinar, Professor Mannering explores this contradiction.

AN UPDATE FROM THE PACTRANS WORKFORCE DEVELOPMENT INSTITUTE

After the successful launch of the PacTrans workforce development institute (WDI), the WDI has delivered several training courses to transportation practitioners. During the reporting period, the institute has focused on three major tasks: (1) Enhancing the online platform for e-learning courses, (2) Developing and delivering new training courses, and (3) Developing the assessment and evaluation guidebook for training courses and the overall program.

Specifically, the WDI has developed and delivered a training course "Transportation Data Analytics and Tools". The course was delivered through the online training platform to over 25 WSDOT employees from 2/14/2022 to 2/17/2022. In addition, the WDI has been working with WSDOT representatives to identify training topics and new training courses. The WDI has also drafted a guidebook including course development processes with carefully designed learning outcomes and associated learning activities, active learning strategies, reliable assessment and evaluation processes of learning, and overall program and course evaluation.

Students

## OSU'S ITE STUDENT CHAPTER RECEIVES ITE'S 2021 STUDENT CHAPTER OF THE YEAR

In early July, Oregon State University's ITE Student Chapter traveled to Palm Springs to the Western District ITE Annual Meeting. During this meeting, OSU Graduate Student Eileen Chai received the 2022 Outstanding Graduate Student Award, and their chapter received the Student Chapter Annual Meeting Award. To top it off, the OSU chapter won the Western District Traffic Bowl. The team then traveled to New Orleans in August to the International meeting and to compete in the National Traffic Bowl.

PACTRANS SUPPORTS UI'S CLEAN SNOWMOBILE TEAM TO PODIUM FINISH

Over the years, PacTrans has been a strong and consistent supporter of the University of Idaho's Clean Snowmobile Team. This year, University of Idaho placed 3rd overall, which is Idaho's first podium finish since 2014! In addition to overall placement, U of I placed 1st in acceleration with rider Will Thielman, 2nd in emissions, and 1st in subjective handling.

The Clean Snowmobile Challenge, hosted by the Society of Automotive Engineers, has been held annually for over twenty years. The goal of the competition is the engineering of better exhaust emissions and sound characteristics of snowmobiles.

The competition features a host of other categories in which teams can score and win, such as acceleration, endurance, and marketability are taken fully into consideration. To achieve these goals, undergraduate students (predominantly engineering) form sub teams for individual components. Students learn skills of engineering and project management, as well as technical writing and team building.
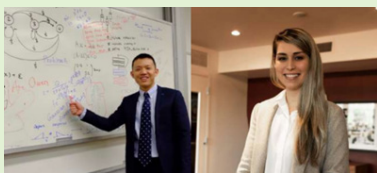
TWO PACTRANS STUDENTS RECEIVE ITE WASHINGTON STUDENT SCHOLARSHIPS

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

UAF STEEL BRIDGE TEAM PLACES 2ND AT NATIONALS

Over the years, PacTrans has been a strong supporter of our consortium partner universities' student competition teams. This past year, a team from the University of Alaska Fairbanks took second place in the 2022 Student Steel Bridge Competition finals, the best showing for UAF in more than a quarter century.

The annual competition is co-organized by the American Institute of Steel Construction and the American Society of Civil Engineering. They use a variety of criteria (construction speed, lightness, aesthetic, stiffness, cost estimate, economy, and efficiency) to judge student teams on their efforts to design and build a unique steel bridge.

This year, the three-person building team constructed UAF's bridge in 5 minutes, 20 seconds, while taking third place in the categories of aesthetics, lightness and construction economy. Those scores helped UAF claim second place overall in a field of 38 teams at the finals, finishing behind only the defending champions from the University of Florida.

"We were just overjoyed," said team captain Ben VanderHart. "We knew we had something special this year."

Along with VanderHart, team members participating in the finals included Branden Hansen, Zach Miller, Lucas Gomes, Haylie Cortez, Jenna Hernandez and Madelin Weeks. Wilhelm Muench, an instructor at UAF's College of Engineering and Mines, was the team advisor.

PACTRANS STUDENT RESEARCHER ZHIYONG CUI RECEIVES 2021 IEEE ITS BEST DISSERTATION AWARD

Recently, PacTrans student researcher, Zhiyong Cui, from the University of Washington, was awarded the 2021 IEEE ITS Best Dissertation Award for his dissertation on Deep Learning for Short-term Network-wide Road Traffic Forecasting. The IEEE ITS Best Dissertation Award is given annually for the best dissertation in any ITS area that is innovative and relevant to practice. This award is established to encourage doctoral research that combines theory and practice, makes in-depth technical contributions, or is interdisciplinary in nature, having the potential to contribute to the ITSS and broaden the ITS topic areas from either the methodological or application perspectives.

Zhiyong has since graduated and after spending a short stint as a Postdoctoral Research Associate in the Department of Civil & Environmental Engineering at the University of Washington, he took a position as Associate Professor with Beihang University. Zhiyong received his Master's degree in Software Engineering from Peking University, China, and his Bachelor's degree in Software Engineering from Beihang University, China.
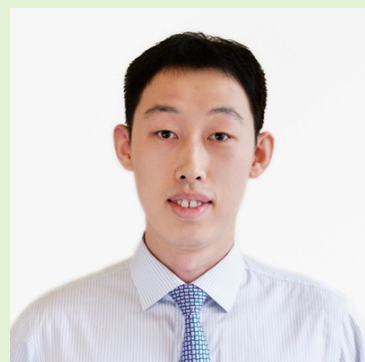
OSU'S BRIAN STAES RECEIVES PACTRANS UTC OUTSTANDING STUDENT OF THE YEAR AWARD

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

Brian Staes is a 1st year PhD student in the School of Civil and Construction Engineering at Oregon State University (OSU). Brian holds a BSCE (2015) from Florida Gulf Coast University (FGCU) and an MSCE (2012) from University of South Florida (USF). Brian is passionate about developing models for traffic flow and simulation that can be used to implement real world decision making. He has significantly contributed to scholarship in the area of evacuation modeling during natural disasters such as hurricanes and fires. Brian's concern is that all citizens have the chance to safely evacuate an impending disaster—including people with disabilities, and all citizens at all economic and demographic levels. Brian is passionate about transportation research, holds a deep desire to solve problems and learn new tools, and regularly demonstrates patience and leadership when working in a team atmosphere.

PACTRANS STUDENT RESEARCHER HELENA BREUER WINS DDETFP FELLOWSHIP AWARD

PacTrans student researcher from Oregon State University, Helena Breuer, was recently awarded the The Dwight David Eisenhower Transportation Fellowship award. The Dwight David Eisenhower Transportation Fellowship Program (DDETFP) awards fellowships to students pursuing degrees in transportation-related disciplines.

Helena is a PacTrans Fellow, ARCS Scholar, and Doctoral student at Oregon State University studying transportation engineering under Dr. David Hurwitz. She is currently working at the Hurwitz Lab conducting research in the overlapping field between human factors/engineering psychology and transportation.

2021 MICHAEL KYTE REGION 10 OUTSTANDING STUDENT OFTHE YEAR AWARD: ANANNA AHMED

Each year, PacTrans facilitates the selection of the Michael Kyte Region 10 Outstanding Student of the Year Award. We are pleased to announce that this year's award winner is Oregon State University Graduate Student, Ananna Ahmed.

To be eligible, a student must attend a university within Federal Region 10 (Washington state, Oregon, Idaho, and Alaska), and must have participated in a University Transportation Center funded research project. Nominees are evaluated in three areas: (1) technical merit and research, (2) academic performance, and (3) professionalism and leadership.

Since receiving this award Ananna has graduated from OSU with the PhD in Transportation Engineering. She is currently located in Mclean, VA, and working as a Human Factor Specialist, at Leidos in the Turner-Fairbank Highway Research Center.

UW STAR LAB TEAM PLACES SECOND IN TRANSPORTATION FORECASTING COMPETITION (TRANSFOR 22)

The Smart Transportation Applications and Research Lab at the University of Washington recently stood second in the Transportation Forecasting Competition (TRANSFOR 22) for their presentation on Identifying and predicting Crossing Speed of High-Risk Pedestrians with Early Stage LiDAR Features.

The 2022 Transportation Forecasting (TRANSFOR) Competition, was held in conjunction with the 101st Transportation Research Board (TRB) Annual Meeting. This is the third time this competition has been held since 2013. This year's competition was also supported by the IEEE ITSS Technical Activities Sub-Committee "Smart Mobility and Transportation 5.0" and sponsored by The Center for Urban Informatics and Progress (CUIP) at The University of Tennessee at Chattanooga (UTC), NSF, City of Chattanooga, Ouster LiDAR, and Seoul Robotics. The scope of this TRANSFOR 22 competition was to: (1) evaluate the accuracy of sub-classifying pedestrians at higher-risk; and (2) predict the time needed to cross the street and whether the pedestrian can safely cross within the allocated pedestrian signal time. UW STAR Lab students who participated in this competition included Meixin Zhu, Zhiyong Cui, Shuyi Yin, Hao Yang, Chenxi Liu, and Yifan Zhuang.

PACTRANS STUDENT RESEARCHER AND ASSISTANT DIRECTOR COLE KOPCA WINS T&DI 2021 OUTSTANDING YOUNGER MEMBER AWARD

University of Washington Graduate Research Assistant and PacTrans Assistant Director, Cole Kopca, was recently awarded the 2021 Outstanding Younger Member Award by The Transportation and Development Institute (T&DI) of ASCE. The award was established to recognize the professional contributions of younger members of the Institute.

Mr. Kopca is a Ph.D. candidate in the Smart Transportation Applications and Research Lab at the University of Washington and serves as the Assistant Director of the Pacific Northwest Transportation Consortium in Seattle, Washington. As a Graduate Research Assistant, his primary research interest is the interplay between new and emerging mobility services and more classical modes of transportation. As the Assistant Director at the PacTrans, he oversees $2.75M in annual federal grants to improve technology, research, education, and workforce development in the Pacific Northwest. Mr. Kopca received his Bachelor of Science degree in Civil Engineering from the University of Iowa, a Master's in Urban Planning from the University of Washington, and returned to Engineering to pursue his Ph.D.

Mr. Kopca is Chair of the T&DI Young Member Committee, the Younger Member Representative to the ICTD Steering Committee, and the T&DI Representative to the Student Presidential Group. He is also a devoted husband, father to a ten-month-old Bernese Mountain Dog, mediocre skier, avid homebrewer, enthusiastic curler, average fly fisherman, and dedicated cyclist.

PACTRANS STUDENT RESEARCHER RUIMIN KE RECEIVES THE COTA BEST DISSERTATION AWARD

PacTrans student researcher from UW and former Michael Kyte Region 10 Outstanding Student of the Year Awardee, Ruimin Ke, recently received the Chinese Overseas Transportation Association (COTA) Best Dissertation Award for his Ph.D. dissertation titled "Real-time Video Analytics Empowered by Machine Learning and Edge Computing for Smart Transportation Applications."

The COTA Best Dissertation Award is established to recognize outstanding students with Chinese nationalities for their accomplishments of pursuing doctoral degrees in the transportation field. The award will be presented annually to two selected graduate students for their Ph.D. dissertations, one in transportation policy & planning and the other on transportation science & technology. COTA presents a number of awards annually to recognize contributions made by members and volunteers as well as the technical excellence of its members, their projects or programs.

Dr. Ke has since completed his Ph.D. and is currently an Assistant Professor at the University of Texas at El Paso. He previously served as a research associate at the University of Washington, Seattle. He graduated from UW in 2020 with a Ph.D. Intelligent Transportation Systems advised by PacTrans Director, Professor Yinhai Wang.

TWO PACTRANS STUDENT RESEARCHERS FROM OREGON STATE UNIVERSITY NAMED 2022 LIFESAVERS TRAFFIC SAFETY SCHOLARS

Recently, two students from PacTrans consortium partner, Oregon State University, Logan Scott-Deeter, and Amy Wyman, were named 2022 Lifesavers Traffic Safety Scholars. They were also invited to attend the Lifesavers National Conference on Highway Safety Priorities on March 12-15. They are pursuing undergraduate or graduate degrees in Civil & Construction Engineering/Transportation Engineering and are two of 43 U.S. and international students selected through a competitive application process. The Lifesavers Conference showcases the latest research, evidence-based strategies, proven countermeasures, and promising new approaches for addressing the nation's most pressing traffic safety problems.

Logan Scott-Deeter, Amy Wyman, and their fellow Scholars kicked-off their Lifesavers experience on March 12, 2022, as they learned about career opportunities from a panel of young traffic safety professionals working in the public and private sectors. The Scholars continued this career discussion when they met with state and national traffic safety leaders during the reception.

Once the Lifesavers Conference began on March 13th, the Scholars had the opportunity to participate in three plenary sessions and 70 workshops featuring leading experts in the fields of distracted and impaired driving; child passenger, pedestrian, bicycle, motorcycle, teen, and aging driver safety; occupant protection; vehicle technology; law enforcement and criminal justice; public health, commercial motor vehicles; roadway design; and more.

PACTRANS STUDENT RESEARCHER PETER YU WINS BEST GRADUATE STUDENT POSTER AWARD

PacTrans student researcher Peter Yu recently won the Best Graduate Student Poster Award for his poster titled "Operational Advantages of the Protected Overlapped Pedestrian Intersection Design" at the Transportation Research Board's Standing Committee on Performance Effects of Geometric Design (AKD10) poster competition.

Peter Yu is an undergraduate student and a member of the Smart Transportation Application and Research Lab at the University of Washington. Originally from Pullman, WA, he is passionate about transportation engineering and is interested in the areas of highway design, alternative intersections and interchanges, traffic operations and simulation, and traffic signal control. Peter earned first place nationally in the 2016 ASCE West Point Bridge Design Contest and has also given multiple conference presentations at international ITE, TRB, and ASCE meetings. He is a student member of ITE, TRB, ASCE, and IEEE.

PacTrans Fellows

IMAN HAJI (UW)

Iman is originally from Seattle, Washington and completed her Bachelor's in Civil Engineering at the University of Washington. Her research interests are in transportation data analytics, intelligent transportation systems, and transportation equity. During her Master's Program she will be working as a data science intern for King County Metro's fare policy team. Prior to her graduate program, she has interned at HNTB and Seattle Department of Transportation.

ARTHUR SEMIONOV (UW)

Arthur Semionov graduated from the University of Washington in 2021 with a bachelor's in Civil Engineering and is currently in his first year in the transportation engineering master's program at UW. He has also joined the STAR Lab on campus where he is learning how to use and develop intelligent transportation systems and using AI in transportation. He hopes to learn more about autonomous vehicles and the infrastructure that are needed to support a fully autonomous mode of transportation.

KEZIE SUWANDHAPUTRA (OSU)

Kezia Suwandhaputra graduated in 2021 with a Bachelor's in Civil Engineering from California Polytechnic State University, San Luis Obispo. Her passion for transportation sparked during her time there and as a result, she became involved with transportation safety research in addition to leading the award-winning student ITE chapter. Kezia hopes to contribute to research about sustainable and active transportation while pursuing her Master's at Oregon State University. During her free time, Kezia enjoys backpacking, running, and spending quality time with her family and friends.

OLLIE WIESNER (UW)

Ollie Wiesner graduated from the University of Pittsburgh in the fall of 2019 with a B.S. in civil engineering and a certificate in sustainability. His work experience has since focused on the transportation sector where he has grown interested in urban mobility patterns and analyzing vehicular crash data. He is interested in ITS, emergency management from a transportation and infrastructure standpoint, and using data analytics to make informed decisions systematically. He hopes to learn more about managing large datasets, using remote sensing for passive data collection, and conducting geospatial data analysis as it applies to these areas. He is excited to return to the classroom and to be living in Seattle, where he will enjoy climbing, backpacking, and the beautiful outdoors of the PNW.

Technology Transfer

PACTRANS DIRECTOR YINHAI WANG-LED STAR LAB LAUNCHES SPIN-OFF COMPANY - AIWAYSION

AIWAYSION

The PacTrans Smart Transportation Applications and Research Laboratory (STAR Lab) at the University of Washington recently launched a spin-off company – AIWaysion. The company provides Smart Mobility Solutions using Artificial Intelligence (AI), computer vision, and edge computing technologies for safer and more efficient transportation.

Their first product – Mobile Unit for Sensing (MUST) – is a cutting-edge technology for smart infrastructure system support produced by STAR Lab research funded by PacTrans and other organizations. MUST integrates sensing, data fusion, analysis, and communication functions all in one device. MUST can collect multi-modal transportation data and provide in-device (edge) data analysis right on the spot. In addition, MUST offers real-time communication to the traffic managers and road users. MUST can produce vehicles, pedestrian, and bicycle volume and speed data, road surface condition information (e.g., dry, wet, ice, snow), travel time estimates, etc. In addition, MUST can be configured as a communication node on the infrastructure side for connected vehicles and other smart transportation applications.

AIWaysion also recently received the Small Business Innovation and Research Award from the US Department of Transportation.
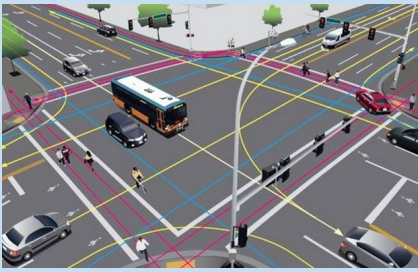
CITY OF BELLEVUE WINS 2021 NATIONAL ROADWAY SAFETY AWARD FOR ITS VIDEO ANALYTICS TRAFFIC SAFETY PROGRAM

This past year, the City of Bellevue, WA was honored with a 2021 National Roadway Safety Award for the success of its video analytics program. The National Roadway Safety Awards are sponsored jointly by the Federal Highway Administration and the Roadway Safety Foundation. First presented in 1999, the biennial program recognizes safety achievements that move the nation toward zero deaths and serious injuries on U.S. roadways.

Bellevue's Video Analytics Traffic Safety Program takes a proactive approach to identify safety improvements by leveraging its extensive traffic camera network to study near-crash conflicts and identify potential countermeasures. This greatly reduces the amount of time required to identify safety hot spots and to evaluate possible remedies – often from a matter of years to a matter of days. The program initially launched five years ago as a partnership with Microsoft and the University of Washington. The lessons learned from that pilot led to subsequent video analytics partnerships with Transoft Solutions Inc. and the Together for Safer Roads coalition, before evolving into the current collaboration with Advanced Mobility Analytics Group, Jacobs Engineering and a renewed collaboration with Microsoft.

PACTRANS DIRECTOR TAKES EDITORIAL LEADERSHIP FOR BOOK ON DISRUPTIVE EMERGING TRANSPORTATION TECHNOLOGIES

PacTrans Director and Professor of Civil and Environmental Engineering at the University of Washington, Yinhai Wang, co-drove the editorial process of the recently published book on Disruptive Emerging Transportation Technologies. The book is prepared by the Technical Committee on CAV Impacts of the Transportation & Development Institute of ASCE.

Disruptive Emerging Transportation Technologies provides a forward-looking overview of the relevant 4IR technologies and their potential impacts on the future disruptive emerging transportation. It is a valuable reference for relevant educators to re-imagine their roles, redesign their curricula, and adopt very different pedagogical strategies to address this inevitability, particularly when they are introducing emerging technologies into transportation planning and development, infrastructure design, and traffic management.

This book will interest educators, researchers, and students interested in disruptive emerging transportation technologies. Professionals of public and private sectors including engineers, managers, planners, and policymakers, as well as specialists of all areas whose work will be affected by the smart transportation trends, will also find this to be an invaluable resource.
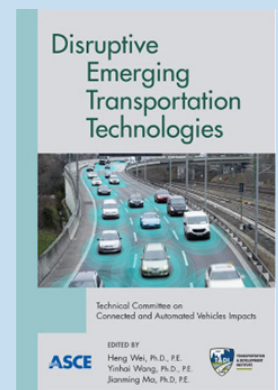
PACTRANS ASSOCIATE DIRECTOR DAVID HURWITZ PRESENTS AT INTERNATIONAL ROAD FEDERATION VISION ZERO FOR LATIN AMERICA CONFERENCE

PacTrans Associate Director and Oregon State University Professor of Civil and Construction Engineering, David Hurwitz, participated as a Guest Speaker at the "Vision Zero" for Latin America Road Safety Conference. The conference was held virtually from May 18-20, 2021 and was jointly sponsored by the Internationally Road Safety Federation and the Puerto Rico LTAP Center.

The conference took place entirely in Spanish and Portuguese, so Dr. Hurwitz's slides and comments were translated into Spanish. His talk titled, "Informando Sobre el Incremento de Muertos y Heridas Graves en Oregon por Conductores y Peatones de Mayor Edad: Un Método Transferible" [Addressing Oregon's Rise in Deaths and Serious Injuries for Senior Drivers and Pedestrians: A Transferable Method] was based on work completed in collaboration with Dr. Chris Monsere (PI), Dr. Sirisha Kothuri, and Dr. Jason Anderson from Portland State University and Cadell Chand, MSCE student from Oregon State University. The work was sponsored by the Oregon Department of Transportation (SPR 828).
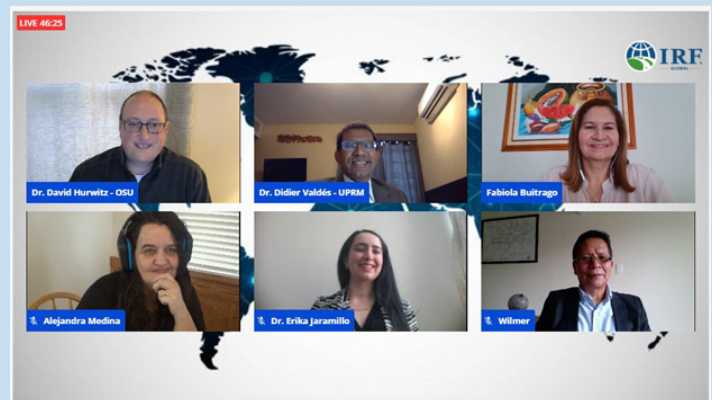
Technology Transfer Webinars

COMPREHENSIVE ROADWAY SAFETY DATA VISUALIZATION AND EVALUATION PLATFORM FOR YAKAMA NATION

In Mid-April, PacTrans hosted a webinar featuring work from the UW's STAR Lab with Yakama Nation on a USDOT Safety Data Initiative Project. The webinar titled, USDOT Safety Data Initiative: Comprehensive Roadway Safety Data Visualization and Evaluation Platform, featured Hollyanna Littlebull, the Tribal Traffic Safety Coordinator at Yakama Nation Department of Natural Resources Engineering Program; Wei Sun, then Post Doctoral Researchers at the University of Washington; and Sam Ricord, graduate research assistant at the University of Washington. This webinar explored gaps in vital data for making important safety decisions, new datasets to combat this gap, and a newly developed visualization and evaluation tool.

INCORPORATING RIDE-SOURCING SERVICE INTO ADA PARATRANSIT

This webinar summarized a technology transfer project co-funded by PacTrans and King County Metro Transit on leveraging ride-sourcing services a part of ADA paratransit. In early December 2021, PacTrans PI and Professor of Urban Design and Planning at the University of Washington, Qing Shen, and a Graduate Research Assistant in the Interdisciplinary PhD Program in Urban Design and Planning at the University of Washington, Lamis Ashour, delivered a webinar titled, Incorporating Ride-Sourcing Service into ADA Paratransit: Opportunities and Challenges for Public Transit Agencies.

They presented findings for an initial research study that was a collaborative effort with partners at King County Metro. After the presentation concluded, they were joined by collaborators: Don Okazaki, Community Access Program Administrator, Matthew Weidner, Senior Planning, Jeremy Trenhaile, Program Manager, and Casey Gifford, Innovative Mobility Senior Planner, for an extended Q&A/discussion time.

SAFE ROUTES TO SCHOOL IN SEATTLE

UI Associate Professor Kevin Chang hosted Ashley Rhead, Senior Transportation Planner for the City of Seattle, for a webinar titled, Safe Routes to School in Seattle. In this webinar, they presented an overview of the key engineering tools used in Seattle to improve safety for students walking and biking to school, including arterial traffic calming, pedestrian improvements, neighborhood greenways, and School Streets.

PacTrans Success Stories

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

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

AVALANCHE MONITORING SYSTEM IN MOUNTAINOUS AREA BASED ON IOT SENSOR NETWORK

PI: Yinhai Wang (UW)

This work aims to utilize a IoT sensor system for avalanche monitoring and offering real-time warning information, which was previously supported by University of Washington and PacTrans. The fundamental idea of this system is deploying the acceleration sensors above the snow and detecting the abnormal movement raised by avalanche. If multiple sensors send the abnormal movement information to the server via intermediate stations, there will be a high possibility for an avalanche in that area. Firstly, the acceleration sensor can detect 3-axis acceleration rates. The avalanche will cause a sudden movement and trigger the sensor to generate abnormal messages and transmit them to nearby stations. Secondly, benefit from the IoT communication technology, e.g., LoRa, the communication distance can reach up to over 300 meters, which is suitable for the rural implementation and reduces the density of intermediate stations. Thirdly, the optimized circuit design and power-saving strategies help boost the battery life significantly to over six months, which is a huge advantage for the proposed system.

TECHNOLOGY TRANSFER OF THE FINDINGS OF "COST COMPARISON OF WASHINGTON SAFETY REST AREA OPERATIONS WITH OTHER STATES"

PI: Kishor Shrestha (WSU)

The principal objective of this study is to transfer the findings of the study titled "Cost Comparison of Washington SRA ..." to the transportation agencies and industry professionals that can put those findings to use in practice, making the US transportation systems better for all. The primary outcome of this study is to advocate using the cost-effective method or to transfer the study findings of "Cost Comparison of Washington SRA ..." to transportation agencies and to transfer the algorithm to calculate how much fund agencies can save using the cost-effective approach. The research team will emphasize using three approaches to transfer the findings of "Cost Comparison of Washington SRA ..." to potential transportation agencies and professionals. They are (i) to provide webinars to state DOT staff, (ii) to deliver presentations to the industry professional through ASCE sections, and (iii) to present and publish research findings in top-ranked conferences or journal papers. The research team will also provide recorded webinars and final project reports to states (over 20 state DOTs) who participated in the PacTrans cost comparison study.

ROADWAY TRAFFIC AND ENVIRONMENTAL CONDITIONS MONITORING AND SAFETY ALERT SYSTEM

PI: Yinhai Wang (UW)

The proposed technology transfer activity is to develop a roadway traffic and environmental conditions monitoring and safety alert system. Specifically, the system will monitor the roadway conditions and detect events such as snow/icy/wet road surface, speeding, crash, stopped vehicles, queue, etc. utilizing edge AI technologies. In addition to monitoring and detecting abnormal events, the system will broadcast warning messages to transportation agencies and road users in real-time. The team will develop a mobile phone app to display real-time roadway monitoring information as well as broadcast warning messages. Besides, other channels such as variable message signs, social media, radio broadcast, etc. will also be explored for information dissemination. The goal of the project is to deploy the system along roadways with high crash risks, such as segments with horizontal and/or vertical curves, locations with frequent snow or ice coverage, etc. particularly locations that traditional sensing devices would not work because of limited funding and personnel support.

SOFTWARE FOR REAL-TIME PREDICTION OF EARTHQUAKE-INDUCED GROUND FAILURE

PI: Brett Maurer (UW)

The developed model allows seismic ground failure to be predicted at regional scale either (i) minutes after an earthquake, allowing for near-real-time predictions once regional ground motions are measured (critical for emergency response and reconnaissance); or (ii) for countless future earthquake scenarios (critical for planning and mitigation). However, at present, the model exists only as code. To facilitate user adoption, we propose to develop "RapidLiq," a windows-executable software program. All predictor variables will be compiled within the program, making user implementation trivial. The only required input will be a "ShakeMap" of ground-motion intensity measures, which can be easily downloaded from the USGS minutes after an earthquake, or for numerous future scenario events. The software will then extract predictor variables across the ShakeMap extents and output probabilities of liquefaction-induced ground failure. Finally, the software will also include inventories of transportation assets (e.g., roads, bridges, ports), such that locations of likely damage can be identified. The software will operate throughout the contiguous U.S. and perform calculations in less than one minute for a given earthquake. We propose that RapidLiq will fully complete the technology transfer of our research, allowing emergency managers, planners, engineers, and the public to predict the impacts of soil liquefaction on their communities. The software will be accompanied by a user manual and webinar demo.

MAKING URBAN ELECTRICAL VEHICLES A CLEAN AND SAFE SOLUTION FOR FIRST- AND LAST-MILE DELIVERIES
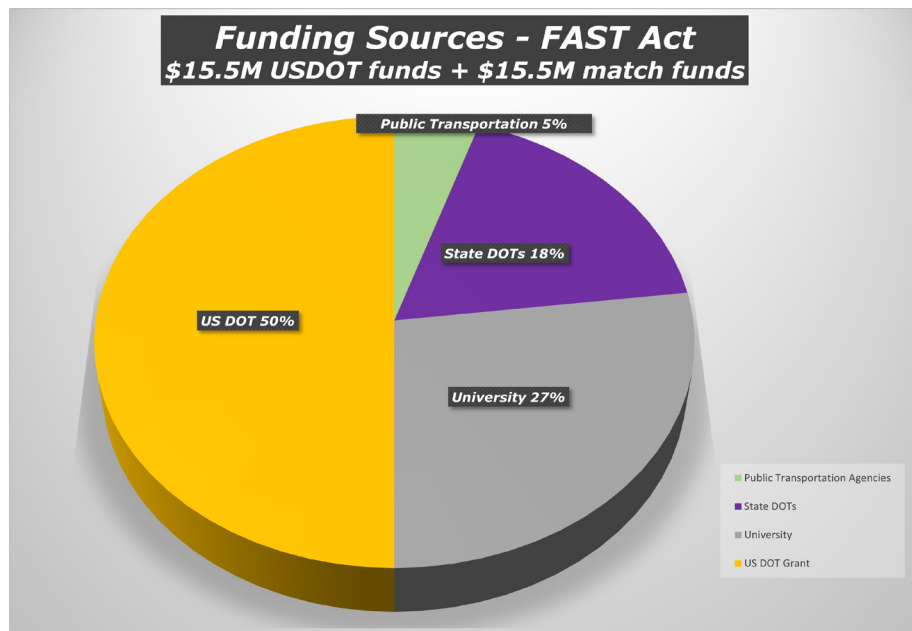
PI: Yinhai Wang (UW)

This project proposes to demonstrate the benefits of urban EVs for first- and last-mile deliveries. Partnering with Innova EV who provides affordable zero-emission mobility solutions using EVs, we plan to install our onboard computer-vision-based transit event logging system (TELS) on delivery EVs to improve first- and last-mile deliveries and also quantify their environmental, safety, and accessibility benefits. The TELS was developed in the FTA Pierce Transit project as an edge-computing artificial intelligence system for detecting and logging transit bus related near-crash events, including those with both pedestrians/bikes and vehicles. In this project, the TELS will take data from the 4 cameras, and 45 other sensors of the Innova EVs (called Dash) for delivery monitoring and planning. Specifically, the following work will be conducted: 1) cooperate with UW transportation office to identify on-campus case study areas for EV-based first- and last-mile deliveries; 2) prepare EVs and personnel for the pilot EV delivery study; 3) install and customize the TELS for delivery monitoring and planning; 4) given data from Dash sensors, the TELS will be used to a) monitor the trajectories of deliveries and provide instructions for route choices and reaching the right delivery or pick-up locations; b) monitor the property safety status of delivery EVs (e.g., capture any lost packages during off-vehicle delivery and give a warning); c) capture the delivery EVs' interactions with other vehicles, bikes, and pedestrians (e.g., near crashes) to provide collision warnings and build safer delivery strategies; and d) quantify delivery operations: efficiency (time and cost), saved delivery emissions (compared to traditional delivery modes), miles traveled, number of packages delivered, number of stops per route, speed, and battery usage; 5) analyze the collected data to quantify the environmental, safety, and accessibility benefits for EV-based first- and last-mile deliveries.

Funding and Expenditures

Public Transportation Agencies 5%

State DOTs 18%

University 27%

US DOT Grant...50%

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	
Total match	2,570,600.00	2,605,200.00	2,574,300.00		15,539,200.00
Total budget	2,570,600.00	2,605,200.00	2,574,300.00		15,539,200.00

Funding Sources - FAST Act
$15.5M USDOT funds + $15.5M match funds

Public Transportation 5%
State DOTs 18%
US DOT 50%
University 27%

- Public Transportation Agencies
- State DOTs
- University
- US DOT Grant

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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