NIATT

University of Idaho
National Institute for Advanced Transportation Technology

Travel during the Pandemic

Annual Report 2019 - 2021

NIATT THEME

"Advancing Transportation Innovations through Research and Education"

NIATT MISSION

To develop engineering solutions (knowledge and technology) for transportation problems in the state of Idaho, the Pacific Northwest, and the United States while preparing our students to be leaders in the design, deployment, and operation of our nation's complex transportation systems.

NIATT VISSION

Our vision is to be one of the premier transportation research and education institutes in the United States.

NIATT is a national leader in developing technology to reduce urban and rural congestion, improve mobility and safety for all users, reduce the environmental impacts of transportation-related operations, and improve the durability and sustainability of the nation's transportation infrastructures.

NIATT faculty and students engage in multidisciplinary research to solve challenging, practical, and relevant transportation problems that have regional and national significance. We create interdisciplinary research and development teams of undergraduate and graduate students that are mentored by our expert faculty. To ensure our work is relevant and responsive to stakeholder needs, we seek collaborative partnerships with transportation organizations in the public and private sectors. These practices engage our students in meaningful, experiential, learning-centered environments that add value to their education.

We integrate our research with the educational mission of the University of Idaho and provide life-long learning opportunities for transportation professionals in Idaho and the Northwest at all levels of practice.

NIATT's work is carried out in the context of a commitment to preserving and protecting natural and pristine environments. Our research on, and development of, clean vehicles, alternative fuels, efficient infrastructure construction and management practices, and efficient traffic control systems contributes to the sustainability of these environments.

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To access an electronic version of this report and to read more about the research, education, and outreach activities, we invite you to visit http://NIATT.org

Credits: Dr. Michael Lowry, Barbara Smith, Marwa Elsayed

From the Director

Greetings from NIATT. This is our first report since the COVID-19 pandemic and, similar to all academic and research institutions, the pandemic and its disruptions to normal operations have had major impacts on NIATT. COVID-19's interruptions to normal face-to-face campus operations, to the availability of international students, and to the State and University economy have all stained available resources. The good news is that by FY21 NIATT has experienced healthy growth in several areas. We started 19 new research projects, and our research expenditures were around the $1.3M mark, exceeding the per-pandemic levels.

The new transportation bill, the Infrastructure Investment and Jobs Act (IIJA), provided great investment in the nation's infrastructure including roads and bridges, rail, transit, ports, airports, the electric grid, water systems, and communication networks providing significant opportunities to NIATT core research areas. A request for proposals was issued this spring for new University Transportation Centers (UTCs) that are authorized as part of the IIJA bill. NIATT submitted proposals to lead four centers in the following IIAJ focus areas: preserving the environment, safety, reducing cybersecurity risks for transportation systems, and infrastructure. Additionally, NIATT was a consortium member in six other applications for national, regional, and Tier-1 centers. USDOT is expected to announce the funded center by mid-November 2022. We continued working with our partners in our two University Transportation Centers (UTCs) that were authorized as part of the Fixing America's Surface Transportation (FAST-Act) Transportation Bill: The Pacific Northwest Transportation Center (PacTrans) and the Center for Safety Equity in Transportation (CSET). PacTrans is led by the University of Washington and includes, in addition to the University of Idaho, Oregon State University, Washington State University, and the University of Alaska- Fairbanks. CSET is a tier-1 UTC that is led by the University of Alaska-Fairbanks and includes, in addition to the University of Idaho, the University of Washington, and the University of Hawaii. The center's mission is to improve the safety and mobility of rural, isolated, tribal, and indigenous communities - a goal that we are all passionate about here in NIATT. In addition to these two UTC centers, our cooperative research program with the Idaho Transportation Department and other state DOTs is also growing.

This annual report highlights research projects from FY19, FY20, and FY21 in our different areas: Transportation infrastructure, traffic operations and control, and clean vehicle technology. It also highlights our educational activities with a special emphasis on our exceptional students and their involvement. While NIATT offers career-building opportunities for our students, it is their contributions that make our work possible and worthwhile. Finally, it has been really an honor and a pleasure serving as NIATT director since January 2014. I believe it is time to hand over NIATT leadership to a new leader. I have been working with the College Administrators to have this transition by January 2023. I am confident that the new NIATT director, soon-to-be selected, will take NIATT to its new level, I, with all other great NIATT faculty, will certainly be around to help.

Ahmed Abdel-Rahim, PhD, P.E.

A word of Thanks to our Advisory Board

John Duval has his MS in Civil Engineering specializing in Geotechnical Engineering from the University of Washington. John Duval has his MS in Civil Engineering specializing in Geotechnical Engineering from the University of Washington. He served as chief of the US Air Force Pavement Evaluation Team. John now has an engineering consultation practice and works with clients to improve roadway and airport pavement systems.

Greg Davisa is a Professor of Mechanical Engineering at Kettering University, formerly known as GMI Engineering & Management Institute, teaching courses in the Automotive and Thermal Science disciplines. Greg received his doctorate in Mechanical Engineering from the University of Michigan in 1991.

Bruce Christensen received his civil engineering degree from the University of Utah in 1994 and has worked in South Central Idaho as the Idaho Transportation Department District as a Traffic Engineer for the last 18 years. He designs and operates traffic signals and studies speed limit changes, developer traffic impacts, and traffic and pedestrian safety concerns. Christensen is a past president of the Institute of Transportation Engineers Intermountain Section (2014).

Phil Rust is currently a traffic engineer with the City of San Diego and a chair on the ITE Standing Committee on Roundabouts. He has previously worked for the Ada County Highway District in Boise, Idaho and for the Washington State Department of Transportation. Phil earned his degrees from the University of Idaho and Washington State University. Phil is an avid runner and ran California International Marathon in 4 hours.

James Colyar is a Transportation Specialist with the Federal Highway Administration. He has been with FHWA for over 15 years and has experience in traffic engineering, analysis and modeling. James enjoys outdoor activities, coaching his son's soccer team, and collecting Pez dispensers outside of work.

Julia Kuhan has participated in and managed several challenging long-range transportation plans, environmental studies, campus master plans, highway corridor plans, and interchange refinement plans. As part of this work, she assisted several jurisdictions in updating their development codes, policies, and ordinances to comply with statewide planning multimodal goals and requirements.

Gary Duncan is the former Chief Technology Officer and currently serves as an Executive Advisor to Econolite. He has over 44 years of experience in the transportation industry. Gary graduated from the University of California Los Angeles (UCLA) with a Bachelor of Science in Engineering in 1970.

Josef Marek Josef Marek is the Transportation Safety Program Manager for Clackamas County, Oregon. He led the effort to create the county's first Transportation Safety Action Plan (TSAP). The plan was adopted by the Board of County Commissioners in 2012. It is the only county in Oregon with an adopted TSAP.

Paul R Olson has been working in Intelligent Transportation Systems since 1980. He graduated with a BSCE from Washington State University and received a Certificate in Telecommunications Engineering. He has worked for Washington State DOT (8 years), Federal Highway Administration (18 years) and as a private consultant (10 years).

John Crockett is the Communication Coordinator for the Biodiesel Education Project. He was with the Idaho Office of Energy Resources for 16 years where he served as Idaho's representative on renewable energy resources and alternative fuels. John holds a B.S. in Mechanical Engineering and a B.S. in Environmental Science and Architecture from the University of Idaho. John enjoys long drives to Boise, camping and yard work.

Zong Tian holds a Ph.D. degree from Texas A&M University. He has been serving as a co-organizer for the International Conference on Traffic and Transportation Studies since 2004. Zong is a member of the Scientific Committee of the World Conference on Transport Research Society (WCTRS).

Michael Kyte is an emeritus professor of Civil Engineering at the University of Idaho. His research focuses traffic signal systems, highway capacity and transportation engineering education. He received his doctorate in civil engineering from the University of Iowa, master's in civil engineering from the University of California – Berkeley, and bachelor's in systems engineering from the University of California – Los Angeles.

Jim Larsen has been with the Ada County Highway District (ACHD) in Boise, ID for the past 22 years. He was the district's traffic operations engineer and is currently the congestion management supervisor. Jim manages the ACHD Traffic Management Center, signal timing staff, and servers for the district's ITS projects. He graduated from Washington State University with a B.S. in Civil Engineering.

Yuri Mereszczak is an associate engineer with Kittelson & Associates, Inc. in Boise, Idaho. His involvement with NIATT began as an undergraduate when offered opportunity to conduct transportation research. Yuri enjoys camping, fishing, golfing, and chasing his two young kids all over town.

Peter Koonce – P.E is a Professor of Mechanical Engineering at Kettering University in Northampton shire. He is the director of the Advanced Engine Research Laboratory, where he conducts research in alternative fuels and engines. Prior to this, he worked as an engineer for both the automotive and electric utility industries.

Ned Parish serves as Research Program Manager for the Idaho Transportation Department. He is responsible for coordinating ITD research, development, and technology transfer activities. Ned also serves on the advisory board for PacTrans, the regional University Transportation Center (UTC) for the Pacific Northwest.

Jerry Whitehead, He established a trailer manufacturing business in Boise four decades ago and continues to serve as President and owner of Western Trailers. He has been a member of the Idaho Motor Carrier Advisory Committee the past 16 years and is past chairman of the Idaho Trucking Association and Idaho Truck Pac Inc.

Brian Walsh is the State Traffic Design Engineer for the Washington State Department of Transportation. Walsh has 32 years of experience in the traffic engineering field. He has been involved in many areas of transportation including traffic signal and roadway geometric design, volume analysis, project delivery, temporary traffic control and pavement markings.

NIATT Faculty, Staff and Students Remember Dr. Sameh Sorour

NIATT's community is remembering Dr. Sameh Sorour, He was an assistant professor in the department of electrical and Computer Engineering. Dr. Sorour passed away on Oct. 6. He was 41.

Dr. Sorour joined the UI from 2016-2019 and was very active in NIATT research. He has been well-respected and well-loved by all NIATT's faculty, staff, and students. His research interests involved the broad areas of advanced communications, networking, computing, and learning technologies for intelligent, autonomous, and cyber-physical systems. Dr. Sorour was a senior IEEE member and an editor for the IEEE Communications Letters and the IEEE Canadian Journal on Electrical and Computer Engineering. He was a prolific author with 50 journal publications in top-tier journals. Dr. Sorour received his B.Sc. (2002) and M.Sc. (2006) degrees from Alexandria University, before earning his Ph.D. from University of Toronto in 2011. Dr. Sorour then obtained a MITACS postdoctoral industrial fellowship to work as an industrial researcher at Siradel Canada in conjunction with the University of Toronto. In 2012 he moved to Saudi Arabia for a year-long postdoctoral research fellowship at King Abduallah University of Science and Technology. He then worked as a lecturer at King Fahd University of Petroleum and Minerals (2013-2016) and as an assistant professor at the University of Idaho (2016-2019). He joined Queens University School of Computing in 2019. Dr. Sorour was married with two young daughters.

Fond Farewell to Retiring NIATT Faculty Members

Fouad Bayomy, Ph.D., 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, the 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, Professor Emeritus of Civil and Environmental Engineering at the University of Idaho

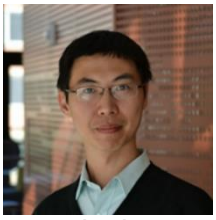
Dr. Sharma obtained his Ph.D. in Civil Engineering from Purdue University, 1986. He Joined the University of Idaho in 1986. His research interest includes computer applications in civil engineering, engineering behavior of saturated and unsaturated soils, stability of slopes and excavations, geotechnical 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, Ph.D. UNIVERSITY OF IDAHO Axel W. Krings is a Professor Emeritus of Computer Science at the University of Idaho.

Dr. Krings 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 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.

Featured Research

Tracking, Mapping, and Modeling Mobility Changes and Business Recovery Amid the COVID-19 Pandemic in the



PI: Haifeng (Felix) Liao, Department of Geography, University of

Since the beginning of the pandemic in 2020, people's daily mobility has been disrupted. The overarching goal of this project is to compile a series of datasets from Google and governmental data sources to track and map cases of COVID-19, mobility changes, and public transit in the Pacific Northwest region amid the pandemic. The aim is to better understand the role played by travel restrictions and mobility changes in mitigating the ongoing spread of COVID-19.

Transportation studies on human mobility before the pandemic are different. Little is known about how this major health crisis affected travel behavior and public transit on the regional level. Studies show that mobility had a decrease in workplace trips plus a decline in public transit ridership trips as well. It is to be noted in large central metropolitan areas, the relationship between mobility and case rates was higher than in rural areas. Studies regarding human mobility in 771 metropolitan areas found a significant reduction in trips to grocery stores and transit stations in compact areas, however, it did not decrease as much in non-essential trips to parks.

Travel pattern data were collected from February through December of 2020 in the PNW region to examine the changes in movement patterns and public transit usage as the monthly average change in visits at the state and the county level, and the daily change at the state and county level. Google tracks six destination types which are retail and recreation, grocery and pharmacy, parks, transit stations, workplace, and residential. However, it does not take into consideration seasonal variations in travel behavior, that's why changes were determined based on January 2020 travel behavior.

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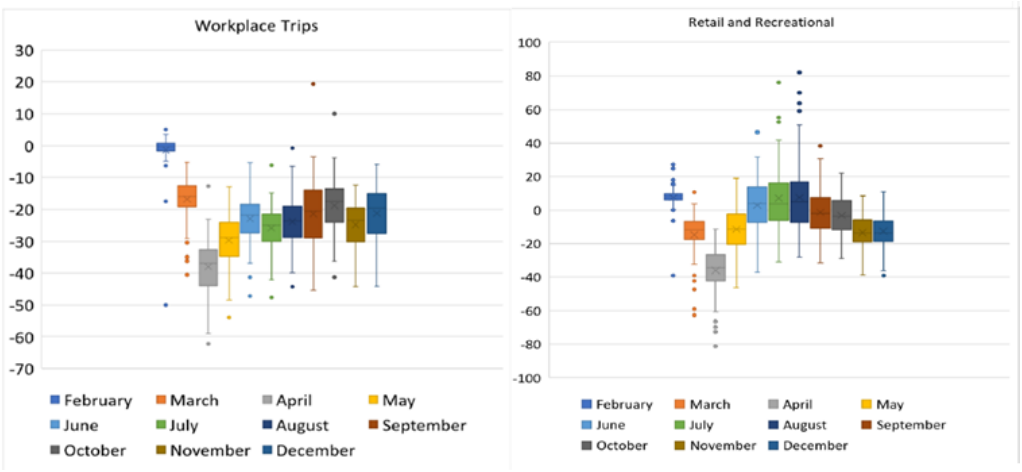
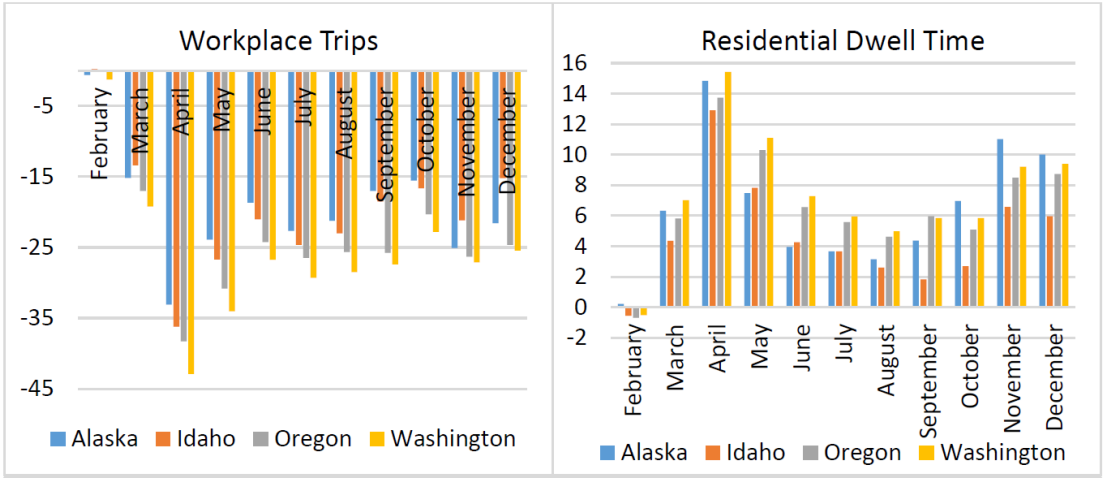
The results in human mobility show commuting and workplace trips decreased starting from February 2020 till the end of the year, with the greatest drop of 35-40% in April. the largest decreases were in Washington, followed by Oregon, Idaho, and Alaska. after October 2020 Idaho became the least affected region.



Monthly average changes in trip visits for both workplace & retail and recreation; relative to the January baseline

Reflecting the impact of the stay-at-home order, the monthly average of people spending time at home increased starting from February 2020 till the end of the year. Retail and recreation trips decreased in all the PNW by approximately 40% since March 2020 then gradually recovered during the summer.

Grocery and pharmacy trips peaked during the beginning of March and then declined sharply till early April. Monthly average park visits peaked during the summer. One county in Washington experienced a nearly 400% increase in park trip visits during the summer.



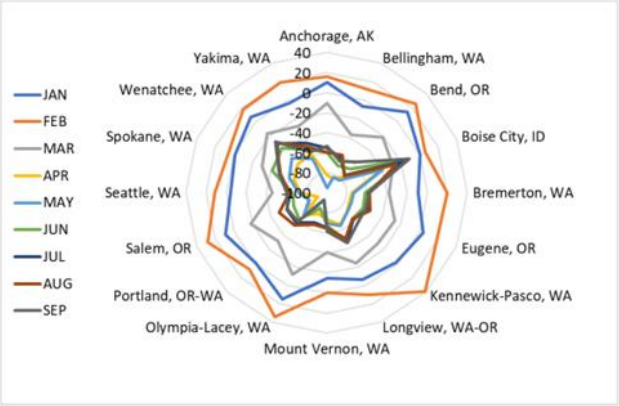
Monthly Changes in trips to six destinations in Alaska, Idaho, Oregon, and Washington; relative to the January baseline

Studying the effect of COVID-19 on public transit modes, found that bike sharing was an important substitute for public rides amid the pandemic. Independent variables have played a role in public transit including education, income, race, household size, and socioeconomic factors. Studies also show that subway ridership was not a statistically significant variable in terms of high infection rates. Public transit modes in the region include rail and non-conventional services, in addition to the most common forms of public transit which are: fixed route buses, demand response, and vanpools. The data were collected from local transit agencies in the PNW region, and state and federal government sources such as Federal Transit Administration.

Analyzing the demand for public transit is represented by the number of transfers made by passengers using a transit mode, and the supply represented by the number of hours that the trip operated to collect fares. In addition to the number of miles covered during that service time, and the number of vehicles that operated during a peak season. It is worth noting the data was collected from full reports in its raw form for absolute reliability.

Studying the effect of social and demographic characteristics and the stay-at-home order on transit ridership based on reports gathered from the community report portal of the Centers for Disease Control (CDC) together with other sources such as the American Community Survey (ACS). This data was used to understand the different diversities of public transit users including total population, percent of poverty, seniors' population percentage, population without health insurance, and the social/COVID-19 vulnerability index. Data for stay-at-home-policies were obtained from *The New York Times* to determine when restrictions were put into effect and the level of those restrictions.

Through analyzing the data, the results showed that ridership began to drop in March and almost diminished in April and May. The recovery rate was very slow during the summer. The drop was very clear in Bellingham, Olympia-Lacey, and Seattle in Washington.



Ridership changes in comparison to the same month in 2019 for all

Counties with highly disadvantaged groups in the PNW exhibited smaller reductions in trips to workplaces due to the nature of their jobs that cannot be done from home. Despite that, African American populations and tribal areas showed a higher reduction in work-related trips, which could be associated with various programs that support minorities on the local level.

Our study suggests that policymakers should continue to invest in transportation and other infrastructure systems to address the inequality gap in society, which may have increased because of the pandemic. Additionally, more attention should be diverted in future studies toward the potential of remote working and its impact on alleviating traffic congestion and job-housing imbalance.

Research Highlights

NIATT Featured Research in Automation

Connected-Vehicle Traffic Signal System Modeling Platform

Principal Investigator

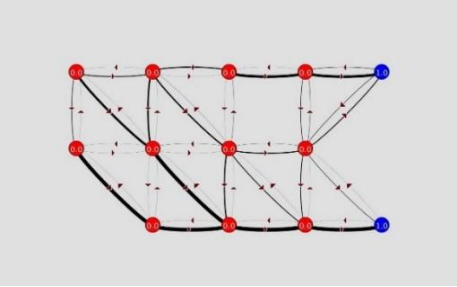
Robert Heckendorn, Computer Science
Ahmed Abdel-Rahim, Civil and Environmental Engineering

Sponsor

Pacific Northwest Transportation Consortium (PacTrans)

Description

Traffic in the cities of the future will be managed by sophisticated signaling systems working in conjunction with networks connected vehicles that share a wide variety of data. A common configuration for information flow is from vehicles on the road to Roadside Units (RSUs) via Basic Safety Messages (BSM). A BSM contains information about position, heading, state of the vehicle, etc. The roadside infrastructure (RSI) may in return convey information about traffic conditions ahead such as the status of signaling. This way the driver may be able to plan better through a richer knowledge of the traffic conditions and transportation infrastructure in which they are embedded. The roadside infrastructure can similarly plan for improved traffic flow and safety.



In this research, we will simulate traffic and the decision making of the RSI including signaling. 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. Aim 2: We will construct an enhanced traffic simulator using the VISSIM traffic simulator creating BSMs to virtual RSUs. Using 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. Project: 851701

A Hybrid Platform for Context-aware V2X Communications

Principal Investigator

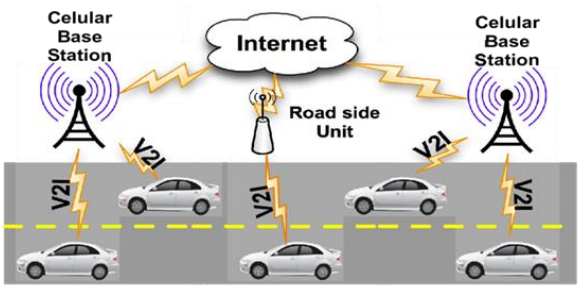
Mohamad Hefeida, Electrical and Computer Engineering
Ahmed Abdel-Rahim, Civil and Environmental Engineering

Sponsor

Pacific Northwest Transportation Consortium (PacTrans)

Description

It's projected that 60% of new light weight vehicle sales will soon have cellular connectivity, many applications based on connected vehicles' technology are often developed without full utilization of the transportation network infrastructure (i.e., Vehicle to Vehicle V2V). The development of each system independently results in adopting different technologies, based on constraints/demands that have many similarities, such as data/congestion management, throughput, and latency. Although the basic communication requirements of transportation networks are rather limited, compared to those of V2V (e.g., autonomous vehicles), there has been little penetration from the communications technology onto transportation networks. On the one hand, the transportation network community along with some automotive manufacturers and government agencies have heavily invested in the well-established DSRC technology. On the other hand, many technology giants and automotive manufacturers are pushing for cellular technology due to its versatility and widespread. Each of these groups have valid concerns and solid reasons and have yet to come to an agreement on technology adoption.



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, and establish a strong interface for the transportation network with other infrastructures (e.g., cellular networks), which will open new horizons for various applications. The proposed platform will collect information from various sources, such as Advanced Traffic Signal Controllers (ATCs), Roadside Unites (RSUs), and Global Positioning System (GPS). Project: 851702

Connected Vehicle Safety Applications

Principal Investigator

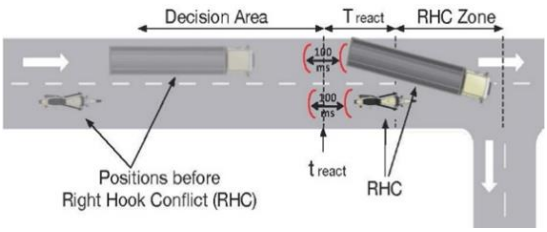
Axel Krings, Electrical and Computer Engineering

Sponsor

Pacific Northwest Transportation Consortium (PacTrans)

Description

For this particular project, the research team will: conduct a thorough scan and document of 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.

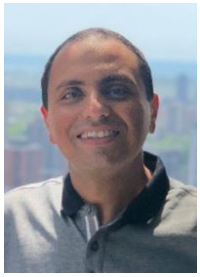


In the context of the project a bicycle safety application to reduce accidents due to Right Hook Conflict is designed and implemented. The bicycle safety application uses information that is exchanged in periodic beacon messages emitted by all vehicles, including bicycles. There are several issues that 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. Project: 851710

Fusion of airborne and terrestrial sensed data for real time traffic monitoring

Principal Investigator

Sameh sorour, Civil and Environmental Engineering
Mohamad Hefeida, Civil and Environmental Engineering

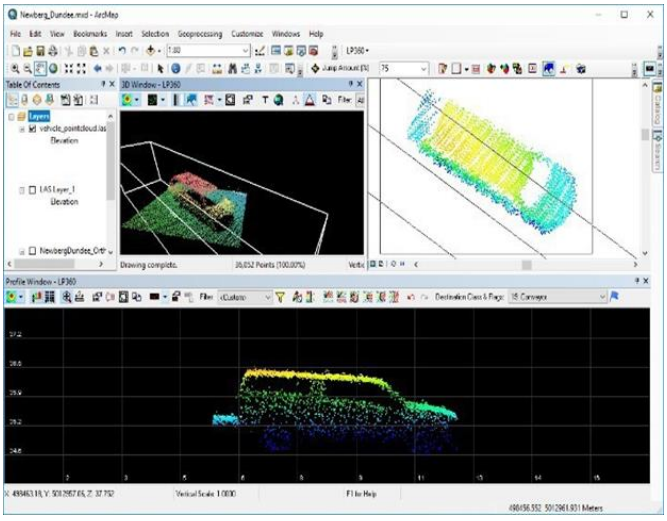


Sponsor

Pacific Northwest Transportation Consortium (PacTrans)

Description

This research project will build upon the project team's current work on real-time object recognition and event extract information from LiDAR scans using UAS on-board processing, while also incorporating a suite of complementary sensors and recent advances in transfer learning and geometry matching techniques. Advanced algorithms will be employed to fuse the objects recognized from multiple sources, increasing the accuracy and robustness of traffic network monitoring and detection of features/events of interest. A key benefit of the terrestrial sensors will be to enable the construction of recognition maps, even when UAS data acquisition is infeasible due to regulatory and/ or logistical considerations.



The proposed solution relies on the collection of recognized objects from the same site by different sensing sources, which are then transmitted to a fusion center. This fusion center will apply transfer learning and geometry matching techniques to both create correspondences between these detected objects (i.e., determine which object corresponds to which other object across the different data sets) and add undetected objects/zones by some of the sources into their proper positions. The final integrated recognition map will provide much richer and more robust information to traffic network controllers, thus enabling data-driven optimization and efficiency for transportation networks. Project: 851724

Hierarchical priority control of signalized intersections in semi connected corridors

Principal Investigator

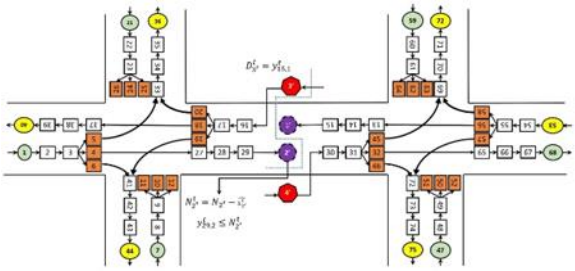
Ali Hajbabaie, WSU, Civil and Environment Engineering
Sameh Sorour, Electrical and Computer Engineering
Ahmed Abdel-Rahim, Civil and Environment Engineering

Sponsor

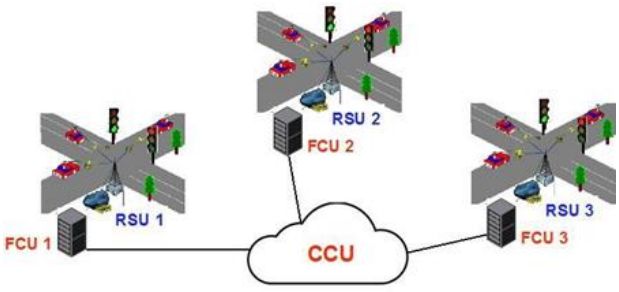
Pacific Northwest Transportation Consortium (PacTrans)

Description

The main objective of this research is to develop efficient distributed yet coordinated algorithms to control signalized intersections in connected and semi- connected (when not all vehicles have connectivity capability or refrain from sharing intentions for privacy reasons) corridors.



The research will enhance traffic signal optimization formulations to allow for the incorporation of connected vehicles and existing point detector data in the models, the distribution of decisions at both the intersection and the corridor levels to reduce computational complexity, and the coordination of control decisions among various intersections by a distributed cloud-fog based communication network to push solutions towards global optimality.



The research will address computation and communication needs required to implement the proposed optimization system in the field by developing, testing, and validating a hierarchical cloud-fog architecture. The proposed architecture allows intersection- and corridor-level optimization algorithms to be performed and control decisions to be communicated to traffic signal system using existing control hardware and communication technology. Project: 851728

Field Evaluation of V2I Connected Vehicle Deployment in Ada County, Idaho

Principal Investigator

Ahmed Abdel-Rahim, Civil and Environmental Engineering

Sponsor

Pacific Northwest Transportation Consortium (PacTrans

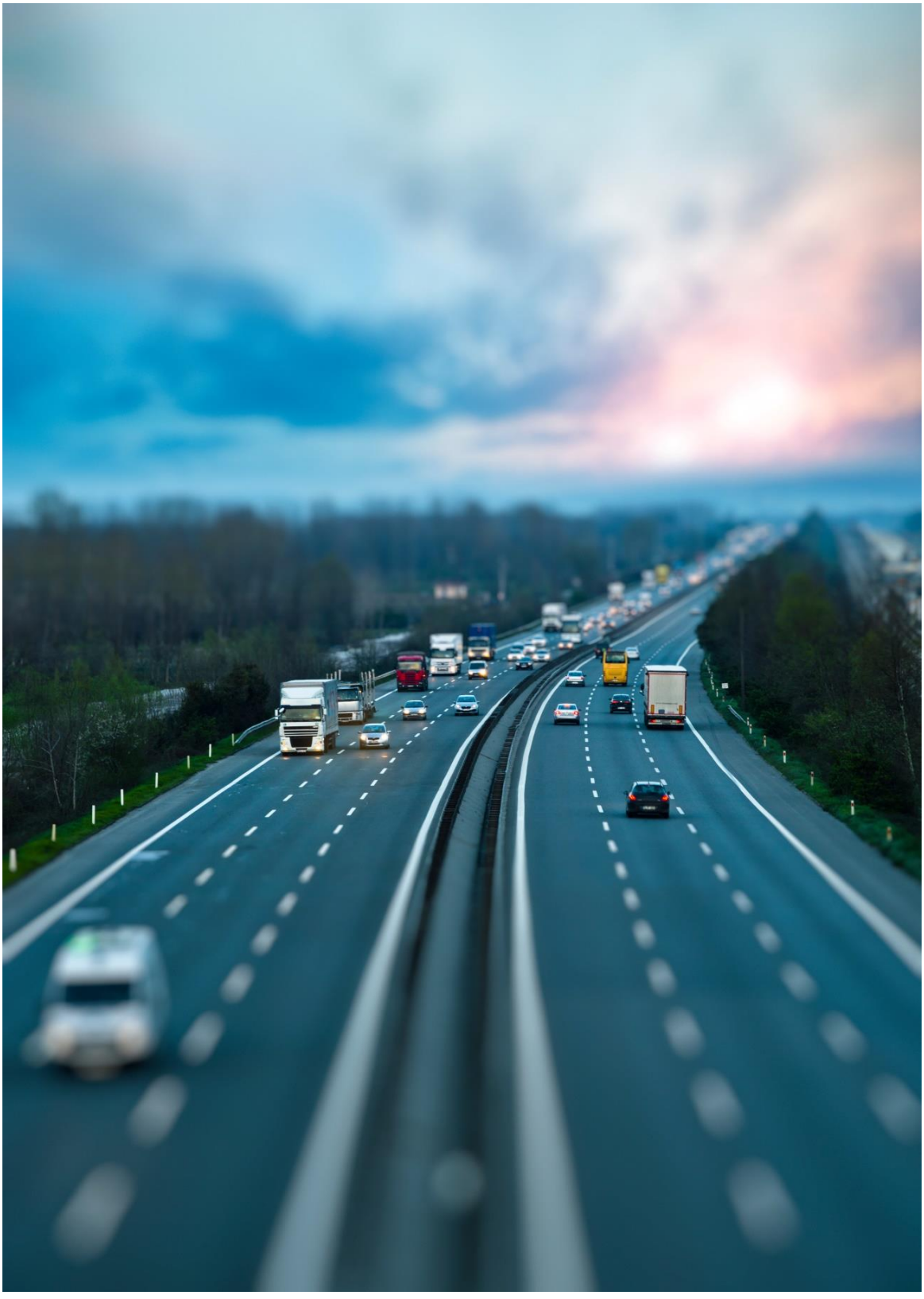
Description

Connected vehicle technologies aim to tackle some of the safety, mobility, and environment challenges our surface transportation system faces and have the potential to transform the way we travel through improved mobility and safety. However, the field implementation of connected vehicle technologies might face several barriers. They require an extensive communication network to support V2I data exchange and the installation of several field devices. Additionally, the legacy traffic control devices, currently running our traffic signal system throughout the nations need to be upgraded to allow for their integration with different connected vehicle applications.

The primary objective of the project is to conduct a field evaluation of a V2I connected vehicle deployment in Ada County, Idaho focusing on validating the communication architecture and control technology readiness for such implementations. The primary focus of the project will be on validating the SDRC data exchange between vehicles, roadside units, and traffic controllers. The project will demonstrate the potential benefits of V2I technology at signalized intersections.

Ada County Highway District (ACHD), the primary agency responsible for operating the Greater Boise Area traffic network is planning to implement vehicle to infrastructure (V2I) technology at 20 intersections as part of the FHWA's SPAT challenge. This V2I interface has two elements of connected vehicle V2I traffic signal system applications: 1) priority for heavy vehicles at signalized intersection approaches and 2) traffic signal system V2I and I2V data exchange. For the heavy vehicle priority application, some selected heavy vehicles, will be equipped with on-board DSRC units, cable of communicating with Roadside Units (RSUs) that are connected to the traffic signal controller at the intersection. The proposed implementation will involve the installation of Dedicated Short-Range Communications (DSRC) radios and an interface device in some test vehicles. NIATT's traffic controller lab, and field evaluation of the two connected-vehicle V2I application. Project: 851938

NIATT Research Highlights



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

Principal Investigator

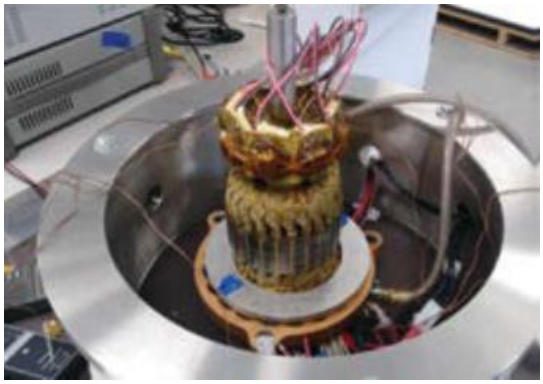
Herbert Hess, Electrical and Computer Engineering

Sponsor

Pacific Northwest Transportation Consortium

In this project, we seek to build, modulate, control, and test the flywheel that we have designed. We will build a toroidal rotor for an "inside-out" field regulated reluctance motor generator (FRRM) that has neither electrical connections nor physical shaft nor bearings. Everything is magnetically interfaced and magnetically supported. A superconducting Halbach Array supports the vertical axis rotor. An absolute encoder provides position and angle in the other five axes. A microcontroller converts this machine information and energy flow data into electrical voltage pulses applied to a stationary core of 24 windings located inside the toroid of the rotor. These modulated pulses provide both field and armature functions through an innovative current modulation. Providing energy from an external source, such as a solar panel or electrical grid, causes our FRRM to accelerate.

Our FRRM is fully reversible, yielding energy to the charging system when customer demand exceeds generation capacity. With no electrical or mechanical connections, but simply magnetic levitation, our FRRM has greater energy efficiency than conventional designs. It operates with a much wider temperature range than batteries. We have all of this performance proven in simulation. The project at hand will make that performance in hardware a reality.



Estimating Bicyclist and Pedestrian Volumes and Crash Exposure with Crowdsourced Data

Principal Investigator

Mike Lowry, Civil and Environmental Engineering

Sponsor

Washington State Department of Transportation (WSDOT

Last year 22% of statewide traffic fatalities were bicyclists and pedestrians and the number has doubled in the past five years from 60 in 2013 to 122 in 2017. The number of serious injuries is also on the rise, despite the well-known fact that bicyclist and pedestrian injuries are extremely underreported. It is possible that the increase is due to increased usage, but there is currently no way to know for sure because, as stated in the Gray Notebook, it is "difficult to estimate the total miles walked and biked because sufficient data about bicyclists and pedestrian traffic volumes have not yet been collected."

Unlike the extensive traffic monitoring program for estimating vehicle volumes that has developed over multiple decades, WSDOT does not have reliable estimates of bicyclist and pedestrian volumes. In recent years WSDOT has made significant progress by installing 50 bike/ped permanent counters throughout the state and has led an annual effort to collect short-duration count data at 280 locations statewide. However, this pales in comparison to the more than 200 permanent counters and 4,000 short duration counts WSDOT uses to estimate vehicle volumes.

Furthermore, bicyclist and pedestrian traffic is more difficult to monitor. Permanent counters need to be located at strategic locations that funnel and detect all users, such as on pathways, but this causes an underrepresentation and lack of information about bicyclists and pedestrians on roadways and sidewalks. Another limitation is that WSDOT's short-duration counts are very short and infrequent (once a year for 4 hours) compared to tube counters for vehicle traffic that WSDOT lays down throughout the year, all day long, and for up to a week. This project will develop new methods to estimate bicyclist and pedestrian volumes using cutting-edge low-cost data collection. Project: 900002

Managing Increasing Demand for Curb Space in the City of the Future

Principal Investigator

Kevin Chang, Civil and Environment Engineering
Anne Goodchild, UW, Civil and Environment Engineering
Ed McCormack, UW, Civil and Environment Engineering

Sponsor

Pacific Northwest Transportation Consortium (PacTrans)

Description

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 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 of 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. Project: 851703

Promoting Positive Traffic Safety Culture in RITI Communities through Engagement

Principal Investigator

Ahmed Abdel-Rahim, Civil and Environmental Engineering

Sponsor

Center for Safety Equity in Transportation (CSET)

Description

RITI crash data analysis clearly highlighted three major areas of concerns: prevalence of exercise speeding, impaired and distracted driving, and underage driving. Specific strategies to reduce motor vehicle crash-related injuries and deaths have been well-documented nationally. Safety-focused educational programs and general awareness campaigns with regard to increased use of occupant restraints, higher visibility traffic enforcement, and stronger laws to address impaired driving have all contributed to reduction in crashes in urban areas. However, in RITI rural communities, where, on average, 30 percent of fatalities occurred due to speeding-related crashes, and 45 percent of all fatalities were related to either impairment and/or distraction and where it is common for children under the age of 16 to drive automobiles in addition to other non-traditional modes of transportation, much more work is still needed.

It is incredibly important that RITI communities are provided the proper resources and methods to deliver the appropriate training and educational tools that promote and cause a significant positive change in the traffic safety culture in these communities. The primary goal of the work proposed in this project is promote and strengthen a positive traffic safety culture among RITI communities in Idaho through active engagement activities.

We aim to achieve the following two objectives: document lessons learned from previous active community engagement activities in tribal and rural communities that attempted to promote and positively impact the traffic safety culture in these communities and develop guidelines for best practices to promote and positively impact the traffic safety culture in RITI communities highlighting both opportunities and barriers. Project: 851711

Assessment of Asbestos Containing Materials Assessment in Idaho Bridges

Principal Investigator

Ahmed Ibrahim, Civil and Environmental Engineering

Sponsor

Idaho Transportation Department (ITD)

Description

ITD bridge section is in need to identify the level of asbestos contamination in their bridges and up to what extent the ACM is dangerous and how to comply with the Environmental Protection Agency (EPA) and the Department of State Health Services (DSHS) Standards in a cost-effective manner. This problem requires a systematic approach to review ITD's past bridge construction and material specifications and bridge plans to determine if known asbestos containing materials were specified for use. Also, a comprehensive review and creation of a database of the results of all asbestos testing that has been done to date on bridges in Idaho will be obtained from the bridge section. The existence of asbestos containing materials in bridge elements such as bearing pads, joints, abutments, concrete rails, and in some concrete coatings subject ITD to a compliance and liability issue especially when it comes to bridge renovations or demolitions. Therefore, more research into understanding of ITD's liability and identifying the extent of problem are believed essential. Other state DOTs such as New York, Texas, Tennessee, and Nebraska have taken actions toward the ACM in their bridge inventory.

The main outcome of this project is to provide ITD personnel with a complete database of all ACM used in Idaho bridges from 1918 to 1980. The proposed research will save ITD personnel a lot of effort, money, and time in identifying ACM in bridges ready for demolition or rehabilitation. If the location of ACM is known, ITD would be able to take steps to dispose of those materials when work is being performed rather than discovering ACM during the project activities. Additionally, it would be possible for ITD to garner funding at times to perform this removal before any demolition or renovation work was performed. Project: 851722

The impact of shared mobility options on travel demand

Principal Investigators

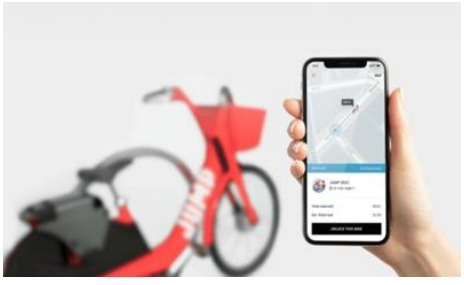
Anne Vernez Moudon, UW, Urban Design and Planning
Jeff Ban, UW, Civil and Environmental Engineering
Mike Lowry, Civil and Environmental Engineering
Qing Shen, UW, Urban Design and Planning

Sponsor

Pacific Northwest Transportation Consortium

Description

The increasing availability of shared mobility options is having a profound impact on travel demand. Smartphone based technology has permitted the rapid spread of bike-, car-, ridesharing, and ride-hailing options, which has impacted how people use traditional travel modes, especially private cars and public transit. Transportation policies urgently need to consider these changes. However, lack of data impedes the objective assessment of both the positive and negative aspects of shared travel options and prevents shaping policies to effectively guide future transportation investments.



The project goal is to use existing travel behavior datasets to identify patterns in the emerging use of shared mobility options. A partnership between the UW and UI, the project will analyze data from several large datasets in Washington and Idaho states, to include data on household travel available from MPOs; employers' data from Commute Trips Reduction program (CTR); longitudinal (2008-2018) data from National Institute of Health sponsored projects in King County; and data from dockless bike share programs. Associated GPS data may also be used to facilitate the analyses (e.g., to identify detailed travel patterns).
Project: 851727

Evaluating Performance of Concrete Overlays for Pavement Rehabilitation

Principal Investigator

Emad Kassem, Civil and Environmental Engineering
Sunil Sharma, Civil and Environmental Engineering

Sponsor

Missouri Department of Transportation (MoDOT

Description

The main objective of this research study is to evaluate, assess, and identify alternative aggregate sources comparable to calcined bauxite that meet the MoDOT HFST aggregate criteria. This objective will be achieved through conducting a comprehensive laboratory experimental testing program following MoDOT's (NJSP-15-13B) criteria along with other proposed tests to assess the frictional properties of alternative aggregates. In addition, the team will evaluate blending calcined bauxite (at various fractions) with alternative aggregates to produce a blend that meets MoDOT's criteria for HFST. Finally, the researchers will also investigate the effect of gradation of alternative aggregates on their frictional performance. The frictional characteristics of HFST and alternative aggregates will be measured using state -of-the-are methods that prove to correlate well with field performance. The team completed several studies on the skid resistance of pavements and has equipment in house needed for the laboratory experiments to access such equipment.

The outcome of this study shall assist MoDOT to identify possible alternative aggregates that provide comparable frictional characteristics to those of calcined bauxite or at least to produce a blend of calcined bauxite and other alternative aggregates that provide comparable performance. Such alternative aggregates or blends shall reduce the demand on the calcined bauxite and utilize more locally available aggregates which would reduce the cost of HFST. In addition, this project will develop a procedure for future screening and testing of potential HFST aggregates. The successful completion of this study will assist MoDOT to enhance road safety by using more HFST at much reduced cost.
Project: 900001

Two-Axle Chassis in Port Operations

Principal Investigator

Ahmed Abdel-Rahim, Civil and Environmental Engineering
Ahmed Ibrahim, Civil and Environmental Engineering

Sponsor

Pacific Coast Container Logistics (PCC)

Description

Intermodal containers are built stronger and tougher than standard trailer because of the stresses they must support during their life of service, and these stresses are expected to be supported by the transportation structures like bridges, roadway pavement, culverts, etc. through which they travel. In most cases, the containers are usually supported and hauled on a two-axle chassis with a limiting gross weight (the weight of the tractor, chassis, cargo, and container tare weight) of 80,000 lbs. as is the case in some states including California. Due to the limitations on the maximum load, there is an increase on the average annual daily traffic (AADT) volume of the intermodal containers to transport goods from one point to the other. To reduce the AADT which directly causes distress and damages to transportation infrastructures, an additional axle might be added to the current two-axle chassis to distribute the loads on more axles that results in less load per axle or by increasing the maximum load beyond the current 80,000 lbs.

Therefore, the primary goal of this project is to assess the potential safety and operational impacts of increasing the maximum gross weight of the two-axle chassis beyond the current State of California limit of 80,000 lbs. The study will be conducted through an in-depth finite element analysis of load distribution, safety analysis and operational performance in addition to cost benefits to users. The outcome of this study will assist policy makers on the need to increase the load capacity of intermodal containers' two-axle chassis. Project: 851709

Development of a Gyratory Stability Index to Evaluate Variation of RAP Content and Rutting Resistance of Asphalt Mixtures

Principal Investigator

Emad Kassem, Civil and Environmental Engineering
Fouad Bayomy, Civil and Environmental Engineering

Sponsor

Idaho Transportation Department (ITD)

Description

Currently the Superpave mix design is conducted without performance tests to evaluate the resistance of asphalt mixtures to rutting. The ITD RP 175 developed a mathematical algorithm for determining a Gyratory Stability (GS) index for asphalt mixtures. The GS index describes the ability of asphalt mixtures to resist rutting, and it is determined during the mix design stage using the gyratory compaction data. However, the current GS index algorithm was developed for the Servopac gyratory compactor. Currently, ITD uses the Pine gyratory compactor that includes a shear measurement device.

Therefore, it is essential — for the evaluation of mixes by means of the Pine Gyratory Compactor — to develop a modified mathematical algorithm for GS index applicable to the Gyratory compactor with model AFG2AS. The GS index can then be used to evaluate the resistance of Idaho mixtures to rutting during the mixture design stage. More importantly, the researchers will examine the sensitivity of this index to the RAP content in asphalt mixtures. If proved successful, this index can then be used as an indirect indicator of variation of RAP content in asphalt mixtures when placed in the field. Thus, the material engineers can use the GS index as a tool to find out if the RAP content in a given mixture exceeds the allowable percentage.

The main objective of this project is to develop a GS index for asphalt mixtures using Pine compactor. The research will evaluate the use of GS index as a tool to check the variation of the RAP content in the mix. Thus, one can use the GS index to detect if an asphalt mixture contains a higher percentage of RAP than the design content. In addition, the researchers will evaluate the use of the GS index to evaluate the resistance of the asphalt mixture to rutting. Project: 851721

Development of a Prediction Model for Pavement Temperature

Principal Investigator

Emad Kassem, Civil and Environmental Engineering
Fouad Bayomy, Civil and Environmental Engineering

Sponsor

Idaho Transportation Department (ITD)

Description

The falling weight deflectometer (FWD) is used to calculate the moduli of pavement layers. The pavement temperature is used to adjust the back calculated asphalt concrete moduli. Measuring the mid-depth pavement temperature is a required step in FWD testing. The current practice at ITD is to drill holes at the mid-depth of the top asphalt layer every three miles along the testing route a day before FWD testing.

Then, mineral oil is added before covering the hole. ITD crew measures the temperature of the mineral oil in the holes before FWD testing. Drilling holes the day before FWD testing requires traffic control that causes traffic delays and puts the ITD crew in the line of traffic. In addition, although this procedure provides accurate measurements for the mid-depth pavement temperature at the locations of the holes, the crew uses interpolation to predict the temperature at locations between holes since they are drilled every three miles. This may result in inaccurate pavement temperature This project aims to expedite the FWD testing and operations by eliminating the need for drilling holes for measuring mid-depth pavement temperature a day before testing. The objective of this project will be achieved by developing a procedure that can be used by ITD crew to predict the mid-depth of pavement temperature as a function of pavement surface temperature, which can be measured using an infrared thermometer, and the high and low air temperatures the day before testing, which can be obtained from weather records. It is expected that such a procedure would save a lot of time and resources for ITD required for traffic control and drilling holes the day before testing. In addition, it will improve the safety of the ITD crew and improve the accuracy of mid-depth pavement temperature at locations where no holes are drilled. Project: 851723

Deterioration of green conflict paint for bicycle facilities

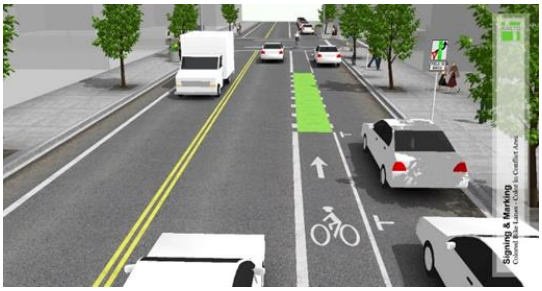
Principal Investigator

Emad Kassem, Civil and Environmental Engineering
Mike Lowry, Civil and Environmental Engineering

Sponsor

Pacific Northwest Transportation Consortium
(PacTrans)

Description



Throughout the country many communities are using "green conflict" paint to improve bike lane visibility. The MUTCD is awaiting research about material (water-based vs thermoplastic), design (pattern), chromaticity (color specification), and retroflectivity specification. The performance of some pavement markings can be degraded significantly after a short time of service. New pavements markings may even have unknown performance until they are used on roads.

Research is needed for green conflict paint to examine its durability and optimal performance. Research is needed to verify whether dashing has the added benefit of providing better friction for motorists and bicyclists or not. If this is true, then perhaps solid paint should not be used near the stop bar or at any location where bicyclists are expected to stop suddenly. Friction should be tested under varying degrees of deterioration, weather conditions, and paint materials.

We will test different green paint products (e.g., water based and thermoplastic) under varying levels of simulated traffic and snow removal agitation. We will document at least seven measures of effectiveness (MOEs) including friction, texture, color, luminance, percent loss, and retroreflectivity. We will use a three-wheel simulator under different loadings to simulate varying levels of traffic. The MOEs will be assessed under simulated weather conditions wet, dry, and snowy (low temperature slush). Friction will be analyzed for solid design and dashes. Additionally, we will inspect the installation of green conflict paint in the field. The City of Moscow has scheduled installation at eight intersections along a one-mile section of a minor arterial. Project: 851725

Taming and Tapping the Bike Share Explosion

Principal Investigator

David Pimentel, College of Law
Mike Lowry, Civil and Environmental Engineering
Ron Pimentel, WSU, Marketing and International Business

Description

The Pacific Northwest is experiencing an explosion of bike share systems (BSS). Every major city in the region has at least one BSS company operating, and many cities are exploring how to effectively introduce or expand this new form of mobility. While there is considerable promise for our region, serious barriers persist; indeed, Seattle's first venture with BSS collapsed after only two years—a failure that cost the city $2.2 million dollars. In the summer of 2017, three new companies hit Seattle with a novel technology and business model called "dockless". They blanketed the city with 10,000 dockless bikes and in the first six months had huge success with over 350,000 trips totaling more than 1 million miles.

Nevertheless, this new technology brings new challenges, which in some cities has included legal problems, negative public reaction, and stress on the transportation system.

The goal of this project is to improve system-wide efficiency for residents and visitors to our region by studying the legal framework, infrastructure needs, and consumer perceptions of BSS. We will identify travel service gaps that BSS can alleviate. We will produce guidance and tools (legal, business, and engineering) that cities, states, and other organizations can use to leverage BSS mobility. We will pursue this study from a system- wide perspective to identify how BSS can complement other modes of transportation, such as ride-hailing services and public transportation, to effectively improve multimodal connections. Project: 851726

Barriers and Opportunities for Using Rail-Trails for Safe Travel in Rural, Isolated, and Tribal Communities

Principal Investigator

Mike Lowry, Civil and Environmental Engineering
Kevin Chang, Civil and Environmental Engineering

Sponsor

Center for Safety Equity in Transportation (CSET)

Description

In the United States more than twenty thousand miles of defunct railroads have been converted to trails for pedestrians and bicyclists. Many rail-trails are located near communities that are rural, isolated, and tribal, yet often users are not residents, but rather affluent visitors from urban areas using the trails for recreation and tourism. For example, the Trail of the Coeur d' Alenes is a 72-mile, paved trail that starts on a tribal reservation and passes through various rural towns.

Does this trail best serve the transportation needs of the local population? Are there potential safety concerns at certain intersections or highway crossings that prevent wider use? Is the trail alignment matched with the daily commute of residents and of those with more utilitarian travel patterns? Are there physical or policy barriers that restrict snowmobile and ATV travel? Are there new or potential technologies, such as e-bikes, that might make the trails more attractive for long-distance travel between rural and isolated communities?

This project will: 1) develop and plan for documents that identify “best practices” that are relevant to RITI communities, 2) collect and obtain data that has not previously been used of existed, and 3) establish and nourish relationships so that residents and local communities will be willing to share information and invite the research team to listen. This project aims to build capacity to support local engagement in planning, decision-making, and resource allocation. Project: 851731

Mobility Implications of School Crossing Guard Programs and Walking Route Maps

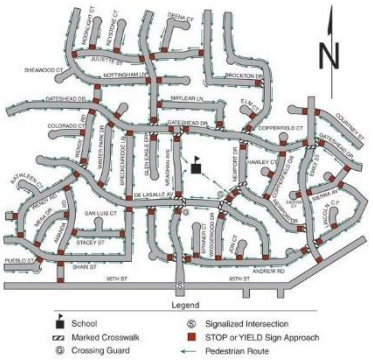
Principal Investigator

Kevin Chang, Civil and Environmental Engineering

Sponsor

Pacific Northwest Transportation Consortium (PacTrans)

Description



The purpose of this project is to determine how school crossing guard programs and the use of school walking route maps influence walking to school behavior by elementary school-aged students. In 1969, 50% of childrenwalked or biked to school, including 87% of those living within one mile of their destination. By 2009, fewer than 15% walked or biked, including only 50% of those living within one mile of school [Safe Routes to School National Partnership]. This reduction is correlated to a number of societal contributors including dual- income parents who have less time to accompany their son or daughter to and from school and a reluctance by parents to allow their children to walk or bike to school due to concerns with regard to child safety and security.

As an overall result, the school transportation-related ramifications include increased traffic near schools and missed opportunities for physical fitness by children in a time of increased childhood obesity. Fundamentally speaking, a change to these trends requires both healthy living and good habit-forming behavior by the next generation of young people and fostering non- motorized transport in the form of walking or bicycling to school as a Kindergarten to Grade 5 (K-5) student is an important

This research aims to examine two specific components of walking and bicycling to school programs: 1) the formation, operation, and effectiveness of crossing guard programs and 2) the development, distribution, and usage of walking and bicycling to school walking route maps. The states of Washington and Idaho will serve as a baseline to determine if external factors such as legislative mandates drive certain policies and correspond to changes in behavior. To complete this research study, a literature review will be initially conducted and will be followed by an analysis of existing data, interviews with school principals and administrators, site assessments, and the development of a final report. Project: 851939

Implementing AASHTO TP 110 for Alkali-Silica Reaction Potential Evaluation of Idaho Aggregates

Principal Investigator

Emad Kassem, Civil and Environmental Engineering

Sponsor

Idaho Transportation Department (ITD)

Description

The reaction between the active silica constituents of aggregates and alkalis in cement in the presence of moisture is called Alkali-Silica Reaction (ASR). ASR forms a swelling gel which can expand and cause internal stresses in cementitious materials leading to cracking, loss of strength, and eventually failure. Many aggregate sources in Idaho have high ASR potential, thus suitable test methods should be adopted to evaluate the susceptibility of Idaho aggregates to ASR, and to select appropriate mitigation strategies. The ASTM C 1293 test method was found to provide strong correlations to field performance in terms of the susceptibility of aggregates to ASR. However, this test takes one full year to complete

The ASTM C1260 takes only 14 days to complete. However, due to the harsh testing conditions of the ASTM C1260, aggregates with good field performance and very low ASR potential may be incorrectly classified as a reactive aggregate. Recently, a new test procedure, AASHTO TP 110 has been developed to overcome the shortcomings of the ASTM C1260.

The test takes about 56 days to complete, with an additional 28 days needed in the case of slow-reacting aggregates. This method can be used to optimize the mix design (e.g., replacing a portion of cement with secondary contentious materials such as fly ash and slag, adjusting w/c ratio, etc.) to produce a mix that has better resistance to ASR.

The main objective of this study is to evaluate advantages associated with implementing AASHTO TP-110 within ITD specifications to quantify the ASR potential of aggregate sources in Idaho. The baseline ASR susceptibility for Idaho aggregates will be established. ASR potentials quantified through the AASHTO TP-110 procedure will be evaluated in light of ASTM C1293 and ASTM C 1260 (AASHTO T 303) test results. Project: 851929

Operational Safety of Gravel Roads in Rural and Tribal Communities

Principal Investigator

Ahmed Ibrahim, Civil and Environmental Engineering

Sponsor

Center for Safety Equity in Transportation (CSET)

Description

Of the 4.1 million miles of federal and state highways in the U.S., 2.2 million miles (or 54%) are unpaved, gravel roads. In the Pacific Northwest and Alaska, unpaved gravel roads provide critical transportation access, with some communities relying on just a single highway for access into and out of town. In such cases, these highways become a critical component of the infrastructure, and there is a need to ensure that safe access is always available to the communities.

To maintain a high level of access, the following data regarding these unpaved, gravel roads must be collected: (1) geometric alignment, (2) width, including shoulders, (3) condition of the unpaved surface, (4) impact from unusual highway loads, (5) impact from geo-hazards, (6) susceptibility to flood events, and (7) influence of adverse weather conditions.

This study plans to use the Idaho highway database to identify unpaved, gravel roads in Idaho that are critical for access to rural communities. Once identified, information regarding their existing condition (items 1 to 3, above) will be used to assess their vulnerability other impacts (items 4 to 7, above). Much of this initial evaluation will rely on information that is readily available in the database. To complete the first phase of the proposed project, we plan to perform a pilot study of a couple unpaved, gravel highways using field data.

The procedures developed for this comprehensive evaluation will provide guidelines for evaluating the remaining critical routes, which should provide a valuable database of these critical assets. The investigators will use the data generated from this project to develop a comprehensive gravel roads rating system on a five years' plan. Project: 851932

Documenting the Characteristics of Traffic Crashes for RITI Communities in Idaho

Principal Investigator

Ahmed Abdel-Rahim, Civil and Environmental Engineering

Sponsor

Center for Safety Equity in Transportation (CSET)

Description

This project documents the characteristics of traffic crashes in RITI communities in Idaho and establishes an in-depth understanding of the baseline traffic safety conditions in RITI communities. This is an important first step towards the ultimate goal of improving safety for these underserved groups through research, education, and outreach activities. The project has the following three objectives: 1) identify and document different sources of crash data for RITI communities in Idaho, 2) conduct an in-depth five-year crash analysis (2012-2016) to document the characteristics of traffic crashes in RITI communities using the Idaho Transportation Department's (ITD) WebCars crash data tool, and 3) identify and document different sources for traffic exposure data (vehicle-miles-travelled) for RITI communities in Idaho

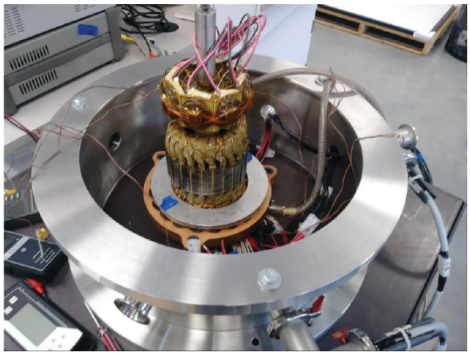
The project activities will help enhance the understanding of the impact factors that affect rural traffic crash frequencies and severities, and how these factors vary over time and across regions. The project outcome will also help identify crash causation factors and effective countermeasures to crashes involving RITI communities. Data generated through this project will allow CSET researchers to measure the center's performance and its overall contribution to RITI transportation safety and help aid and guide the state's efforts to improve safety on Idaho's RITI roadway network through the identification of effective crash countermeasures that have the highest possible return on investment for these communities. Project: 851934

Advanced Energy Storage System for Electric Vehicle Charging Stations for Rural Communities in the Pacific Northwest

Herbert Hess, PhD

Background

The context for this project an improved system for charging electric vehicles (EV) in remote locations. We have an ongoing project with a public electrical utility to create a network of billable charging stations, some of them in remote locations without grid electrical power. Such remote charging stations need energy storage because remote energy sources, usually renewables, cannot instantly meet customer demand. Batteries are the incumbent technology, but flywheels are often better for harsh environments and for longevity. We created such a flywheel-based energy storage system for NASA to serve on the surface of the moon. We have promising performance observed in simulations and in building small scale, partial prototypes. We have captured energy from solar panels and fed it successfully into a mock electromechanical interface of our flywheel. We have designed and simulated a completely unprecedented form of a reluctance machine with a magnetically levitated, bearingless, and shaftless rotor. In simulation, it promises better efficiency and better energy storage per unit volume than conventional designs. We have created a modulation algorithm that shows excellent promise in driving the rotor to store energy on command. This project has the background to make this unique and promising machine a reality.



Research Project

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

ABOUT THE AUTHORS

The research team consisted of Herbert Hess of the University of Idaho.

ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the University of Idaho.

EXPECTED DATE OF COMPLETION

August 2022

FOR MORE INFORMATION

http://depts.washington.edu/pactrans/research/projects/advanced-energy-storage-system-for-electric-vehicle-charging-stations-for-rural-communities-in-the-pacific-northwest/

Characterization of Underserved Population Perceptions and Mobility Needs in Connected-Vehicle and Smarter City Environments – Phase V

Ahmed Abdel Rahim, PhD, David Hurwitz, PhD, Billy Connor, PhD, Eric Jessup, PhD, Jeff Ban, PhD

Background

PacTrans has structured its research activities, as part of the FAST Act mobility center, around four main themes: 1) mobility innovations to improve accessibility for all transportation users; 2) mobility innovations to improve system-wide efficiency; 3) mobility innovations to improve reliability across modes; and 4) ross-cutting theme on Data-Driven Methods in Transportation. To support these themes, PacTrans has funded a total of fourteen multi-institution collaborative research projects and forty-four single institution research projects in the three-year period covering (2017-2020). The main goal of year 4 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.

Research Project

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

ABOUT THE AUTHORS

The research team consists of one member from each of our five consortium research partner institutions.

ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the University of Washington, Oregon State University, the University of Idaho, the University of Alaska Fairbanks, and Washington State University.

EXPECTED DATE OF COMPLETION

March 2022

FOR MORE INFORMATION

https://depts.washington.edu/pactrans/research/projects/characterization-of-underserved-population-perceptions-and-mobility-needs-in-connected-vehicle-and-smarter-city-environments-phase-v/

Development of PacTrans Workforce Development Institute - Phase IV

Yinhai Wang, PhD, Wei Sun, PhD, Shane Brown, PhD, Kevin Chang, PhD, Billy Connor, Eric Jessup, PhD

Background

With support from WSDOT, other transportation agencies, and the former form of the Region 10 University Transportation Center (UTC), the Civil and Environmental Engineering (CEE) Department at the University of Washington (UW) had operated a very popular continuing education program called TRANSPEED, which brought transportation engineering's professional training and continuing education to governmental agencies and private firms. It generated huge national influence by conducting 50 workshops annually that serve over 1,400 students. Although the TRANSPEED program was popular and far-reaching, it was badly hit by the most recent financial crisis.

However, with the recent technology development and applications in transportation practice, such as Connected and Autonomous Vehicles (CAVs), smart cities technologies, the demand for continuing education and workforce development is getting even stronger. In order to fulfill the gap, in 2016, a new dialog started between transportation agencies and PacTrans to re-establish a new workforce development program to address the critical workforce development needs of transportation agencies and companies in the Pacific Northwest.

Research Project

To gain a better understanding of the existing training or professional development needs within Region 10 (i.e., Idaho, Alaska, Oregon, and Washington), the research team conducted qualitative, structured interviews with transportation engineers, managers, and learning coordinators, and synthesized the findings to generate an online survey tool for broader distribution. In addition, the research team designed the administrative structure and business model that ensure sustainability, efficiency, and quality of the proposed program, and the collaboration with existing programs in Region 10. The research team is currently in the process of launching the workforce development institute through delivering training courses/ programs to working professionals in Region 10. Specifically, the research team will focus on the following tasks:

- Adding new courses/certificate programs and improving the existing education platform. The team is developing an online training platform and include new training courses and certificate programs that cover more topics with critical training needs. In addition, the research team will integrate previous education research products into the education platform and evaluate various methods for the delivery of training services.
- Improving assessment and evaluation processes for training courses and the overall program of the PacTrans WDI. The research team proposes to develop a guidebook including course development processes with carefully designed learning outcomes and associated learning activities, active learning strategies, reliable assessment and evaluation processes of learning, and overall program and course evaluation.
- Outreach and marketing plan of the PacTrans WDI. In order to make the institute sustainable, the research team proposes to develop the effective outreach and marketing plan to help to develop long-term collaboration with existing connections and explore new opportunities with local DOTs and other transportation.

ABOUT THE AUTHORS

The research team consists of one member from each of our five consortium research partner institutions.

ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the University of Washington, Oregon State University, the University of Idaho, the University of Alaska Fairbanks, and Washington State University.

EXPECTED DATE OF COMPLETION

August 2022

FOR MORE INFORMATION

http://depts.washington.edu/pactrans/research/projects/development-of-pactrans-workforce-development-institute-phase-iv/

Efficient and Data-Driven Pavement Management System using Artificial Intelligence

Billy Connor, Emad Kassem, PhD.

Background

Pavement management systems (PMSs) are used by transportation agencies to determine cost-effective strategies for pavement preservation and maintenance at the network level. A large amount of data is collected as part of this process, including road location, climate, geometry, surface/structural characteristics, material properties, traffic level, and others. This information is processed using analytical-based methods to predict future pavement conditions and program treatments. However, this approach does not make complete use of the available information while focusing on a single aspect (e.g., roughness). Moreover, due to the increasing complexity and scale level of collected data, the current methods are unable to provide accurate pavement assessment and optimal intervention strategies. Recently, Artificial Intelligence (AI) has been used, as a powerful tool, to examine large datasets that are often very challenging to be analyzed by conventional methods and derive helpful correlations and models. These can be used to assist scientists and engineers in the decisional process.

Research Project

AI is underutilized in the current PMSs; therefore, this study aims to provide State DOTs in the Pacific Northwest with advanced AI-data-driven solutions to make informed decisions for pavement preservation and rehabilitation strategies. To achieve the main goal of this study, the following tasks are sought:

- Conduct a comprehensive review of the state of the practice on the use of AI in PMSs.
- Collect pavement management data currently available at State DOTs in the Pacific Northwest as well as at the Long-Term Pavement Performance (LTPP) database for pavement conditions at the national level.
- Evaluate the most promising AI approaches based on the findings of the literature search to process the collected data and to be next incorporated into the PMS.
- Develop an AI-based pavement management tool that incorporates engineering, economy, environment/climate, policy, and other information and provide data-driven solutions for optimal, cost-effective, and efficient pavement preservation and rehabilitation strategies.
- Prepare guidelines on the proposed AI-based PMS to facilitate its implementation at the DOT level.

The proposed research is expected to lead to the implementation of an innovative PMS that provides precise and effective selection of intervention strategies ultimately resulting in more sustainable and resilient road infrastructures.

ABOUT THE AUTHORS

The research team consisted of Billy Connor of the University of Alaska Fairbanks, and Emad Kassem of the University of Idaho.

ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the University of Alaska Fairbanks, and the National Institute for Advanced Transportation Technology.

EXPECTED DATE OF COMPLETION

March 2022

FOR MORE INFORMATION

https://depts.washington.edu/pactrans/research/projects/efficient-and-data-driven-pavement-management-system-using-artificial-intelligence/

Estimating County to County Transportation and Trade Flow

Mike Lowry, PhD, Philip Watson, PhD, Greg Alward

Background

Knowing what commodities are supplied and demanded within a region does not necessarily correspond to knowing where the commodities consumed within a region are produced. This difference relates primarily to inter-regional trade that is outside the region at the regional level but inside at the higher level of regional aggregation. This outside-inside the region final demand distinction makes aggregating regional results to the national level problematic. A solution to this problem lies in a derivation of a multi-regional input-output model.

Research Project

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

ABOUT THE AUTHORS

The research team consisted of Mike Lowry, Philip Watson, and Greg Alward of the University of Idaho.

ABOUT THE FUNDERS

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FOR MORE INFORMATION

http://depts.washington.edu/pactrans/research/projects/estimating-county-to-county-transportation-and-trade-flow/

Evaluation of the Idaho (Bicycle) Stop Laws in the Pacific Northwest

David Hurwitz, PhD, Kevin Chang, PhD, Rhonda Young , PhD

Background

During the 2019 legislative session, the Oregon legislature passed a bill legalizing a similar law to the "Idaho Stop" that became effective January 1, 2020 (OSL, 2019). The new Oregon law allows any bicyclist approaching an intersection regulated by a stop sign or flashing red light to proceed through the intersection without stopping. Under this new law bicyclists are required to yield to traffic and pedestrians in the intersection and cannot proceed if doing so creates an "immediate hazard". The name "Idaho Stop" refers to a similar law that was passed by Idaho's Legislature in 1982. The

Idaho law was amended in 2006 to change the treatment of traffic signals by bicyclists from a yield condition to a stop-then-yield except for right-turning cyclists, which remained a yield condition (Bicycle Law, 2009). The states of Delaware, Arkansas, and parts of Colorado have implemented various versions of the Idaho Stop. Washington Bikes, a statewide bicycle advocacy group in Washington State, listed the "Safety Stop" (Idaho Stop) as its second highest priority issue for the 2020 State Legislative Session (Washington Bikes, 2019). Washington State Senator Billig (representing Spokane) and Representative Fitzgibbon (Burien) were prime sponsors in the Senate and House, respectively, for a bill implementing the proposed "Safety Stop" which would have been similar to the law in Oregon and apply only to stop signs.

Research Project

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

ABOUT THE AUTHORS

The research team consisted of David Hurwitz of Oregon State University, Kevin Chang of the University of Idaho, and Rhonda Young of Gonzaga University.

ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the Oregon State University, the National Institute for Advanced Transportation Technology, and Gonzaga University.

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FOR MORE INFORMATION

http://depts.washington.edu/pactrans/research/projects/evaluation-of-the-idaho-bicycle-stop-laws-in-the-pacific-northwest/

Impact of Autonomous and Connected Truck Platoons in the Pacific Northwest on Transportation Infrastructure

Ahmed Ibrahim, PhD

Background

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 literature lacks major information about the impact of truck platooning on the superstructure and substructure system. However, platooning may accelerate the damage accumulation of pavement and bridge structures due to the formation of multiple load axles within each platoon. The potential damage of infrastructure may arise due to various factors such as the number of trucks in a platoon, gap spacing between trucks and the configuration (similar or dissimilar) of truck platoons and many other factors are not clear in the literature. This damage if accumulates, will cost the country billions of dollar to fix and will affect the mobility of people and goods. The goal of this project is to develop a well-defined framework and data-driven solution of the influence of platooning on existing bridges in the Pacific Northwest to be ready for the near future implementation of ACTs and to preserve the current bridge inventory. The results of this project will be used to develop integrated load rating approach and a preliminary tool and new policies, and standards for professional practitioners.

Research Project

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. The results of this proposal will answer the following questions:

1. How long a platoon can be before it begins to pose unacceptable risks to the traveling public?. For instance, if a platoon is exiting an highway, how does that affect other traffic access to the same exit? Will the exit ramp accommodate the platoon length?
2. What happens if a platoon backup onto a bridge?
3. Will a platoon of trucks consist of similar configurations (number of axles with the same axle loading) or mixed configurations will be permitted?
4. What is the minimum gap spacing between trucks? and the minimum spacing between platoon and non-platoon?
5. In addition, the stress range and the number of load cycles caused by a platoon may accelerate shorten the service life and deterioration of the bridge. This will increase bridge maintenance and rehabilitation activities overwhelming bridge owners.

ABOUT THE AUTHORS

The research team consisted of Ahmed Ibrahim of the University of Idaho.

ABOUT THE FUNDERS

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EXPECTED DATE OF COMPLETION

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FOR MORE INFORMATION

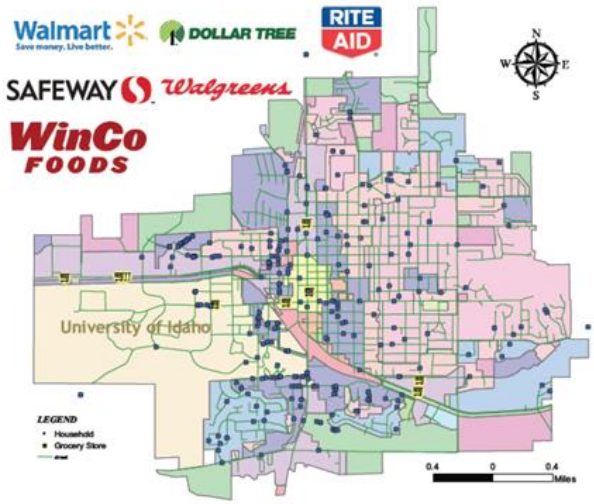
https://depts.washington.edu/pactrans/research/projects/impact-of-autonomous-and-connected-truck-platoons-in-the-pacific-northwest-on-transportation-infrastructure/

Integrating Foot Access with Public Transit Service to Explore where there are Food Deserts

Felix Liao, PhD

Background

Access to healthy food retailers remains a pressing issue in the U.S. and might have become a more serious problem amid the COVID-19 pandemic. Many studies have found that neighborhoods with high accessibility to healthy food retailers tend to have healthier food consumption habits and outcomes (e.g., lower likelihood of obesity and chronic diseases such as cardiovascular disease). However, it should be noted that the issue of food deserts can hardly be mitigated by solely steering new supermarkets or community gardens to low-income neighborhoods. Recent studies show that the key solution to food access would be more closely tied to transportation planning or the issue of accessibility. Neighborhoods with low accessibility to healthy food retailers are often associated with lower levels of car ownership. Residents living in this type of neighborhood might not be able to afford high transport costs for grocery shopping and probably prefer to purchase fast food nearby. Therefore, public transit could provide new opportunities to enhance accessibility to healthy food retailers and is considered a cost-effective way to mitigate mobility constraints of disadvantaged groups with respect to food access.



Research Project

The goal of this research is to quantify and better understand accessibility to healthy food retailers. The new $1.2 trillion infrastructure bill calls for a transportation system that provides equitable access to jobs and critical amenities, such as schools, daycare, and healthy food opportunities. The U.S. Department of Agriculture (USDA) has called for the mitigation of food deserts which they define as "urban neighborhoods and rural towns without ready access to fresh, healthy, and affordable food". This project aims to do the following:

- Identify spatial and temporal patterns of transit-based accessibility to healthy food retailers
- Estimate travel times at the census block group level to create a new food desert index
- Statistically evaluate socioeconomic disparities between residents living in neighborhoods with low access to healthy food retailers and the citywide average
- Develop an open-source toolkit in ArcGIS Pro, which enables planners to integrate data on transit services and food retailers' characteristics in other cities.

ABOUT THE AUTHORS

The research team consisted of Felix Liao of the University of Idaho.

ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the University of Idaho.

EXPECTED DATE OF COMPLETION

March 2023

FOR MORE INFORMATION

https://depts.washington.edu/pactrans/research/projects/integrating-foot-access-with-public-transit-service-where-there-are-food-deserts/

Interfacing Major Subsystems for a Resilient Electric Vehicle Charging System for Remote Locations

Herbert Hess, PhD

Background

Over the past several years, our research group has developed major subsystems for our stand-alone vehicle charging station for remote locations. These address major elements of such a complex system: energy capture, energy storage, and energy dispensing. Photovoltaic panels capture the energy. A field regulated reluctance machine (FRRM) stores the energy and makes it available for charging a vehicle battery. A secure cyber physical control system arranges for dispensing the energy to an electric vehicle, providing billing and reliable, secure delivery. Each of these pieces is either complete or nearing successful development. What is now necessary is an interface based on power electronics to assemble the pieces into a functional vehicle battery charging unit for remote, off-grid locations typical of much of the rural Pacific Northwest. In this project, we propose to do this deceptively difficult task of interfacing this larger interconnected system. Beginning with prototypes being developed of each subsystem, we will build the necessary interface electronics and software, coordinate the communications and controls, and debug the combined result.

Research Project

This project builds on projects that created the major pieces of our remotely located, renewable energy based, charging system: solar energy collection and conversion, field regulated reluctance motor-based flywheel energy storage, battery charging electronics, and brokered dispensing of electrical energy. Each of these pieces is at NASA Technology Readiness Levels (TRL) from TRL 1 to TRL 4. In this project, we propose to interface this work to advance more closely toward an integrated whole. This interfaced system will provide a testbed for future experiments and will advance us significantly toward realizing a portable, resilient, and billable vehicle charging station for remote locations of the Pacific Northwest. To achieve this goal and make realizable advances toward a practical, resilient charging station for remote locations in the Pacific Northwest, we propose the following set of tasks:

- Obtain the flywheel energy storage system based on the FRRM when it is ready at the end of its current development later in the upcoming calendar year 2022,
- Complete a small array of solar panels to capture energy at the input to our remote charging system,
- Design an instrumentation system to gather data on performance,
- Document and report performance in appropriate publications,
- Translate our findings into recommendations for improving performance, advancing closer to manufacturing, and solving the problem of optional grid interface,
- Provide recommendations appropriate to help design a more practical and resilient unit.

ABOUT THE AUTHORS

The research team consisted of Herbert Hess of the University of Idaho.

ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the University of Idaho.

EXPECTED DATE OF COMPLETION

March 2023

FOR MORE INFORMATION

https://depts.washington.edu/pactrans/research/projects/interfacing-major-subsistence-for-resilient-electric-charging-facilities-for-rural-areas/

IoT Platforms for Smart City Implementation in Rural and Urban Communities: A Comparative Review

Rick Sheldon, PhD, Ahmed Abdel-Rahim, PhD

Background

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.

Research Project

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. This will be a comparative study that evaluatesdifferent IP solutions currently available in terms of interoperability, functional capabilities, delivery models, and integration strategies toward achieving sustainable mobility. Other factors that will be examined include platform security, user experience, scalability, and suitability for urban sub-urban, and rural areas.

Ultimately, we plan to employ AI (i.e., machine learning) algorithms that can help predict and adapt traffic management strategies to better leverage such metrics as link travel time on a specific segment of large-scale traffic networks. These capabilities will be further used to develop an advanced traffic simulator (i.e., high fidelity, efficient, reliable, and location sensitive) necessary for developing future optimization algorithms.

ABOUT THE AUTHORS

The research team consisted of Rick Sheldon and Ahmed Abdel-Rahim of the University of Idaho.

ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the University of Idaho.

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https://depts.washington.edu/pactrans/research/projects/iot-platforms-for-smart-city-implementation-in-rural-and-urban-communities-a-comparative-review/

Optimization of Electrified Propulsion Systems for School Bus Fleets using Scheduled Routes Data

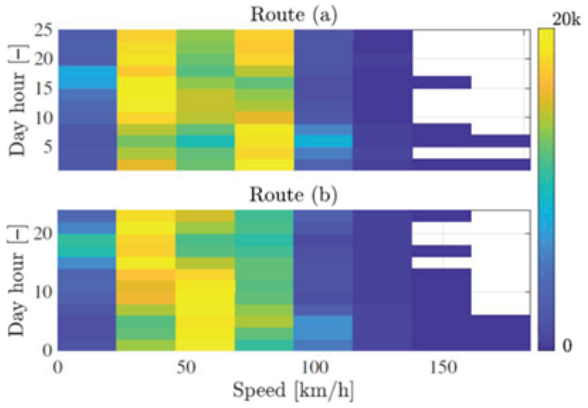
Ahmed Abdel Rahim, PhD

Background

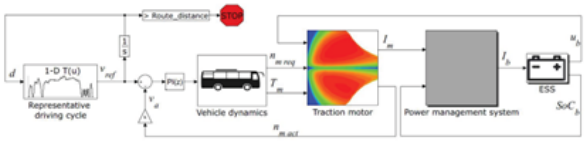
Electrification of vehicular drivelines has been receiving increasing attention from researchers and governments. Despite the significant potential of electrified vehicles to improve propulsion efficiency and reduce environmental degradation in transportation sector, range limitation, long recharging periods, and short batteries' lifetime are considered the major challenges. Besides, the uncertainty of upcoming driving conditions and rapidly–changing traffics contribute to the complexity of route planning, driveline sizing, and infrastructural requirements. Providing useful insights into daily trip conditions is particularity important for driveline sizing and load scheduling for school bus fleets, hence battery aging and excessive grid-loading can be mitigated.

Research Project

This research will implement a new approach to develop school-bus driving cycles. Real-time and historical school bus fleet will be collected from different school districts in Idaho. The collected data will be clustered to develop representative driving patterns and cycles. These data will then be used in electrified powertrain modeling and sizing.



The research will examine the operational and environmental benefits that would result from the electrification of school bus fleets, transforming the current pollution emitters fuel-based fleets to the environmentally friendly electrified engines. Representative driving cycles will be generated using both historical and real-time GPS fleet route data. The developed driving cycles will be used to define optimal driveline and fleet sizing of electrified school buses. Three main tasks will be conducted as part of this project. School-bus GPS-based route data will be collected from two school districts in Idaho. One representing rural operations and the second representing urban school-bus operations. Data will be collected for during spring 2022for a three-month period covering different weather conditions. The collected data will be clustered and analyzed to develop driving patters and repetitive driving cycles for each school-bus route in the two school districts. Clustering and analysis of the collected speed data will be characterized over route distances to construct representative driving cycles for each route.



ABOUT THE AUTHORS

The research team consisted of Ahmed Abdel Rahim of the University of Idaho.

ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the University of Idaho.

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FOR MORE INFORMATION

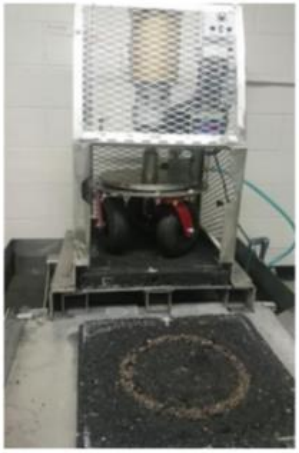
https://depts.washington.edu/pactrans/research/projects/optimization-of-electrified-propulsion-systems-for-school-bus-fleets-using-scheduled-daily-routes-data/

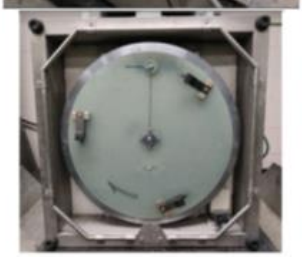
Pavement Winter Operations in Cold Regions

Emad Kassem, PhD

Background

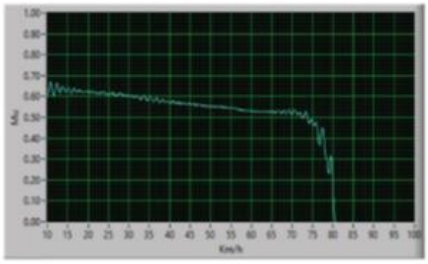
Several winter maintenance operations and techniques are used by transportation agencies to improve road safety. These techniques include the application of deicing and anti-icing chemicals combined with snow removal. Deicers are applied to melt and break the ice, while anti-icing is applied before ice formation to prevent and weaken the bond between the pavement surface and Ice. The application of anti-icing has several advantages over deicing operations including reduced cost and efforts to remove the snow and reduced negative impacts on the environment. The selection of proper type as well as application rate of both deicing and anti-icing materials is necessary for optimal performance. The lack of test methods used to evaluate the effectiveness of different materials and application rates limit viable options for effective winter maintenance operations.





Research Project

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



ABOUT THE AUTHORS

The research team consisted of Emad Kassem of the University of Idaho.

ABOUT THE FUNDERS

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August 2022

FOR MORE INFORMATION

http://depts.washington.edu/pactrans/research/projects/pavement-winter-operations-in-cold-regions/

Shared Mobility Options for the Commute Trip: Opportunities for Employers and Employees

Qing Shen, PhD, Xuegang (Jeff) Ban, PhD, Anne Vernez Moudon, PhD, Mike Lowry, PhD

Background

Commuting is a major topic area of urban transportation research because (1) it is the most essential component of travel demand and (2) it generates disproportionately large "loadings" on the transportation infrastructure through peak-hour traffic and long-duration parking. Mobile ICT-enabled new mobility services, such as ride-hailing, App-based carpooling, and dockless bike sharing, present potential mode-shift opportunities for commuters who currently travel by SOV, which consequently would relieve traffic congestion and reduce carbon emissions. Therefore, it is important and timely to understand how employers and employees can make concerted efforts to create and promote shared mobility options for commuting. Built upon the concept of Mobility as a Service (MaaS), the research team will explore innovative approaches for making shared mobility appealing to both employees and employers, such that it significantly reduces commuting cost and stress while improving workforce productivity and retention.

The Covid-19 situation, which was unexpected at the time that the proposal was being written, has forced us to focus the empirical research on a subsample of commuters, namely the essential workers. Due to the pandemic, many employees have been working from home, but the essential workers must still regularly commute. We realize that focusing on essential workers may bring interesting information and insights about income-based differences in commuters, their behaviors, and attitudes toward and use of shared mobility.

Research Project

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

ABOUT THE AUTHORS

The research team consisted of Qing Shen, Xuegang Ban and Anne Moudon of the University of Washington, and Mike Lowry of the University of Idaho.

ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the Seattle Department of Transportation and the University of Idaho.

EXPECTED DATE OF COMPLETION

August 2022

FOR MORE INFORMATION

http://depts.washington.edu/pactrans/research/projects/shared-mobility-options-for-the-commute-trip-opportunities-for-employers-and-employees/

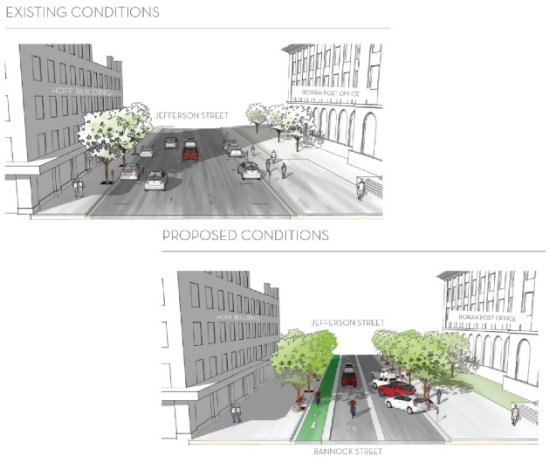
Using Computer Vision to Evaluate Bicycle and Pedestrian Improvements

Don MacKenzie, PhD, Mike Lowry, PhD

Background

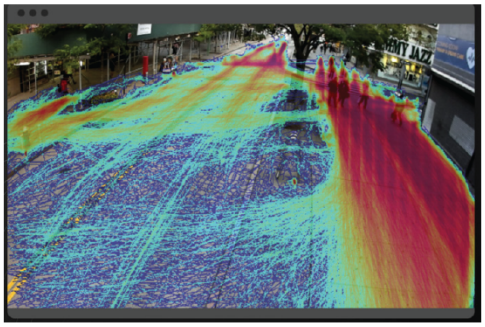
The November 2021 federal infrastructure bill allocates $20 billion for road safety including a "Safe Streets and Roads for All" grant program to cities aimed to improve pedestrian and bicycle safety. This new federal funding combined with a national spike in pedestrian fatalities in the wake of COVID-19 has elevated cities' need for guidance on how to establish priorities for bicycle network and sidewalk improvements that enhance safety and mobility.

A pole-mounted computer vision system from Numina offers several advantages over traditional traffic counting systems for generating metrics to inform decision-making about improvements to streetscapes. This system provides data on what type of vehicles are moving through the study area, the directions the vehicles are traveling, and when different users enter close proximity. The data is saved in a cloud-based system that is easy to query for further analysis. To address the privacy concerns of cities, all the mobility information is recorded without any personally identifiable information.



Research Project

Our project will deploy six Numina computer vision sensors on a major bicycle corridor in downtown Boise, Idaho that has recently introduced a curb-separated bike path for safety and rider comfort and a new parking configuration designed to limit conflicts between cyclists and people exiting their cars. Our study will evaluate how pedestrians, cyclists, and auto users move across the new streetscape, whether the actual street use achieves the design goals, and whether computer vision systems can help improve relevant design decisions.



ABOUT THE AUTHORS

The research team consisted of Don Mackenzie of the University of Washington, and Mike Lowry of the University of Idaho.

ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the University of Washington and the University of Idaho.

EXPECTED DATE OF COMPLETION

March 2023

FOR MORE INFORMATION

https://depts.washington.edu/pactrans/research/projects/using-computer-vision-to-evaluate-bicycle-and-pedestrian-improvements/

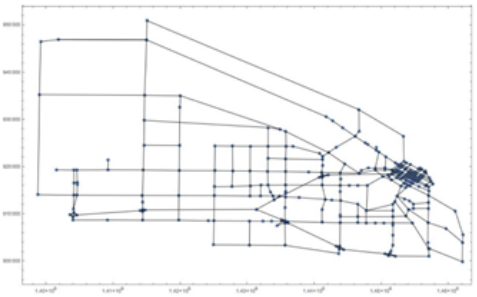
Using Machine Learning to Customize Traffic Prediction for High Performance Traffic Analysis and Optimization

Robert Heckendorn, PhD

Background

Traffic optimization is a complex system without reliable and situation specific closed form formulas for optimization. This means a simulation plays a critical roll in any advancement in traffic optimization. Micro models rely on simulating car behavior in very small steps leading to extremely long computing times that are impractical for any in-depth optimization. Furthermore, the connection with real traffic behavior is tenuous in that the car behavior model is based on a few simple hard coded abstractions that apply everywhere. This effects the reliability in predicting traffic flow. On the other hand, macro simulation is much faster in that it only requires the ability to estimate arrival times at the ends of street segments. Unfortunately these estimations are difficult to make because they can be based on not only engineering parameters but road conditions including glare, physical condition of the road, congestion, and subjective influencers.

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 predicating 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.

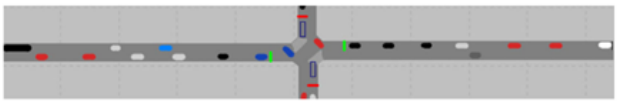


Research Project

This project explores using machine learning techniques to spatially and temporally customize predictive functions in queuing based macro simulations of traffic. Its objective is to replace much slower "one-size fits all" micro simulators so that reliable adaptive traffic control and optimization will be possible, which is a very practical end-goal.

Our first goal is to create machine learning algorithms for learning how to predict the travel time of a car on a specific segment which may include difficult segments which represent signaling such as intersections or toll booths. Data will ultimately come from car telemetry monitoring. The predictor functions will be further used in this project to make much more efficient, reliable, and location sensitive traffic simulator which is necessary for future optimization algorithms. Our initial experiments will attempt to reproduce VISSIM output but much more efficiently.

Our second goal is then to create traffic optimization algorithms using our simulator to estimate cost of a signaling strategy. We will be using several algorithms we have used in the past for evacuation planning as a starting point.



ABOUT THE AUTHORS

The research team consisted of Robert Heckendorn of the University of Idaho.

ABOUT THE FUNDERS

This research was funded by the Pacific Northwest Transportation Consortium, with additional support from the University of Idaho.

EXPECTED DATE OF COMPLETION

March 2022

FOR MORE INFORMATION

https://depts.washington.edu/pactrans/research/projects/using-machine-learning-to-customize-traffic-prediction-for-high-performance-traffic-analysis-and-optimization/

PacTrans and NIATT Co-Host the 2022 National Travel Monitoring Exposition and Conference (NaTMEC) with the Idaho Transportation Department (ITD)

The original concept for NaTMEC spawned from a workshop held in 1974 in Orlando, FL. Following that in 1983, the first National Conference on Weigh-in-Motion was held in Denver, CO. It morphed into the National Traffic Data Acquisition Conference in 1990, and became NATMEC (with a capital A, for "North American") in 1998, when it was held in Charlotte, NC. In 2020, the conference name was changed to the National Travel Monitoring Exposition and Conference (NaTMEC). PacTrans and ITD had the pleasure of working together to co-host the 2022 NaTMEC, a wonderful opportunity to meet with federal, state, and local transportation professionals as well as industry leaders who have a 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 and 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 the pandemic's 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 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 at the 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.

Faculty and Student Awards

PACTRANS EXCELLENCE IN TECHNOLOGY TRANSFER AWARD

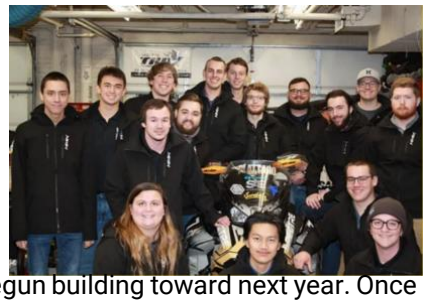
This Excellence in Technology Transfer Award is presented annually to investigators for effective partnerships and collaboration with outside industry, innovative marketing of newly developed techniques and technologies, or successful implantation of research rules. The 2020 PacTrans Excellence in Technology Transfer Award was awarded to Professor Michael Lowry, Associate Professor, Civil and

Kevin Chang, Ph.D., P.E. was named a Fellow of the Institute of Transportation Engineers, or ITE, in 2021 for his ongoing contributions and leadership in transportation safety and education.

Chang is an Associate Professor in the Department of Civil and Environmental Engineering and has been the faculty advisor to the UI ITE Student Chapter since 2014. He is a past Chair of the ITE International Transportation Education Council and a past President of the ITE

UI STUDENT CLEAN SNOWMOBILE TEAM BRINGS HOME HARDWARE

Each year the Society of Automotive Engineers (SAE) hosts a Clean Snowmobile Challenge where student teams from around the US and Canada develop clean snowmobiles and then use them to compete in a variety of competitions. This past year, PacTrans consortium partner University of Idaho's student team won several of these categories. "Our team is continuing to prove two-stroke engines are a viable option for clean, quiet, and fuel-efficient snowmobiles." In addition to receiving fourth place overall, the UICSC performed well in several events at the competition, earning:



- Best Value from Continental EMITECH
- 1st for In-service Emissions
- 1st in Fuel Economy
- 1st in Subjective Handling
- Best Design Winner from Oshkosh

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

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

University of Idaho and NIATT-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. 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 is also active in the Graduate and Professional Student Association, the Institute of Electrical and Electronics Engineers, and the Bangladeshi Association of Students and Scholars. Yamin's research is focused on the improvement of communication schemes in smart vehicles on highways and has done work on intelligent transportation systems.

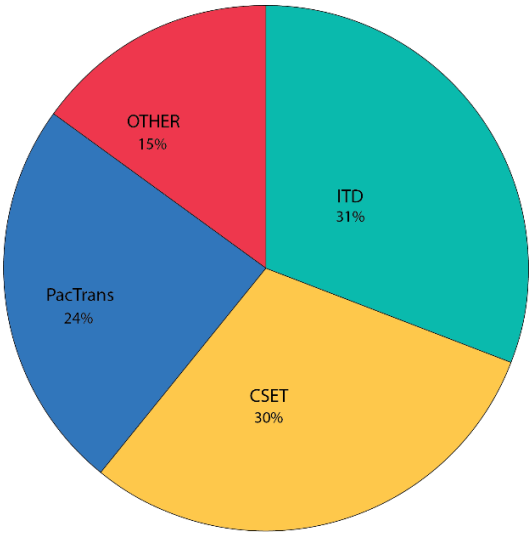
2021-2022 CORAL SALES COMPANY/DOUGLAS P. DANIELS SCHOLARSHIP

Madelynn Gregoire is a rising senior studying Civil and Environmental Engineering at University of Idaho. During summer 2022, Madelynn is working as a Structural Engineering Intern for KPFF Consulting Engineers in Boise, Idaho. Outside of school, Madelynn stays involved in several clubs including Society of Women Engineers, College of Engineering Ambassadors, and the Engineering Student Advisory Council. If she is not on campus, she would be busy watering her dozens of houseplants or snowboarding all weekend. Congratulations,

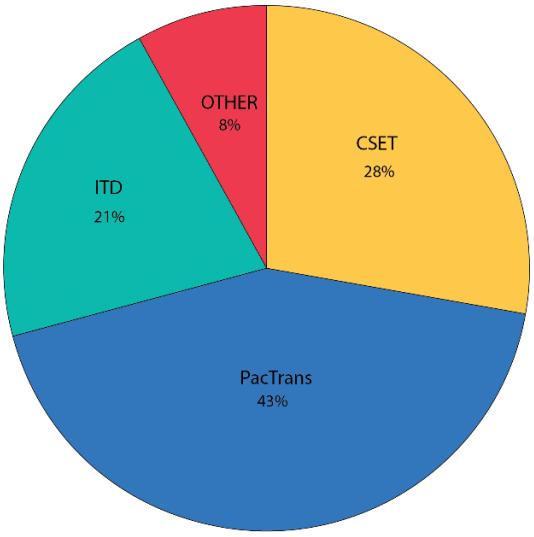
Luis Garcia Hernandez transferred to the University of Idaho in the Fall of 2019. He graduated spring of 2022 with a Bachelor of Science degree in dual majors: Civil and Environmental Engineering and Mechanical Engineering. Luis will be pursuing a job as a transportation engineer. Luis enjoys watching and playing soccer. He also likes being outdoors, especially in the winter when he most joyful activity, riding snowmobiles.

Financial Reports

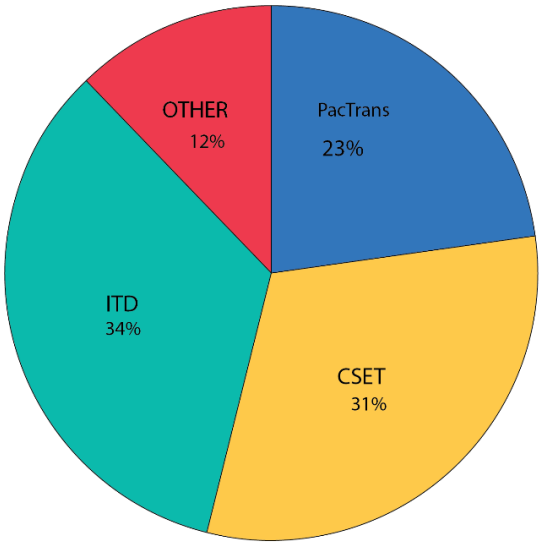
NIATT Funding Sources for Expenditures –FY 2018-2021



NIATT FUNDING SOURCES FOR EXPENDITURES FY 18-19

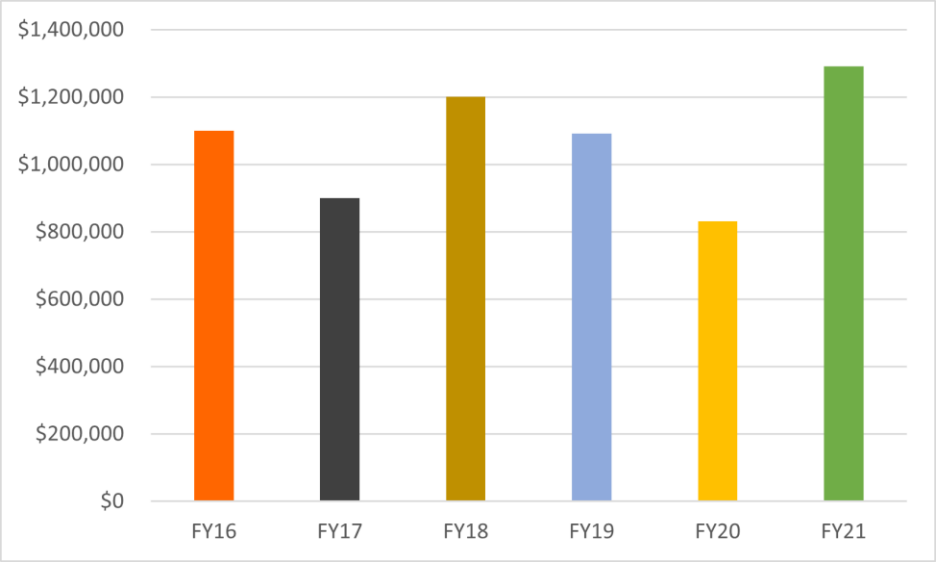


NIATT FUNDING SOURCES FOR EXPENDITURES - FY 19-20

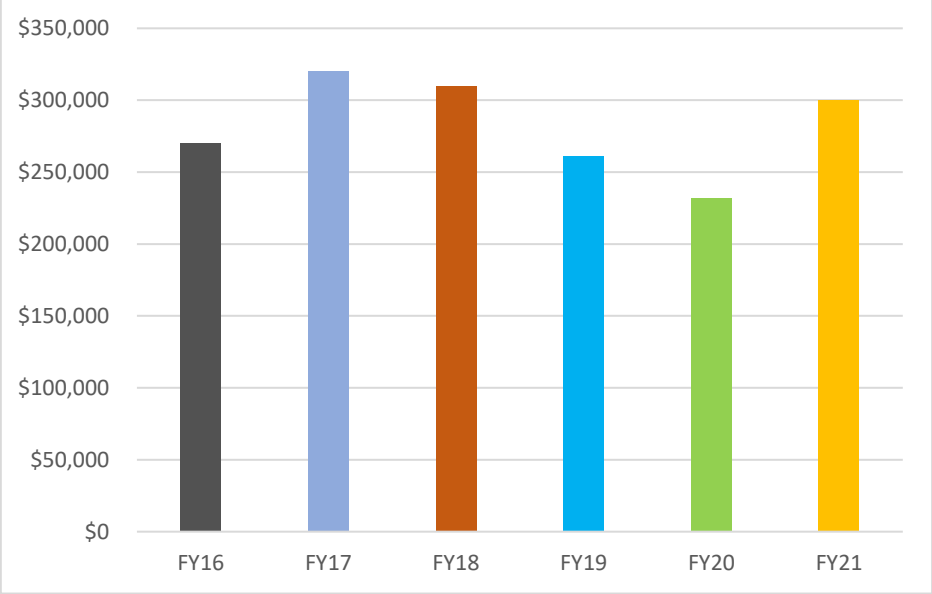


NIATT FUNDING SOURCES FOR EXPENDITURES - FY 20-21

The charts below show the growth trends in funding received since FY2016



Total Funding Received



Total F&A Dollars Generated

List of Projects

FY19 NEW PROJECTS

Development of a Statewide School Safety Outreach Program
PI: Kevin Chang
Funding Agency: Idaho Transportation Department

Development of Pavement Temperature Prediction Model
PI: Emad Kassem
Funding Agency: Idaho Transportation Department

Development of a Gyratory Stability Index to Evaluate Variation of RAP Content and Rutting Resistance of Asphalt Mixtures
PI: Emad Kassem
Funding Agency: Idaho Transportation Department

Assessment of Asbestos Containing Materials in Idaho Bridges
PI: Ahmed Ibrahim
Funding Agency: Idaho Transportation Department

Managing Increasing Demand for Curb Space in the City of the Future
PI: Kevin Chang
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

A Hybrid Platform for Context-aware V2X Communications
PI: Mohamed Hefeida
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Connected Vehicle Safety Applications using V2X under Consideration of Bicycles, Pedestrians and Persons with Special Needs
PI: Axel Krings
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

A Connected-Vehicle Traffic Signal System Modeling Platform
PI: Robert Heckendorn
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center
(UTC) for Federal Region 10.

Characterization of Underserved Population Perceptions and Mobility Needs in Connected-Vehicle and Smarter City Environments
PI: Ahmed Abdel-Rahim
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Development of PacTrans Workforce Development Institute
PI: Kevin Chang
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Development of Grass-Roots Data Collection Methods in Rural, Isolated, and Tribal Communities
PI: Kevin Chang
Funding Agency: Center for Safety Equity in Transportation (CSET), Tier-1 University Transportation Center

Promoting Positive Traffic Safety Culture in RITI Communities through Active Engagement: Barriers and Opportunities

PI: Ahmed Abdel-Rahim
Funding Agency: Center for Safety Equity in Transportation (CSET), Tier-1 University Transportation Center

FY20 NEW PROJECTS

Two-Axle and Three-Axle Chassis in Port Operations: Potential Safety and Operational Impacts of Increasing the Maximum Vehicle Gross Weight beyond 80,000 Pounds

PI: Ahmed Abdel-Rahim
Funding Agency: PCC Logistics

Evaluation of Alternatives to Calcined Bauxite for Use in High Friction Surface Treatment (HFST) in Missouri

PI: Emad Kassem
Funding Agency: Missouri Department of Transportation, Missouri University of Science and Technology

Correlations between CoreLok and AASHTO T-85 for Determining the Specific Gravity and Absorption Properties of Coarse Aggregates in Idaho

PI: Emad Kassem
Funding Agency: Idaho Transportation Department

Shared Mobility Options for the Commute Trips: Opportunity for Employers and Employees

PI: Michael Lowry
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Evaluation of the Idaho (Bicycle) Stop Laws in the Pacific Northwest

PI: Kevin Chang
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Estimating county-to-county transportation and trade flow

PI: Michael Lowry
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Pavement Winter Operations in Cold Regions

PI: Emad Kassem
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Advanced Energy Storage System for Electric Vehicle Charging Stations for Rural Communities in the Pacific Northwest

PI: Herb Hess
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Development of an Acoustic Method to Collect Studded Tire Traffic Data

PI: Kevin Chang
Funding Agency: Center for Safety Equity in Transportation (CSET), Tier-1 University Transportation Center

Assessing the Relative Risks of School Travel in Rural Communities

PI: Kevin Chang
Funding Agency: Center for Safety Equity in Transportation (CSET), Tier-1 University Transportation Center

FY21 NEW PROJECTS

Local Calibration of "C-Values" for Common Idaho Soil Types for Use in Mechanistic-Empirical Pavement Design

PI: Emad Kassem
Funding Agency: Idaho Transportation Department

HAZMAT Training and Plan Development for the Nez Perce Reservation

PI: Ahmed Abdel-Rahim
Funding Agency: USDOT Hazardous Materials Grants Program - the Nez Perce Tribe

Simplified Analysis Methods of Traffic Speed Deflectometer (TSD) and Falling Weight Deflector (FWD) Data for Effective Pavement Preservation Program

PI: Emad Kassem
Funding Agency: Idaho Transportation Department

Evaluation of Highway Safety Improvement Program (HSIP) Project Performance

PI: Michael Lowry
Funding Agency: Idaho Transportation Department

Implementation of Balanced Mix Design of Asphalt Mixtures Prepared with Reclaimed Asphalt Pavements and Rejuvenators for Enhanced Performance

PI: Emad Kassem
Funding Agency: Idaho Transportation Department

Assessment and Repair of Prestressed Bridge Girders Subjected to Over-Height Truck Impacts (OHTI)

PI: Ahmed Ibrahim
Funding Agency: FHWA Pooled Fun Study, Missouri Science and technology University

Efficient and Data-Driven Pavement Management System using Artificial Intelligence

PI: Emad Kassem
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Impact of Autonomous and Connected Truck Platoons in the Pacific Northwest on Transportation Infrastructure

PI: Ahmed Ibrahim
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

IoT Platforms for Smart City Implementation in Rural and Urban Communities: A Comparative Review

PI: Fredrick Sheldon
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Machine Learning-Based High-Fidelity Mesoscopic Modeling Tool for Traffic Network Optimization

PI: Robert Heckendorn
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Using Pole-mounted Computer Vision Devices to Evaluate the Introduction of Candlestick Bollards to Existing Bike Lanes

PI: Michael Lowry
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Interfacing Major Subsystems for a Resilient Electric Vehicle Charging System for Remote Locations

PI: Herbert Hess
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Integrating Food Access with Public Transit Service: Where are the Food Deserts?

PI: Felix Liao
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Optimization of Electrified Propulsion Systems or School Bus Fleet Operations

PI: Ahmed Abdel-Rahim
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Development of PacTrans Workforce Development Institute

PI: Kevin Chang
Funding Agency: The Pacific Northwest Transportation Consortium (PacTrans), Regional University Transportation Center (UTC) for Federal Region 10.

Promoting Positive Traffic Safety Culture in RITI Communities through Active Engagement: Implementation Guide and Outreach Activities

PI: Ahmed Abdel-Rahim
Funding Agency: Center for Safety Equity in Transportation (CSET), Tier-1 University Transportation Center

The Perception of Autonomous Driving in Rural Communities

PI: Kevin Chang
Funding Agency: Center for Safety Equity in Transportation (CSET), Tier-1 University Transportation Center

Impact of the COVID-19 Pandemic on Fatal Crash Rates for RITI Communities in Idaho

PI: Ahmed Abdel-Rahim
Funding Agency: Center for Safety Equity in Transportation (CSET), Tier-1 University Transportation Center

School Travel Behaviors in Rural Communities

PI: Kevin Chang
Funding Agency: Center for Safety Equity in Transportation (CSET), Tier-1 University Transportation Center

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