

PSR Emerging Scholars Transportation Research Symposium

University of Southern California, Lewis Hall, Room 308

8:30 am

Registration & Breakfast

9:00 am

Welcome Address

9:15 am

Dr. Genevieve Giuliano
University of Southern California



Emerging Factors Affecting Mobility In Urban Areas

How Does Commute Experience And Mode Choice Affect Life Satisfaction?

Aakansha Jain
University of California, Davis



Inequitable Inefficiency: A Case Study Of Rail Transit Fare Policies

Zakhary Mallett
University of Southern California



Global Disruptions In The Transport Sector: Effect Of Ridehailing Services And The Covid-19 Pandemic

Jai Malik
University of California, Davis



Moderator:

Dr. Genevieve Giuliano
University of Southern California



10:45 am

Break

11:00 am

How Will Autonomous Vehicles Impact The Future Of Transportation?

Comprehensive Platooning Algorithm For Multi-Lane Highway Cooperative Automated Driving

Xu Han
University of California, Los Angeles



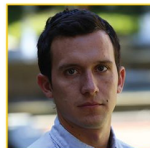
Connected And Automated Vehicle Impacts In Southern California: Travel Behavior And Demand Analysis

Qinhua Jiang
University of California, Los Angeles



Cooperative Safe Lane Changing In Connected Environments And Its Impact On Traffic Flow

Fernando Valladares Monteiro
University of Southern California



Provably Correct Design Of Autonomous Vehicles Under Safety, Comfort, And Regulatory Constraints

Muhammad Waqas
University of Southern California



Moderator:

Dr. Ketan Savla
University of Southern California



PSR Emerging Scholars Transportation Research Symposium

1:00 pm

Lunch In The Courtyard

1:30 pm

Disaster And Pandemic Preparedness In Hawai'i

Covid-19 Effects On Mobility And
Traffic Safety In Hawai'i

Ratul Debnath
University of Hawai'i at Mānoa



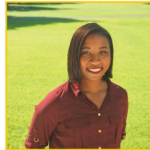
An Agent-Based Model Of A Tsunami
Evacuation In Waikiki, Hawaii

Farnaz Kaviari
University of Hawai'i at Mānoa



Assessing Barriers To Green
Infrastructure For Flood Mitigation

Sequoia Riley
University of Hawai'i at Mānoa



Moderator:

Dr. Dan Wei
University of Southern California



3:00 pm

Keynote Speaker
Transdisciplinary Approaches To Resilience

Dr. Karl Kim
University of Hawai'i at Mānoa



3:30 pm

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Keynote Speaker & Moderators

Keynote Speaker



Department of Urban and Regional
Planning, College of Social Sciences,
University of Hawai'i at Mānoa.

Executive Director of National Disaster
Preparedness Training Center

Dr. Karl Kim

Transdisciplinary Approaches To Resilience

Dr. Karl Kim is Professor of Urban and Regional Planning at the University of Hawaii at Manoa, and Director of the graduate program in Disaster Management and Humanitarian Assistance. He studies transportation, cities, and resilience. He served as the Chief Academic Officer (Vice Chancellor for Academic Affairs) overseeing tenure and promotion, strategic planning, international programs, and program review for the Manoa campus. He is Executive Director of the National Disaster Preparedness Training Center, authorized by the U.S. Congress to develop and deliver FEMA-certified training courses for underserved, at-risk communities on natural hazards, mitigation, and urban planning. The Center has trained more than 70,000 first responders, emergency managers, and leaders in over 400 communities across the world. Dr. Kim has served as the Chairman of the National Domestic Preparedness Consortium. He has published many papers on disaster management, transportation, and urban planning. He is Editor-in-Chief of *Transportation Research Interdisciplinary Perspectives* (Elsevier) and is editing a 10-volume series on disaster risk reduction and resilience (Routledge). He was educated at Brown University and the Massachusetts Institute of Technology and has been a Fulbright Scholar to Korea and the Russian Far East. He has also led research and training programs in Vietnam, the Philippines, and Indonesia.

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Moderators

Dr. Genevieve Giuliano

Welcome Address & Emerging Factors Affecting Mobility In Urban Areas Panel

Professor Giuliano's research areas include relationships between land use and transportation, transportation policy analysis, travel behavior, and information technology applications in transportation. Current research includes examination of relationships between urban form, online shopping behavior, and local freight demand; market potential for zero emission trucks; reducing local impacts of truck traffic, and applications for transportation system analysis using archived real-time data. She has published over 170 papers and given invited lectures around the world.

Professor Giuliano is a past Chair of the Executive Committee of the Transportation Research Board, and of the Council of University Transportation Centers. She has received numerous distinguished scholarship and service awards including the TRB Distinguished Service Award (2006), the Thomas B. Deen Distinguished Lectureship Award (2007), the Transportation Research Forum Outstanding Researcher Award (2012), the Council of University Transportation Centers Distinguished Contribution award (2013), and the Walter Isard Award for Distinguished Scholarship in Regional Science (2017). She is a former member of the ITS Joint Program Advisory Committee and the National Freight Advisory Committee. She has participated in many TRB policy studies; most recently on the Committee on the Future of the Interstate Highway System. At the state level, she is working with Caltrans and CARB on the implementation of the California Sustainable Freight Action Plan.



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of Public Policy,
University of Southern California

Director of METRANS
Transportation Research Consor-
tium

Director of PSR UTC.

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Dr. Ketan Savla

How Will Autonomous Vehicles Impact The Future Of Transportation? Panel

Ketan Savla is an associate professor and John and Dorothy Shea Early Career Chair in Civil Engineering at the University of Southern California, with joint appointments in the Sonny Astani Department of Civil and Environmental Engineering, the Daniel J. Epstein Department of Industrial and Systems Engineering (courtesy), and the Ming Hsieh Department of Electrical Engineering-Systems (courtesy). Prior to that, he was a research scientist in the Laboratory for Information and Decision Systems at MIT. He obtained his Ph.D. in Electrical Engineering and M.A. in Applied Mathematics from the University of California at Santa Barbara (UCSB), M.S. in Mechanical Engineering from the University of Illinois at Urbana-Champaign, and B. Tech. in Mechanical Engineering from the Indian Institute of Technology Bombay. He currently serves as an Associate Editor for the Conference Editorial Board of the IEEE Control Systems Society, the IEEE Transactions on Intelligent Transportation Systems, and the IEEE Control Systems Letters.



Sonny Astani Department of Civil
and Environmental Engineering,
Viterbi School of Engineering,
University of Southern California

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Department of Public Policy, Price
School of Public Policy,
University of Southern California

Dr. Dan Wei

Disaster And Pandemic Preparedness In Hawai'i Panel

Dan Wei is a Research Associate Professor at the USC Sol Price School of Public Policy, and Research Fellow of USC's Center for Risk and Economic Analysis of Threats and Emergencies (CREATE) and Schwarzenegger Institute for State and Global Policy. She holds a B.E. degree in Engineering Physics and an MSc degree in Public Policy from Tsinghua University, and a Ph.D. in Geography from The Pennsylvania State University.

Dr. Wei's major research interests include modeling of economic impacts of energy and climate change policies and economic consequence analysis of disasters. She performed macroeconomic impact analyses of state climate action plans for several major states and regions in the U.S. and conducted analysis of cap and trade systems and/or carbon tax policies at the regional, state, national, and international levels. She made key contributions to a recent study in collaboration with National Renewable Energy Laboratory to evaluate the economic impacts of the City of Los Angeles transitioning to a 100% renewable electricity supply by 2045. She is also the PI of a study that evaluates the economic impacts on both the state economy and the freight transport sector of electrification of cargo handling equipment at major seaports in California. In the area of economics of disasters, she has made significant contributions in the studies of the economic impacts of four major disaster scenarios for the U.S. Geological Survey. She has led two studies funded by Caltrans that focus on analyzing the socioeconomic dimensions of resilience to seaport and highway transportation network disruptions. She is currently a co-PI on an NSF study to apply edge computing to improve reliability and resilience of interdependent infrastructure systems. Dr. Wei is the co-recipient of Regional Economic Models Outstanding Economic Analysis Award and the Sir Richard Stone Best Article Award for her contributions in economic impact modeling of disaster and energy and climate related policies.

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Student Speakers

Ratul Debnath

Covid-19 Effects On Mobility And Traffic Safety In Hawai'i

Stay at home policies in response to COVID-19 cause less mobility than before. As a result, it reduced travel on the road networks of the U.S. Therefore; fewer travel trips transformed high traffic volume roads into lower volume roads. Experts examine the mobility changes of people for different categories of modes and trips. With drastic mobility changes, Stiles et al.(2021) found that the severity level of crashes increased during the pandemic time. However, another study in New York City observed that, during the stay-at-home period, the severity of accidents decreases with the number of accidents (Lin et al., 2021). The paper aims to examine the mobility changes and the relative crash rates and severity before and after COVID-19 hits in the State of Hawaii. Google mobility data were used to analyze the mobility change, and crash data were extracted from Highway Safety Plan Reports of the State of Hawaii. This study will help to understand the effects of Covid-19 on mobility and traffic safety measurements in the State of Hawaii.



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Department of Civil and
Environmental Engineering,
Samueli School of Engineering,
UCLA

Xu Han

Comprehensive Platooning Algorithm For Multi-Lane Highway Cooperative Automated

Driving automation and vehicle-to-vehicle (V2V) communication provide opportunities to deploy cooperative automated driving systems (C-ADS) for transportation system goals such as sustainability, safety, and efficiency. Among various C-ADS applications, vehicle platooning has great potential to achieve the above system management goals by establishing trajectory-aware V2V cooperative strategies among C-ADS vehicles. Previously, the concept of cooperative adaptive cruise control (CACC) has been studied by researchers extensively, i.e., single-lane decentralized ad-hoc operations of multiple vehicles that closely follow each other. This study builds upon the existing research and proposes a comprehensive multiple-lane platooning algorithm with organized behavior via a hierarchical framework. The proposed algorithm also adopts modern C-ADS software platform framework for planning and control that incorporate both the mission level (i.e., strategic level) and the motion level (i.e., tactical level applications to cope with complex multi-lane highway challenges, including same-lane platooning, multiple-lane joining, and on-ramp merging. Based on the algorithm's strategies, the platoon leaders coordinate between platoon members and external vehicles to guide the platoon through complicated and realistic driving scenarios. On the mission level, a platooning behavior protocol based on a deterministic finite state machine (FSM) is developed to guide the platoon member operations. Additionally, as heuristic protocols fall short in explicitly expressing and regulating complex cooperative scenarios, a genetic fuzzy system (GFS) was trained with FSM as a baseline controller to extend the algorithm's capability under the cooperative on-ramp merge scenario. On the motion level, trajectory generation for general ADS maneuvers (i.e., lane following and lane changing) and platooning behavior regulation is proposed such that planned trajectories of other relevant vehicles can be fully considered (i.e., intent sharing of predictiveness). The performance is evaluated in both traffic and automated driving simulators, and the results indicate that the proposed comprehensive platooning algorithm can efficiently and safely regulate C-ADS-equipped vehicle behavior and meet system goals.

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Aakansha Jain

How Does Commute Experience And Mode Choice Affect Life Satisfaction?

Research in recent years has developed to determine how travel mode choices impact indicators of quality of life, life satisfaction and subjective well-being. Mode choice and the quality of commute not only affect travel satisfaction but can also influence overall well-being and life-satisfaction. Through this study we investigate how satisfaction with commute mode and travel experiences impact commute satisfaction and their linkage with different socio-demographic factors. We present some preliminary findings from our analysis of the annual Campus Travel Survey of students and employees at the University of California, Davis. The analysis also looks into how overall life satisfaction correlates with commute satisfaction and satisfaction in other dimensions of life: physical health, mental health and financial satisfaction. The results of the study can provide some critical insights about travel related well-being and life satisfaction of UC Davis students and employees and how important it is for people to feel happy about their commute. The outcomes will also be unique from the perspective of a bike friendly city such as Davis in the United States



Transportation Technology and
Policy Graduate Group, Institute of
Transportation Studies,
UC Davis



Qinhua Jiang

Connected And Automated Vehicle Impacts In Southern California: Travel Behavior And Demand Analysis

Connected and automated vehicle (CAV) technologies attracted extensive attention in the past decade. As CAV brings convenience to travel, people's travel behaviors and patterns might change significantly. Existing models, however, cannot comprehensively evaluate the impacts on transportation systems. This study adopted an activity-based approach to evaluate the comprehensive impacts of CAV on the transportation system in Southern California. A stated-preference survey was conducted and captured people's behavior changes associated with CAV deployment. The model prediction demonstrated that the total trip number increased by 7%, with an 11% growth in total car-like mode travel distance. Among all trip purposes, work trips contributed to 56% of total trip number growth and 79% of the increased car-like mode travel distance. Although CAV technology can bring many benefits to travel, it may not be a perfect solution to future transportation systems by themselves. It is still critical to have appropriate policy interventions in place.

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Environmental Engineering,
Samueli School of Engineering,
UCLA

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Farnaz Kaviari

An Agent-Based Model Of A Tsunami Evacuation In Waikiki, Hawai'i

The effectiveness of an emergency evacuation plan highly depends on human behaviors and transportation systems. It is essential to study human behavior, predict their decisions, and estimate the capacities of the transportation system to plan for a safe evacuation. In this study, an agent-based mode (ABM) is developed to simulate the behavior of people and estimate the endangered population and clearance time during a short-notice tsunami evacuation. The model is implemented for Waikiki, Hawaii, as the study area. This study aims to estimate the vulnerable population and evaluate different travel modes and horizontal and vertical evacuation effectiveness to consider them in emergency evacuation planning. Three types of agents are defined based on their evacuation modes: pedestrians, bicyclists, and car drivers. The response of agents to the evacuation alarm is defined based on survey findings. After a milling time, agents decide to evacuate or not. If they choose to evacuate, two types of shelters can be selected: vertical evacuation shelter or horizontal evacuation to safe zones. Four scenarios are implemented to estimate the fatality rate and clearance time in case of using different strategies: 1) based on the real situation, 2) constructing a new exit path, 3) encouraging people to evacuate on foot, 4) and encouraging people to evacuate vertically. Based on the results of the scenarios, suggestions can be made to improve the current emergency evacuation plan.



Department of Urban and Regional Planning, College of Social Sciences, University of Hawai'i at Mānoa



Jai Malik

Global Disruptions In The Transport Sector: Effect Of Ridehailing Services And The Covid-19 Pandemic

Enabled by information and communication technologies (ICT) and based on the principles of shared/gig economy, ridehailing (e.g. Uber, DiDi, Ola) is transforming the lifestyle and travel patterns of people around the world. More importantly, other new technologies based on the same principles (e.g., food delivery services, micromobility) can potentially have similar transformative impacts. Thus, it is pertinent to study these services and their impacts carefully to leverage these technologies in creating a more inclusive, sustainable and greener transportation system.

Transportation Technology and Policy Graduate Group, Institute of Transportation Studies, UC Davis

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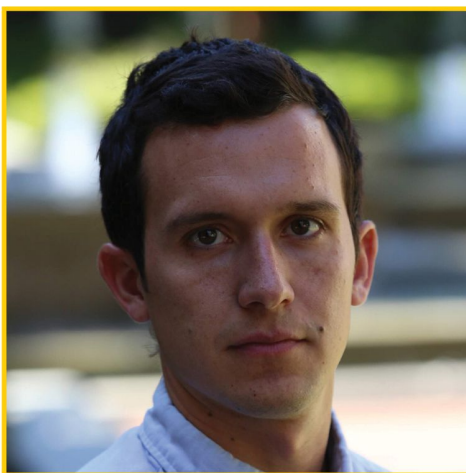
Zakhary Mallett

Inequitable Inefficiency: A Case Study Of Rail Transit Fare Policies

Previous research on spatial and temporal transit fare equity has shown that suburban and peak-period riders are subsidized more than urban and off-peak riders, particularly when capital costs are accounted for, and that these patterns are race- and income-regressive. However, the literature almost exclusively focuses on bus transit, uses aggregate data, and measures equity based on the variability in the fare-per-mile paid by users. This approach to measuring equity omits the economies of density and cost-sharing nature of transit. Here, I devise a cost allocation model using highly disaggregate asset and labor data to assign costs to stations, links, and time periods of the BART and MARTA rail systems, and use ridership data to devise costs-per-rider. I measure spatial and temporal equity using the cost-per-rider metric to calculate origin-destination trip and time-of-day costs, and estimating how much of these costs are recovered through fares paid. I interact these findings with the socioeconomic makeup of riders to test for disparate impacts. Findings show that off-peak travel is more subsidized than on-peak travel; spatial subsidy variability correlates with distance of travel and location of travel; and these patterns are moderately progressive with respect to race and income.



Department of Urban Planning and
Spatial Analysis, Price School of
Public Policy, USC



Ming Hsieh Department of Electrical
and Computer Engineering, Viterbi
School of Engineering,
USC

Fernando Valladares Monteiro

Cooperative Safe Lane Changing In Connected Environments And Its Impact On Traffic

Despite the recent advancement of autonomous vehicle technology, performing safe lane changes and merging in dense traffic environments remains a challenge. One important question is how to find a space to merge into without placing any vehicle in a collision-prone situation. In this work we adopt a safety definition based on a worst-case braking scenario and propose a measure of risk that encompasses possible collision severity and time exposed to collision in a single value. We then present a communications-based cooperative decentralized lane change method to generate safe lane change gaps under varied traffic conditions. In the proposed approach, the merging vehicle negotiates the creation of a safe gap in the destination lane. Until the lane change maneuver is completed, it operates as having two possible leaders, one in its own lane and one in the destination lane. Moreover, the future following vehicle in the destination lane operates as if the merging vehicle has already changed lanes. Once the gap is created, the vehicle performs the lane change maneuver using a linear controller, whose robustness with respect to longitudinal speed variations and parameter uncertainty is analyzed. Vehicle level simulations are used to evaluate the approach in detail for a single lane change maneuver. The method is also tested under a challenging scenario in VISSIM. Results indicate that connected and autonomous vehicles can achieve almost zero risk in both congested and uncongested scenarios without an impact on traffic flow.

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Sequoia Riley

Assessing Barriers To Green Infrastructure For Flood Mitigation

Urban and rural flooding is a major planning problem. As urbanization continues to increase, more traditional grey infrastructure is applied to both urban and rural areas. This in turn leads to flooding of public and private properties, resulting in property damage and high repair costs. Green infrastructure is becoming a popular topic both in urban communities and government institutions as a sustainable solution. While there are many research publications illustrating the benefits of green infrastructure, not many discuss the barriers to both planning and implementing it. There is also not much research discussing why there is insufficient investment in implementing a mitigation plan integrating green infrastructure to combat inland flooding. This dissertation focuses on identifying (1) what the physical, socio-cultural, political-institutional, and economic barriers are for three case studies within the state of Hawai'i regarding green infrastructure implementation, and (2) what important planning components are needed to better develop a hazard mitigation plan integrating green infrastructure in order to accomplish environmental justice objectives. A quantitative methods approach and secondary literature review were conducted for this study. From the secondary literature review, several barriers were found preventing planning and implementation of green infrastructure in each of the three case studies. In addition, several planning components were also identified to be of major importance in developing a hazard mitigation plan integrating green infrastructure.



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Planning, College of Social Sciences,
University of Hawai'i at Mānoa



Muhammad Waqas

Provably Correct Design Of Autonomous Vehicles Under Safety, Comfort, And Regulatory Constraints

The safety-critical nature of autonomous vehicles calls for systematic design procedures, e.g., based on formal methods or Control Barrier Functions (CBFs), to provide strong guarantees of safety and performance under all driving conditions. However, existing approaches have mostly focused on fully verified solutions under smooth traffic conditions, with the exception of stop-and-go scenarios. Systematic methods for high-performance autonomous vehicle design under safety and regulatory constraints like traffic regulations are still elusive. The goal of this research is to develop a fully verified and provably correct design for autonomous vehicles under sensor uncertainty, safety, comfort, and regulatory constraints for all driving conditions.

Ming Hsieh Department of Electrical
and Computer Engineering,
Viterbi School of Engineering, USC