March 17, 2023
Concurrent Sessions 1
1:30 pm - 3:00 pm

Improving Mobility

Konstadinos Goulias (presenter), UC Santa Barbara, Exploring the impact of COVID-19 pandemic on Americans time use related subjective well being, Co-authors: Hui Shi

In this study, the most recent American Time Use Surveys containing reported activity-based emotions and sensations information before (10,378 respondents in 2013) and during (6,902 respondents in 2021) the COVID-19 pandemic are used to assess if time use related individuals' subjective wellbeing (SWB) decreased in the pandemic. Given that the coronavirus has been shown to strongly influence activity decisions and social interactions, sequence analysis is applied to find daily time allocation patterns and changes in daily time allocation. Then, those derived daily patterns and other activity-travel factors, as well as social and demographic, temporal, spatial, and other contextual characteristics are added as explanatory variables in regression models of SWB measures. This provides a holistic framework of pandemic impacts on activity-travel schedules and SWB changes while controlling for contexts such as the living environment and daily schedules of activity and travel. The results show that respondents in the COVID year reported a new time allocation pattern that has a substantial amount of time at home, and they experienced more negative emotions. Three relatively happier COVID-19 daily patterns contained substantial amounts of outdoor activities. In addition, no significant correlation was observed between metropolitan areas and individuals' SWB in 2021. However, comparisons among states show Texas and Florida residents experienced more positive wellbeing presumably due to fewer COVID-related restrictions.

Laura Messier (presenter), USC, Broken Sidewalks, Broken Policies

Municipal governments recognize the need to improve walkability to address a wide array of challenges, such as mitigating the climate impacts of vehicle emissions, easing congestion, and improving accessibility and public safety, and have been enacting programs like Complete Streets and Vision Zero in service of these goals. Integral to these policies is a recognition of systemic inequality in pedestrian infrastructure, with sidewalks generally worse in low-income communities and communities of color and people in those communities disproportionately injured and killed while walking. Equity is often a focus of city sidewalk programs and is typically discussed in the context of how cities will prioritize limited funds for city-initiated projects, both to improve accessibility to specific destinations for those with disabilities and to address historically underserved neighborhoods. While this is important, it misses a larger opportunity for systemic change that asks the question, why are sidewalks in many U.S. cities in such disrepair, and what can be done about it?

I completed a qualitative analysis of sidewalk policies and programs of the 30 most populous cities in the United States through review of municipal codes, city websites, available planning documents, ADA transition plans, relevant local news articles, and direct communication with staff from the public works or planning departments in Dallas, Austin, Portland, Phoenix, and Memphis, as well as through my involvement with committees for the Strategic Mobility Plan and Sidewalk Master Plan in Dallas. My analysis focuses on the structure of sidewalk ordinances (responsible parties, enforcement, and financial assistance), the motivations behind existing policies (the Americans with Disabilities Act, the fear of lawsuits, and enormous funding shortfalls), and the challenges cities face in addition to a lack of funding (unclear policies, coordination among different departments and programs, and enforcement).

*This work was supported by the National Institute for Transportation and Communities Scholars Program. Subsequent work while at USC has been supported by the National Science Foundation Graduate Research Fellowship Program.

Aisling O'Reilly (presenter), USC, How can new mobility serve the needs of mobility-constrained communities? A case study of Southeast Los Angeles, Co-authors: Genevieve Giuliano, Marlon Boarnet, Yuquan Zhou, Jacob Collins

The mobility constraints for low-income households are well known. Limited or no access to a private vehicle and often poor quality transit access result in shorter trips, slower travel speeds, and overall less travel. New mobility services that fill the gap between vehicle ownership and transit can potentially provide better mobility options for those with no or limited access to private vehicles. Little is known about how these new services may serve travel needs of low income, minority populations. We examine the concept of a community-based, non-profit ride-matching service to provide low-cost mobility services for local travel. Using a community-based, mixed methods approach, we analyze travel patterns, attitudes, and perceptions in Southeast Los Angeles, a predominantly Latino, low-income community. We find that the spatial distribution of travel is focused on a small number of high-frequency destinations creating the potential for a ride-matching service. Community members are generally favorable to the concept, but there are many community needs and designing a suitable service presents many challenges. This research provides the framework for the design and testing of the ride-matching concept.

Julene Paul (presenter), UCLA, Sharing with strangers: The costs and benefits of online ridesharing

In this paper, I consider informal practices of sharing out, in which people share vehicles with members outside of their social networks. U.S. residents frequently travel by sharing in, such as by carpooling with family members. Yet travelers also share vehicles with strangers. Examples of vehicle-sharing with strangers include (1) riding public transit, (2) using taxi/ridehail and carshare services, and (3) forming casual carpools and ridesharing. While the first two categories are mediated by external parties – including public transit agencies and private companies – travelers in the third category must coordinate these exchanges themselves. This latter category provides an opportunity to understand the role of social factors, identity, and disadvantage in facilitating sharing.

Due to the difficulty of identifying data on informal sharing out, I use the case study of posts on the Craigslist rideshare board. With these data, I evaluate how travelers present themselves and communicate their needs when seeking to share with strangers. Among other factors, I emphasize differences between people who offer and request shared rides, as well as differences between those who engage in primarily commercial versus noncommercial transactions. I find that most posts on Craigslist list intercity trips, although this varies by whether people are posting commercial versus noncommercial trips. While many people share due to financial motivations, others highlight the importance of opportunities to socialize. Yet social and financial motives to share are not always mutually exclusive. Additionally, many posters mention safety as a barrier to sharing with strangers in ridesharing. Some posters volunteer personal information to overcome these concerns.

These findings suggest that policies to increase vehicle-sharing among strangers – for example, formal carpooling programs – might consider incorporating demographic information when matching users. Frequent posting of certain routes could suggest that new services could fill gaps in the transportation infrastructure, for both intercity travel and intracity travel in smaller towns and cities.

Mobility & Technology (RGL 215)

Missy Blair (presenter), Pima Community College, Workforce Development: Autonomous Vehicle Driver & Operations Specialist Certificate Program. An Update, co-author: Amanda Abens

As a member of the PSR UTC, Pima Community College worked with business and industry to create and implement a 12 credit hour certificate program to upskill learners for autonomous technology. The program, Autonomous Vehicle Driver & Operations Specialist, was created with TuSimple, an autonomous trucking company and is the first of its kind nationwide. Attend this presentation to learn more about the certificate program: where it started, where it is now, and the future plans for evolving the program.

Milad Pooladsanj (presenter), USC, Ramp Metering to Maximize Freeway Throughput under Vehicle Safety Constraints, co-authors: Ketan Savla, Petros Ioannou

Ramp Metering (RM), which regulates the entry of on-ramp vehicles into the freeway system, is one of the most well-known tools to combat traffic congestion. The design of RM is often done at the macroscopic level by using macroscopic traffic flow models. These models, which are derived from spatio-temporal averaging of vehicle interactions, lack the necessary resolution to capture safety, Vehicle-to-everything (V2X) communication protocols, and the emerging autonomy paradigms. Therefore, the resulting RM design may lead to sub-optimal performance when implemented in real life. One solution is to design and analyze RM directly at the microscopic (vehicle) level. In this work, we present one such microscopic RM policy which is coordinated and traffic-responsive but does not require any information about the traffic demand, i.e., it is reactive. The proposed RM policy operates under vehicle following safety constraints, where new vehicles are released only if there is enough gap on the mainline. In addition, each on-ramp operates in cycles of fixed length during which it does not release more vehicles than the number of vehicles waiting in its queue at the beginning of the cycle. Moreover, each on-ramp dynamically modulates its release rate based on the existing traffic conditions but cannot release faster than an assigned release rate. Under standard vehicle speed and safety rules, we show that the proposed RM policy can maximize the freeway throughput. In other words, the peak traffic demand that our RM policy can handle without creating long on-ramp queues is at least as good as any other RM policy. We use microscopic simulations to compare the travel time of our policy with the state-of-the-art macroscopic RM policies.

Guoyuan Wu (presenter), UC Riverside, Improving Truck Merging at Ramps in a Mixed Traffic Environment: A Multi-human in-the-loop (MHuiL) Approach, co-authors: Xuanpeng Zhao, Xishun Liao, Kanok Boriboonsomsin

Freeway ramp merging involves a conflict of vehicle movements that may lead to traffic bottlenecks or accidents. Thanks to advances in connected and automated vehicle (CAV) technology, a number of efficient ramp merging strategies have been developed. However, most of the existing CAV-based ramp merging strategies assume that all the vehicles are CAVs or do not differentiate vehicle types (i.e., passenger cars vs. heavy duty trucks). In this study, we focus on improving truck merging efficiency in a mixed traffic environment and develop a multi-human-in-the-loop (MHuiL) simulation platform that integrates SUMO traffic simulator with two game engine-based driving simulators. This platform allows us to investigate the interactions between two human drivers under various traffic scenarios. The case study cross-compares 8 scenarios to assess the performance of a connectivity-based cooperative ramp merging system for heavy-duty trucks, including safety, comfort, and fuel consumption factor. The results show that guided trucks tend to have larger gaps, smoother speed profiles, and lower fuel consumption compared to non-guided trucks.

Fernando Valladares Monteiro (presenter), USC, Risk-Taking Autonomous Lane Changing Decision Method and its Impact on Traffic Flow, co-author: Petros Ioannou

Safety is the number one issue in the deployment of any vehicle technology. On the other hand, the negative traffic flow impacts of an overly conservative system might render it impractical. This problem becomes evident when vehicles must perform challenging maneuvers, such as lane changes, in vehicle-dense scenarios. Numerous existing works proposed strategies that minimize the risk taken during the maneuver to overcome this issue. However, these approaches cannot enforce a predefined bound on the risk. We propose a method that takes a maximum accepted risk as a parameter to address this shortcoming. In this work, the risk is defined as the severity of a collision that would happen under a worst-case scenario. Then, given a maximum risk value, we show how to compute the minimum distances to all surrounding vehicles before a lane change can start. Moreover, we address how a vehicle should behave while looking and adjusting for acceptable gaps. This is done using a method that assumes the vehicle is simultaneously on both origin and destination lanes. This approach is extended to show how connected vehicles can cooperate to generate the desired gaps. We perform extensive simulations using the commercial software VISSIM with varying percentages of Autonomous Vehicles (AVs) and Connected Autonomous Vehicles (CAVs), different vehicle inputs, and several accepted risk values. Results indicate that, while AVs need to accept small risks to achieve the same traffic flow efficiency as humans, CAVs can improve safety and efficiency without taking any risks. Moreover, our results indicate that AVs and CAVs can behave safely in mixed fleets.

Improving Resiliency (RGL 219)

Ali Kothawala (presenter), UC Davis and Fehr & Peers, "Smartness" in Cities: A Case of Nine Cities on the Pacific Coast

Many in the urban planning field consider "smart cities" a distraction. Leadership, staff capacity, public finance (or lack thereof), dysfunctional political and institutional systems, the need for the public sector to take over investor-owned utilities, and social inequality are issues that deserve more attention, critics contend. Despite these misgivings, we cannot discount these technologies' promises and benefits for our urban spaces, especially regarding urban infrastructure planning, delivery, maintenance, and operations. But, cities typically do not have the financial and human resources to pursue targeted technology-infrastructure integration. Public-private partnerships and other innovative models can be an excellent way to tap the technical knowledge, financial support, and training capabilities of the private sector and city citizens. To enable such partnerships and innovations, we must understand what cities want, what barriers they face in integrating technologies, and how these integrations fit into their future plans. Such a holistic understanding of issues surrounding the deployment of smart city infrastructure can help cities and other stakeholders identify pathways toward integrating these technologies into their infrastructure (and in eventually becoming smart cities).

In this study, we
• research government websites and other sources to understand the current funding and political landscape around smart cities
• research city websites and grey and published literature to map the "smartness," i.e., the extent of smart city initiatives in cities, both big and small, on the Pacific coast and Alaska
• and interview (10+) city officials to understand their city's experience with smart city ideas, their implementation, and future potential

Technologies like cloud computing, artificial intelligence, the Internet of Things, augmented reality, edge computing, and blockchain can improve infrastructure, enhance public services and quality of life, and promote economic development in American cities. When applied to problems in transportation, energy, and the environment, they can help streamline service delivery, improve environmental and financial outcomes, and achieve greater resilience and

efficiency. These new technologies offer many purported benefits for cities, a strong market potential for the private industry due to the hardware, software, and infrastructure dependencies it creates, and promise the democratization of several key municipal processes. Therefore, stakeholders of all kinds, from elected officials to private industry to nonprofits, are interested in promoting smart city concepts. Our findings can help create an inventory of smart city initiatives in selected cities and help private-sector companies and nonprofits better plan their partnerships with cities.

Erika Garcia (presenter), USC, California's early transition to electric vehicles: observed health and air quality co-benefits, co-authors: Jill Johnston, Rob McConnell, Lawrence Palinkas, Sandrah P. Eckel

BACKGROUND: The transition to electric vehicles is projected to have considerable public health co-benefits, but most evidence regarding air quality and health impacts of this transition comes from projections rather than observed real-world data. We evaluated whether population-level respiratory health and air quality co-benefits were already detectable at the relatively low levels of zero-emissions vehicles (ZEV: battery electric, plug-in hybrid, hydrogen fuel cell vehicle) adoption in California. Additionally, we evaluated the ZEV adoption gap in underserved communities.

METHODS: We conducted a zip code-level ecologic study using linear mixed effects models relating changes in annual number of ZEVs (nZEV) per 1000 population from 2013 to 2019 to: (i) annual average monitored nitrogen dioxide (NO2) concentrations using 629 records from 107 air monitoring stations in 95 zip codes and (ii) annual age-adjusted asthma-related emergency department (ED) visit rates using 8163 observations in 1238 zip codes. Models were adjusted for calendar year and educational attainment to control for possible confounding.

RESULTS: The average nZEV increased from 1.4 (standard deviation [SD]: 2.1) to 14.7 (SD: 14.7) per 1,000 population between 2013 and 2019. ZEV adoption was considerably slower in zip codes with lower educational attainment ($p<0.0001$), a proxy for socioeconomic status. A within-zip code increase of 20 ZEVs per 1,000 was associated with a -0.41 ppb change in annual average NO2 (95% confidence interval [CI]: -1.12, 0.29). A within-zip code increase of 20 ZEVs per 1,000 population was associated with a 3.2% decrease in annual age-adjusted rate of asthma-related ED visits (95% CI: -5.4, -0.9). Findings were supported by a variety of sensitivity analyses.

CONCLUSION: Observational data on the early phase ZEV transition in California provided a natural experiment, enabling us to document one of the first real-world associations between increasing nZEV and changes in air quality and health. Results suggest co-benefits of the early-phase ZEV transition but with an adoption gap among people with lower socioeconomic status which threatens the equitable distribution of possible co-benefits.

Karl Kim (presenter), UHawaii, Rapid Integrated Damage Assessment (R-IDA) to Support Response, Recovery and Resilience

This presentation summarizes research in progress funded by PSR UTC and the National Disaster Preparedness Training Center (ndptc.hawaii.edu) to improve (near) real time situational awareness of damage and impacts resulting from hazard events including volcanic eruptions, hurricane, tornado, wildfire, and flooding. The NDPTC is a congressionally authorized national center which develops and delivers FEMA-certified training for first responders and emergency managers. With the R-IDA (Rapid Integrated Damage Assessment) project, we integrate satellite, aerial, drone, and 360 degree imagery to capture imagery of roadways and transportation infrastructure before and after hazard events. The imagery is used with HAZUS and other systems and tools for estimating impacts and damage to communities and intended to support prioritization of response, search and rescue, mass care, evacuation and early recovery efforts including debris management and restoration of

critical infrastructure and community lifelines. While the research and development of R-IDA is intended for use in training and capacity building activities of the NDPTC, there are many other potential applications and uses for the technology and platforms. Working with community based organizations and non-profits engaged in preparedness, response, and recovery as well as partnerships with technology vendors, providers, and educational groups requires not only understanding of the technologies and its capabilities but also many legal, institutional, ethical, and administrative concerns regarding the handling, processing, sharing, and use of sensitive, confidential, proprietary data collected during disasters. While the technological challenges resulting from rapid evolution of systems and data are significant, the obstacles and challenges resulting from appropriate use and sharing of data, as well as training, education, and capacity building among users and impacted communities are especially difficult and needed. We argue that a focus on critical transportation assets and capabilities provides a pathway for both better understanding and enhanced capabilities to support community resilience.

Jaehyun Ha (presenter), USC, Simulating Street Network Resilience and Robustness around the World, co-author: Geoff Boeing

Urban street networks underlie the movement of people and goods. Network resilience and robustness are critical to these movements. In this context, robustness refers to a network's ability to absorb and resist impacts from a disruption, whereas resilience refers to a network's ability to adapt and recover from a disruption. Researchers have explored the resilience and robustness of different street network designs in the face of disruption during events like flooding, earthquakes, or terrorist attacks. Most of these studies tend to be case studies or focus on specific regions. However, less is known about the relative resilience and robustness of street networks around the world and the kinds of network designs that foster these characteristics.

This study investigates this gap. It simulates over 2.4 billion trips across more than 8,000 urban areas in 178 countries—covering every urban area in the world larger than a small village. We model these urban area street networks using OSMnx and OpenStreetMap data constrained to urban area boundaries defined by the Global Human Settlement Layer.

First we generate 10,000 origin-destination pairs for each urban area. Then we simulate these trips before and after network disruptions of different types and magnitudes. The first network disruption type is based on elevation: we eliminate the lowest-lying nodes in the network to roughly represent a flooding event. The second type is based on importance: we eliminate the nodes with the highest betweenness centralities in the network to roughly represent a targeted attack on the most important infrastructure, such as in a terrorist attack. The third type is random: we eliminate a random sample of network nodes, representing distributed and unpredictable events like vehicle collisions or earthquakes. We model each of these three disruption types at 0%, 1%, 2%... up through 10% of the network's nodes. Then we operationalize two primary indicators of network robustness and resilience. We measure robustness as

the percentage of solvable OD pairs that remain after each network disruption, and resilience as the percentage reduction in trip efficiency (adapting Latora and Marchiori's measure of such) after each network disruption.

These simulations allow us to answer two questions. First, how vulnerable are street networks around the world to these different types of disruption? In other words, which cities or world regions tend to be more robust or resilient and why? Second, what is the relationship between resilience/robustness and various geometric and topological street network design characteristics, all else equal? Alongside several control variables, the characteristics of interest that we model include network connectedness (average node degree), circuity, and intersection density. Collectively these measure the redundancy and efficiency of the underlying network, which theoretically should help it resist and recover from disruption. We also develop a novel "chokepoint" indicator: extreme relative dependence on few nodes (such as a bridge linking two parts of a city) suggests more likely network failure when such nodes are attacked.

Our findings reveal that attacking nodes with high importance leads to severe network disconnection and reduced trip efficiency. Random disruptions result in moderate impacts and elevation-based disruptions result in the least. Among world regions, urban areas in Europe, Northern America, and Oceania were least robust and resilient. On average, eliminating the 10% most important nodes disconnected 80% of OD pairs. We also find that the average node degree is positively associated with robustness and resilience as it adds redundancy to the network. In contrast, our chokepoint indicator has a negative association on robustness and resilience. We argue that urban planners and engineers should emphasize designing new—and retrofitting old—networks with more redundancy and less reliance on chokepoints to create more robust and resilient cities.

Research Session: Data aggregation and standardization
Location: Ralph and Goldy Lewis Hall (RGL), 308

This panel will focus on open data plans that allow interoperability of data and systems. California is developing open data standards and protocols. At the same time, the California Integrated Travel Project (Cal-ITP) has commissioned standards and hardware that can allow multi-platform payments across any transit system in the state. The Los Angeles DOT, in partnership with LA Metro, is also launching a Mobility Wallet pilot that aims to allow interoperability of payment across public and private platforms. What challenges and opportunities may arise? Topics to be covered include:

- How do we share data across multiple platforms? What are the privacy and confidentiality issues that might arise?
- How can research universities help address those challenges?
- How can data sharing, open data, and interoperability be implemented when working with private transportation providers?

Panelists:

- Marlon Boarnet – USC (moderator)
- Hunter Owens – Caltrans and Cal ITP
- Joy Bonuguro (invited) – California Chief Data Officer
- Avital Shavit – LA Metro
- Geoff Boeing – USC
- Caroline Rodier (invited) – UC Davis

Improving Mobility (RGL 209)

Andrea Nguyen (presenter), UC Davis, Barriers to mobility, barriers to unity: Freeway construction and racialized displacement in San Jose, CA, co-authors: Susan Handy, Jesus Barajas

In the years following World War II, highways came to control the character of the North American built environment, becoming a symbolic representation of the modern city. In California, sprawling highway development fostered suburbanization and new geographic and social transformations that reshaped racial relationships in metropolitan areas. Through empirical research including comprehensive reviews of historical documents, key informant interviews, and a geospatial analysis of neighborhood housing characteristics between 1950 and 1980, this study shows how freeway planning reflected implicit biases which resulted in devastating and lasting negative outcomes for neighborhoods of color. This study presents the findings on the historical impacts of freeway construction in San Jose, California, as well as a theoretical framework for understanding the social function of highway placement and underlying politics of highway construction through an anthropological view of power and social control.

The construction of I-280 and I-680 cut through the heart of predominantly Latino neighborhoods in San Jose, such as Washington-Guadalupe, Martha Gardens, and Mayfair, destroying affordable housing stock. By quantifying the total population displaced by race and ethnicity, we illustrate how this freeway-induced displacement disproportionately impacted San Jose's neighborhoods of color. These neighborhoods were historically graded as "less desirable," and interviewee accounts suggested that the planning process for these freeway sections was motivated by racial segregation. These freeways not only separated the majority Latino east side from the more affluent and white west side, but also broke thriving, unified Latino communities into smaller, less connected neighborhoods. By additionally framing this displacement as an act of state power exercised upon "blighted" neighborhoods to achieve postwar suburban homogeneity, the extent of freeway impacts can be analyzed as not only physical and economic, but also social and symbolic, as a policy to break up political power in communities of color. Ultimately, this study offers a roadmap to the state department of transportation and other policymakers to redress past harms through an interdisciplinary understanding of the access barriers faced by disadvantaged communities, so that future harms may be avoided when delivering transportation investments.

Jaehyun Ha (presenter), USC, Innovation on job accessibility and transit scenario planning with General Transit Feed Specification data, co-authors: Madison R.E. Swayne, David R. Flores Moctezuma, Marlon Boarnet, Jiawen Fang

The public transportation in Los Angeles is rapidly expanding and will continue to do so during the next decades. Planning and policymakers need to understand how this large investment is changing accessibility in the region, with particular attention paid to communities that are heavily reliant on public transit services. Since 2010, the Los Angeles County Metropolitan Transportation Authority has opened three new rail transit segments, and over sixty billion more dollars will be used to further improve the transit system. This rapid build-out of rail transit, combined with an ongoing re-assessment of the bus transit network due to the COVID-19 pandemic and other system changes, requires methods to empirically evaluate how these changes to the network impact access.

Accessibility, determined by the spatial distribution of destinations, the travel costs associated with reaching a destination, and the travel modes available, is central to understanding individuals' residential location decisions and opportunities within a metropolitan area. Yet in practice, the difficulty of calculating detailed accessibility measures from agency data has limited the use of accessibility as a tool for planning and evaluating transit expansions. The availability of new data sources allows for the build-out and implementation of new accessibility calculators that can be more readily applied to transit expansions. In this paper, we create a cumulative opportunity measure of accessibility to jobs using existing and

planned transit lines to evaluate how transit expansions may improve access to jobs. In our analysis, we explore three cases -- one of transit line additions and their impacts systemwide, another of changes to individual line service, and station/stop infrastructure changes. Our analyses provide insights into job access research, and more broadly, opportunities for transit scenario planning assessments. Additionally, the methodologies applied here are accessible to urban planning professionals who might not have the capacity to build new tools for scenario planning analysis.

We use Los Angeles County as the study area for our case studies and include in our analysis evaluations of the entire county. It is the most populous county in the United States and is one of the most ethnically diverse counties in the nation. We use General Transit Feed Specification (GTFS) data to model existing transit services and to construct the transit network. In detail, we include the GTFS data for all major public transit service providers in Los Angeles-Long Beach-Anaheim metropolitan area including the rail networks, bus networks, stations, stops, and walkable streets network.

Overall, we find that scenario planning for job access is both possible and illuminating. The access improvements for the Purple Line extension are considerably larger than for the Crenshaw light rail. The access improvements from faster first/last mile travel to/from stations are larger than access improvements from systemwide headway reductions. These results do not, by themselves, indicate which scenarios should be favored. Different policies will give localized access improvements that vary, and the scenarios we presented here illustrate those local variations also. Yet job access can be a tool to not only evaluate the characteristics of existing transit systems.

Susan Pike Cayar (presenter), UC Davis, Public Transit and Open Payments: Challenges and Opportunities for Unbanked Travelers, co-author: Kailey Flynn

The state of California's California Integrated Travel Project (Cal-ITP) aims to help transit agencies implement open payment systems, i.e. those that accept all forms of payment including phone-based, credit and debit card, and smart watch payments. However, transitioning to new payment methods will be met with a number of logistical and ethical challenges to ensure the benefit of all riders from this transition. How well these systems can serve unbanked passengers remains an open question. In partnership with Cal-ITP we collected 200+ intercept surveys in the Davis-Sacramento-Woodland area of California. With this data, we explore the current practices and future payment preferences of un- and underbanked riders, and how these compare to those of banked riders. We explore a number of challenges and how these relate to preferences for different means of payment. We find that by and large our respondents prefer to use means of payment they are already familiar with and tend not to identify as many challenges with means of payment they are likely to have used before.

Susan Pike Cayar (presenter), UC Davis, Public Transit and TNC partnerships: Barriers, Opportunities and the Impacts of COVID-19

As Transportation Network Company (TNC) services became more widely available in the years leading up to the COVID-19 pandemic and their impacts on transit were felt, transit agencies and some municipalities considered what could be called an "if you can't beat 'em, join 'em" approach to these new services. That is, partnerships were formed between TNCs and transit agencies and pilot programs were launched. The pilot programs typically involved subsidizing TNC travel for passengers connecting to public transit routes or travelling at times that public transit offers limited or no service (such as late at night). Before the pandemic a growing number of transit agencies formed TNC partnerships and launched pilot programs. However, during the pandemic this trend stalled out as other transit agency concerns became more urgent. In this paper we draw on interview and survey data collected from transit agencies throughout the US to examine factors that impact transit agency and TNC partnerships both before and during the pandemic. The pandemic presented a number of new challenges for transit agencies and intensified challenges that existed in the preceding decade. However, the challenges of agencies that form partnerships are no different than those of other agencies. Rather, the factors that contribute to partnership formation and the launch of TNC-transit pilot programs may be more akin to a set of necessary conditions. Our interviews suggest that, before the pandemic champions of these partnerships were important for partnerships to form and pilots to launch. Other necessary conditions include internal agency support, a source of funding, and lower numbers of concerns with TNCs and potential

partnerships. TNCs also saw reduced demand during the pandemic, with stay-at-home orders and concerns over public health impacts prompting travelers to avoid these services. The results presented in this paper highlight the areas or most importance to transit agencies when considering TNC partnerships and provide insight into the longevity of this model as a means to address transit agency challenges.

Mobility & Technology (RGL 215)

Siddhartha Gulhare (presenter), UC Davis, The Use of Passively Collected Data to Study the Evolution of Travel Demand

In early 2020, the pandemic brought the normal life to a halt around the world. Consequently, the mobility of people dropped significantly and many who travelled, shifted to personal vehicles and active modes of transportation to avoid contacts with others. However, there was heterogeneity in the adaption in the travel behavior within the society during pandemic. White-collar workers such as software professionals, accountants, etc. adopted remote work, the blue-collar workers such as construction workers, restaurant staff, etc., including frontline workers such as nurses, bus operators, etc., had to travel to their work locations and could not significantly shift to remote work. While white-collar workers are more likely to have higher income; the blue-collar workers can mostly be characterized by low-income, people of color and not having access to car to commute. These blue-collar and frontline workers were also believed to be dependent on public transportation to commute during pandemic. It is important to understand the variation in the adaptation in travel behavior to optimally allocate the resources (e.g. public transportation). The general approach to understand the heterogeneity in travel behavior within society involves hypothesis testing. The analyst hypothesizes, for instance the disruption in travel pattern varies by income and employment type, and then compares the neighborhoods with different income, employment types to test the hypothesis. The approach is well established; however, it is limited by the number of hypotheses that can be tested. There are possibilities that there existed heterogeneities due to unknown underlying factors. We developed a data driven approach which scan the northern California to uncover the heterogeneity in the change in travel patterns in the neighborhoods without using sociodemographic information. The sociodemographic information can later be used to learn the causality for the heterogeneous behavior. This novel data driven approach can get better insights of travel demand which can also help transit agencies to introspect and prepare for any future health crisis.

Siwei Hu (presenter), UC Irvine, An Urban Network Assignment Platform with Equitable Peer-to-peer Congestion Pricing and its Policy and Equity Implications, co-authors: Daisik Nam, Pengyuan Sun, R. Jayakrishnan, Michael Hyland

Researchers have investigated different methods to alter travelers' selfish driving behaviors to direct the state of transportation networks from User Equilibrium (UE) to System Optimal (SO). To reach such a goal, congestion pricing is adopted as a common approach. However, a significant proportion of newly constructed toll roads has failed to attract the expected number of drivers, resulting in the underutilized road capacity. Furthermore, the unfair feeling among drivers about the tolls is also a barrier to congestion pricing, because it is difficult to persuade drivers to give up their "right" of free travel on urban roads. So it makes congestion pricing policies politically difficult to implement in cities around the world. In addition, the current congestion pricing schemes are also unclear about how the collected tolls are fairly distributed among drivers.

To address those issues, we propose an equitable and efficient mobility platform with a peer-to-peer equitable congestion pricing scheme that allows travelers to coordinate their path choices with monetary exchanges. The proposed platform consists of a dynamic traffic assignment component, which calculates time-dependent SO routes as travelers' choice set, and a monetary exchange component, which calculates the equitable peer-to-peer monetary exchange prices under such SO routes.

To ensure equity among travelers, we adopt envy, a term originating from the fair division problem in economic welfare theory, to design the monetary exchange mechanism in the proposed mobility platform. A person feels envy if he/she finds that an option assigned to (or selected by) other travelers provides a higher value than his/her current selected option, based on his/her own value functions and not the other travelers'. Based on envy, the equitable state in the proposed mobility platform occurs when nobody feels envy, i.e., an envy-free state.

We test this platform in the Los Angeles I-10 toll expressway corridor network with 799 nodes, 1,927 links and 78,196 trips. The results show that with as little as 7.7% of travelers engaging in peer-to-peer route choice coordination with monetary exchanges, the transportation system state could be directed from UE to a both SO and envy-free state, resulting in a 13% increase of network space mean speed from 31 mph to 35 mph. Furthermore, the average transaction of the engaging travelers is only $0.904, which is significantly less than the current I-10 expressway tolls, whose peak period price varies from $4.25 to $5.46. The low price will make the proposed platform more acceptable to the public. Moreover, the envy-based peer-to-peer exchanges can also yield a higher level of traveler satisfaction among different income groups and equity across the traveler population.

Yiqiao Li (presenter), UC Irvine, Real-time Truck Characterization System: A Pilot Implementation of the Freight Mobility Living Laboratory (FML2), co-authors: Andre Tok, Guoliang Feng, Stephen Ritchie

California possesses multiple major freight gateway and logistics facilities that serve both the state and the entire U.S. But the economic, environmental, and local community impacts of trucks, especially heavy-duty trucks that are currently essential to our supply chains and freight transportation system remain poorly measured due to the lack of comprehensive and detailed truck activity data. This paper describes the pilot implementation of the real-time, scalable, and cost-efficient Freight Mobility Living Laboratory (FML2). This system provides truck characterizations across multiple attributes, such as truck body types, axle-based and Gross Vehicle Weight Rating (GVWR)-based classification and is currently deployed at 30 detection locations in Southern California along major freight corridors to support freight modeling and analysis needs. This paper details the design of the FML2 from edge data processing, predictive model development, communication architecture, and backend data storage to the real-time data dashboard to visualize the classification results. Three case studies have been presented at the end of the paper to demonstrate potential of FML2 for use by both researchers and practitioners to gain further insights on truck activities.

Mobility & Technology (RGL 219)

Faria Raha (presenter), NAU, Investigating the Impact of the COVID-19 Pandemic on Traffic Crash Injury Outcomes among Different Demographic Groups, co-authors: Alyssa Ryan, Brendan Russo

Recent research suggests that COVID-19-associated stay-at-home conditions affected the motor vehicle crash rate throughout the world. It is crucial to advance our knowledge in the transportation system following drastic changes to this system with respect to which group(s) of people are most impacted. As such, this study investigated the impact of the COVID-19 pandemic on different demographic groups in resulting traffic crash injury severity in California. Logistic regression analyses were developed to identify the interaction of the pandemic effect and demographic characteristics (age, race, and sex) of drivers on crash injury outcomes. The investigation was performed by utilizing policed-reported public vehicle collision data gathered from the California Highway Patrol from January 1, 2019, to April 30, 2021.

Results reveal that young drivers and Black drivers were more likely to experience severe crashes during the height of the pandemic compared to other age and racial groups, respectively. Additionally, the relationship between the pandemic and driver gender was investigated to reveal potential connections; however, no significant relationships were found. These observations provide a data-driven framework for prioritizing road safety strategies based on specific demographic groups to reduce the impact of future pandemic waves as well as similar disruptions to the transportation system.

Wei Gu (presenter), USC, A General Coupled Morning-evening Traffic Equilibrium Model with Rideshare and Ride-hailing Services, co-author: Maged Dessouky, Jong-Shi Pang, Michael Zhang

We develop a general equilibrium model to capture the complex interactions between solo driving, rideshare and ride-hailing services such as Uber and Lyft that allows travelers to switch between different transportation modes and allows passengers from different Origin-Destination (OD) pairs to share a ride together in a coupled morning-evening commute framework. The model is formulated as a variational inequality (VI), and reformulated as an equivalent mixed complementarity problem (MiCP). Then we prove the existence of an equilibrium solution, and provide the conditions on the model parameters under which the equilibrium will be unique. Furthermore, we prove that the travelers' disutility of our coupled model will not be worse than that of a decoupled modeling approach. The computational results on the Sioux-Falls network show that our model captures the possible mode switches and the coupling effects between morning and evening commutes, as well as the detour of rideshare drivers to pick up or drop off passengers. Furthermore, our numerical examples demonstrate that modeling morning and evening commutes separately tends to overestimate the number of drivers and total Vehicle Hours Traveled (VHT) in the network when accounting for travelers' capabilities for mode switches and the coupling interaction effects between morning and evening commutes.

Muhammad Waqas (presenter), USC, Systematic and Provably Correct Control Design Methodology for Connected Autonomous Vehicles, co-author: Petros Ioannou

Fully verified automatic longitudinal control under all driving conditions is essential for the success of autonomous vehicles (AVs). These driving conditions include but are not limited to complex road geometric constraints, traffic rules, adverse weather conditions, pedestrian avoidance, etc. However, the verification of autonomous vehicles (CAVs) is a bottleneck in the design of these safety-critical systems. A correct-by-construction design is a promising methodology that can significantly accelerate the design process. Recently, control barrier functions (CBF) are proposed to guarantee simple forward invariance and reachability tasks. We use the control barrier function technique to define a dynamic safe set for autonomous vehicles. We then design a system that would provide formal guarantees that the autonomous vehicle will stay inside a well-defined safe set. The safe set is defined in such a way that its forward-invariance would guarantee the safety of passengers, neighboring vehicles, pedestrians, obstacles, and provable compliance with traffic rules. We formulate CBF based assume/guarantee contracts (CBF contracts) to provide guarantees for more complex safety behaviors. We then show that CBF contract-based design can provide safety in the presence or absence of vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications. We show that the proposed methodology can provide strong guarantees of safety, comfort, and compliance with traffic rules under complex road geometric constraints, and adverse weather, with or without V2V and V2I communication.

Pengfei Chen (presenter), USC, Centrally coordinated scheduling and routing co-simulation optimization method for airport shuttle fleet management

Today's airport terminals face a critical traffic congestion problem partly caused by uncoordinated operations of oversize shuttles and buses. Specifically, the congestion near pick-up and drop-off points negatively affects passenger traffic leading to unnecessary idling, delays and congestion with negative impact on air quality and mobility. The need for an intelligent shuttle management system becomes more urgent with the surge of development in information technologies and battery electric shuttles.
In this project, we develop a centrally coordinated shuttle scheduling and routing management system for mixed fleets of diesel and electric shuttles using a digital twin of LAX to LA downtown traffic road network by optimizing the total combined cost of energy consumption and travel time. A multi-layered Co-Simulation Optimization method is used to solve the problem. The framework of this method is shown in Figure 1. Specifically, the upper layer is in charge of scheduling the order of shuttles arriving at the stops around the network based on constraints such as traveling time, energy cost, charging time, etc. This layer is formulated based on a job assignment problem with complex constraint specification on charging behavior for each electric shuttle. Based on the scheduling of shuttles across the whole network, a traffic load balancing assignment is used to assign the shuttle demand on the transportation system aiming to minimize the travel time and energy consumption cost. This layer is formulated based on a Traffic Assignment Problem (TAP). The general framework of the optimization model can be described as

follows: a central coordinator receives from individual users (shuttle companies) their origin/destination (O/D) demand with time window and information about the mixed fleet of diesel and electric shuttles. Then the proposed system generates a scheduling solution by deciding the order of shuttles to be served at each stop based on the network link cost and desired service constraints. The network link cost consists of the travel time cost and energy consumption cost. Then the order of shuttles entering and leaving each stop is input into the load balancing assignment layer, which generates routes for each shuttle that minimize an overall system cost. The impact of the loads on each link is taken into account to achieve load balancing across the road network. The dynamic and predicted link cost information is generated by a traffic simulator that is part of the overall co-simulation optimization approach. Note here, the predicted link costs such as travel time is important in calculating battery life in the case of electric shuttles. In this project, we develop a centrally coordinated shuttle scheduling and routing management system for mixed fleets of diesel and electric shuttles using a digital twin of LAX to LA downtown traffic road network by optimizing the total combined cost of energy consumption and travel time. A multi-layered Co-Simulation Optimization method is used to solve the problem. The framework of this method is shown in Figure 1. Specifically, the upper layer is in charge of scheduling the order of shuttles arriving at the stops around the network based on constraints such as traveling time, energy cost, charging time, etc. This layer is formulated based on a job assignment problem with complex constraint specification on charging behavior for each electric shuttle. Based on the scheduling of shuttles across the whole network, a traffic load balancing assignment is used to assign the shuttle demand on the transportation system aiming to minimize the travel time and energy consumption cost. This layer is formulated based on a Traffic Assignment Problem (TAP). The general framework of the optimization model can be described as follows: a central coordinator receives from individual users (shuttle companies) their origin/destination (O/D) demand with time window and information about the mixed fleet of diesel and electric shuttles. Then the proposed system generates a scheduling solution by deciding the order of shuttles to be served at each stop based on the network link cost and desired service constraints. The network link cost consists of the travel time cost and energy consumption cost. Then the order of shuttles entering and leaving each stop is input into the load balancing assignment layer, which generates routes for each shuttle that minimize an overall system cost. The impact of the loads on each link is taken into account to achieve load balancing across the road network. The dynamic and predicted link cost information is generated by a traffic simulator that is part of the overall co-simulation optimization approach. Note here, the predicted link costs such as travel time is important in calculating battery life in the case of electric shuttles.

Research Session: Novel travel data collection approaches for freight and active travel data
Ralph and Goldy Lewis Hall (RGL) 308
This panel will focus on novel ways to collect travel data and the gaps in two traditional travel data collection methods: active travel, and freight/goods movement over the ground transportation system. Topics to be covered include:

- What are the pros and cons of counting systems, and how do those compare with more traditional travel surveys?
- For an active travel count program, what would be the requirements for data accuracy, information density, and privacy protection? For freight, how can different technologies - loops, weigh-in motion, LiDAR, Automated License Plate Recognition (ALPR) – be helpful?
- California is developing a statewide active transport count program. What parts of the network should be covered by such a program to inform policy goals? What devices – inductive loops, passive infrared, machine learning analysis from video cameras, or other methods – might be used? What data is needed to assist state and metropolitan planners in understanding truck traffic and goods movement?

Panelists:

- Genevieve Giuliano – USC (moderator)
- Andreas Krause – Caltrans
- Scott Strelecki – SCAG
- Susan Handy – UC Davis
- Steve Ritchie – UC Irvine
- Luciano Nocera - USC

Carbon & Air Quality (VPD 112)

Adam Cohen (presenter), SJSU, Planning for Advanced Air Mobility

This presentation will share early findings from a forthcoming American Planning Association guidebook that: (1) provides planners with an overview of advanced air mobility (AAM) and how it may impact communities and planning practice; (2) discusses the potential impacts and challenges of AAM; (3) explains considerations for integrating AAM with other transportation modes; (4) examines how AAM can impact social equity and potential strategies for enhancing it and mitigating adverse impacts on underserved populations; and (5) explains how AAM can be integrated into planning practice. Key topics in the presentation will include potential opportunities and challenges of AAM from an airport, local, and regional planning and policy perspective; opportunities and challenges related to vertiport land use compatibility, and recommendations to plan and guide the implementation of AAM toward sustainable and equitable outcomes. Additionally, the presentation will discuss the importance and practices for involving key stakeholders and the public, including key findings from another forthcoming study, Airport Cooperative Research Program (ACRP) 11-02/Task 43 Successful Community Inclusion in Advanced Air Mobility.

Sue Dexter (presenter), USC, Cradle-to-grave Life Cycle Assessment of Zero-emission Heavy-duty Trucks

Heavy-duty trucks are a leading contributor to global climate change. California has enacted technology-forcing legislation to replace fossil fuel trucks with zero-emission vehicles to address freight transportation emissions. These vehicles include both battery-electric and hydrogen fuel cell class-8 trucks. To determine which type of vehicle provides the most significant savings in energy consumption and emissions over diesel, a cradle-to-grave life cycle assessment (LCA) using Argonne National Laboratory's AFLEET and GREET tools explores energy and emissions of different truck powertrains. The analysis includes upstream raw material and mineral extraction, manufacturing, distribution, operation, end-of-life recycling/disposal, and the fuel production phase of electric, hydrogen fuel cell, and diesel models. From this method, stage, place, or materials assessment can reduce energy consumption and GHGs. Results from the LCA modeling suggest that battery-electric powertrains are superior at reducing the lifecycle carbon footprint more than a comparable hydrogen fuel cell model using standard hydrogen-producing methods. Significant investments in renewable green hydrogen production are needed to make fuel cell technology a viable option.

Mariano Rubio (presenter), USC, Plasma-Enhanced Combustion of Carbon-free Fuels for Reduced CO2 Emissions, co-authors: Boxin Zhang, Oscar Hernandez, Yushan Chen, Fokion Egolfopoulos, and Stephen B. Cronin

As a society, we must find a pathway towards sustainable/clean energy and combustion. Among all zero-carbon fuels, ammonia (NH3) and hydrogen (H2) are the most promising candidates. With as much as 55% less CO2 released per Joule in comparison with petroleum and diesel, natural gas (mainly CH4) is considered as a feasible "bridge" fuel. However, H2 and NH3 combustion are challenging due to the high NOx (mainly NO and NO2) emissions produced from combustion of both H2 and NH3 and the low burning rates associated with NH3. In the work presented here, we used nanosecond pulse transient plasma (NPTP) in a natural gas (NG) engine to enhance the combustion of H2 and NH3, and reduce the emissions of NOx and greenhouse gases (GHG). To lower CO2 emissions, H2 and NH3 are currently being mixed with natural gas (NG), but in relatively small ratios. With the ability to initiate a series of plasma discharges, our plasma-enhanced ignition system enables stable combustion of higher percentages of H2 and NH3. Using this approach, we find that transient plasma enables stable combustion of higher NH3:H2 ratios (up to 55% NH3) than with conventional spark ignition, which is significant considering the difficulties in H2 liquification, transport, and storage. Also, transient plasma

enables stable combustion of higher H2:CH4 and NH3:CH4 ratios than with conventional spark ignition. In addition, it enables further CO2 reduction (up to 58%) with NH3 under lean CH4 conditions than conventional spark ignition. Optical spectroscopy demonstrates the formation of atomic oxygen (O) and nitrogen monohydride (NH) radicals, which are considered as highly reactive intermediates accelerating the combustion kinetics.

Carlos Otero (presenter), UC Davis, Electrification of heavy-duty fleets under a sustainable regulatory environment and infrastructure limitations

The arrival of zero-emission vehicles (ZEVs) enables the possibility of reducing overall emissions (at least tailpipe emissions) while clean energy is still in the works. In recent years, multiple government agencies have supported the development and promotion of cleaner vehicles through several strategies ranging from economic incentives to penalty-based mechanisms to discourage the use of internal combustion vehicles. However, small- and medium-sized (SMEs) companies face challenges in adopting these technologies, either because of high purchase costs or because the volume of their operations may not justify the expense. To address this issue, this work evaluates cooperative strategies between companies that would exploit economies of scale through the sharing of vehicle capacities in joint routing. In doing so, the study proposes an extension of the Vehicle Routing Problem (VRP) to evaluate such cooperative strategy. The model allows load matching from different companies while considering heterogeneous fleets, limited number of charging/refueling locations, multiple depots, vehicles' cargo and range capabilities, and time windows. Different scenarios explore the impact of sustainability policies that limit the percentage of diesel vehicles in fleets, and subsidies to foster ZEV adoption. Results show the potential benefits of implementing collaborative practices in reducing costs and emissions, and how large emissions reduction can be reached cost-efficiently. Additionally, the analyses evaluate the trade-offs between vehicle specifications (e.g., range) and supporting infrastructure (e.g., coverage of charging stations) in California.

Improving Mobility (VPD 105)

Brendan Russo (presenter), NAU, Analyzing the Impacts of Intersection Treatments and Traffic Characteristics on Bicyclist Safety: Development of Data-Driven Guidance on the Application of Bike Boxes, Mixing Zones, and Bicycle Signals, co-authors: Sirisha Kothuri, Edward Smaglik, David Hurwitz

Transportation modes converge at intersections resulting in conflicts between bicyclists and motor vehicles. A common conflict and crash type involving bicycles at intersections is the right-hook, where a right-turning vehicle collides with a through bicyclist. While various geometric and signal control treatments have been used in attempts to mitigate bicycle-vehicle crashes and conflicts, agencies often face questions regarding optimal treatment selection. To date, limited research has been conducted to analyze how certain treatments (bike boxes, mixing zones, and bicycle signals) along with traffic characteristics (e.g. vehicle, bicycle, and pedestrian volumes) impact the frequency of bicycle-vehicle conflicts, as well as the severity of such conflicts. To address this research need, this study provides an analysis of bicycle-vehicle conflicts reduced from field-collected videos at twelve intersections; three with bike boxes, three with mixing zones, three with bicycle signals, and three control sites with no specific bicycle treatment. From these videos, bicycle-vehicle conflicts were identified and measured using post-encroachment time (PET), along with conflict-involved road user speeds and hourly road user volumes. From these data, a series of Poisson regression models were estimated to assess hourly predicted conflicts as a function of bicycle and vehicle volumes across different treatment types. Additionally, conflict severity differences across treatments were analyzed, including through use of a novel measure which incorporates both PET and vehicle speed. Ultimately, several differences with respect to conflict frequency and severity were observed between the treatment types providing new data-driven guidance to assist practitioners in treatment selection.

Weijing Wang (presenter), UC Davis, Mobility Justice in Rural California: Examining Transportation Barriers and Adaptations in Carless Households, co-author: Jesus M. Barajas

Rural residents face significant challenges to destination accessibility and mobility because travel destinations are far, opportunities are limited, and roadways are more dangerous than their urban peers. These challenges are exacerbated when households have limited or no vehicle access because other transportation options are often inconvenient, expensive, or non-existent, leading to greater difficulties in conducting daily activities. Given the mandates in California to limit vehicle miles traveled and to promote more sustainable forms of transportation, a deeper understanding of rural residents' transportation needs, is a primary step for an equitable transition. The study used the US Census microdata to describe socioeconomic and mobility characteristics of carless households and residents in rural California and conducted interviews with 22 San Joaquin Valley residents to understand the barriers to access and travel adaptations among individuals who have limited vehicle access.

Findings show that about 1 million California households (7%) have no vehicle and 2.9 million (22%) have fewer vehicles than household adults, also known as car deficit. About 110,000 households (5%) in rural areas do not have a car and 387,000 households (18%) are in car deficit. Rural carless and car-deficit households are most concentrated in the Central Valley, where up to 8% of households do not have a car and over 30% are in car deficit in some areas. Socioeconomic and mobility differences associated with car access are pronounced. About 8% of Black people living in rural areas are carless, about 2.5 times as many as white rural residents. About 35% of Latino and Asian rural residents are car-deficit, twice as many as white residents. Rural carless households earn about two-thirds less than rural households that have at least one car per driver. Compared to their counterparts in non-rural areas, rural carless and car-deficit households earn 27% and 23% less, respectively.

Despite not having a car, rural carless residents are two times more likely to drive or ride in a shared vehicle than their nonrural peers but are significantly less likely to use public transit. To overcome the limitations of not having one car available, rural residents rely on family, friends, and neighbors to get rides or borrow vehicles when they did not have one available for themselves, however, access to vehicle through social networks are often challenged by the transportation costs and high gas prices placing additional burdens on those giving and receiving rides. In the meantime, informal options, like those organized by community coalitions and neighbors, and formal options, like on-demand ridehailing, publicly operated transit, and community-based car sharing, are frequently mentioned and desired by rural carless residents during interviews, suggesting vehicle access is practically a necessity getting around rural areas. Thus, policy interventions that support community-based transportation options, complementary to transit services, might best alleviate mobility and access challenges for carless residents in an equitable sustainability transition in rural California.

Robert Binder (presenter), USC, When Lyft Becomes the Best Option: Interactions with the Near-Captive Rider

Public transit is meant to provide basic mobility for the transportation of the disadvantaged and to serve broader social and environmental goals in the metropolitan areas of the United States. It is thus a means to achieve the objectives of the community and urban planners, alike. Public transit is also often considered to have external or hard to quantify benefits that add value beyond the service provided and the passengers attracted—for example, functioning in a way that is like public space.

The purpose of this research was to show how the functions of and interactions within public space may also occur on public transit, and thus, that public transit functions like a public space and has social value. The nature of the way public transit operates, "with people from diverse backgrounds constantly entering and exiting, sitting and standing, facing one another, and shifting and bracing their bodies," riders are "bound to come into visual or physical contact with others… The transit vehicle, then, presents people with a unique space for practicing being a stranger in the city (Ocejo & Tonnelat, 2012)." With this research, I was seeking to answer the research question—does public transit act as a mechanism or tool for social mixing?

It was not the intent, however, to include my experiences of driving Lyft in this research. Utilizing Lyft as a supplement to the bus brings better opportunities to engage with the community, a greater understanding of the transportation ecosystem, and a snowballing impact on my own experience as a suburban Detroiter living in the city and my understanding of the community and their daily struggles with transportation.

Over 12 days (70.46 hours) in December 2022 and January-February 2023, I completed 174 trips driving Lyft. I used an ethnographic approach to interact with the riders through natural conversation and by finding common ground, most often in discussing the state of public transit and the frequent need to take a Lyft. Building from previous examples of ethnographic work that looked for a greater understanding of the interactions within public space, I considered the unobtrusive moments and social interactions that occurred while driving diverse populations in Detroit and its suburbs. These experiences while driving Lyft are supplemental data to the key findings along the bus and is another method to connect with the "gatekeepers" of public transit in the geographies under study.

This research is part of a dissertation with the working title, “Brushing Shoulders: In-Transit Social Interactions and Intersecting Identities in Los Angeles and Detroit.” The findings to date include preliminary observations of key interactions while driving Lyft, in comparison with observations along transit routes in Metro Detroit. There are common ‘typologies’ of the interactions that happen along a particular route between riders and between the riders and the participant observer, themself.

A discussion of the relationship between public space and Lyft (as well as the social interactions within them), and key reflections and conclusions of these observations will be included in a dissertation chapter.

Hossain Mohiuddin (presenter), UC Davis, Increasing the Use and Equity of Shared E-bike: The Case of Sacramento Dockless E-bike Share, co-authors: Dillon Fitch-Polse, Susan Handy

As bike-share systems proliferate across the US, a deeper understanding of current bike-share users could enable an expansion of these services and their benefits to a larger population. A bike-share system improves social equity if the service is available to segments of the population who struggle to afford transportation and who cannot own or use a personal car. In this study, we use market segmentation approaches to identify opportunities for growing demand while improving equity. We focused on groups with clear disadvantages, such as low-income, and groups with potential disadvantages such as carless individuals/households, transit users, carshare users, and student users. Using data from bike-share user surveys in the Sacramento region, we segmented bike-share users based on their perception of the bike-share service, modality patterns, and the use purpose of the service. Our market segmentation of bike-share users shows that the use of the service is mostly driven by the need for transportation rather than perceptions of bike-share. The results show that individuals with low income, students, and non-auto owners use the service frequently for commuting and a variety of non-commuting purposes. Bike-share is generally adopted by all types of modality groups. Among the bike-share users, two types of multimodal groups exist: one group that mainly uses active modes (i.e., walking and bicycling) for commuting purposes and another group that uses a combination of ridehailing, transit, carshare, and active modes. The former group uses the service at a greater-than-average frequency, while the latter group uses the service at a much greater frequency. The segments consisting of non- and infrequent-personal bike users use the bike-share service at a greater rate for different purposes than regular bicyclists, suggesting that bike-share may act as a lever for increasing bike travel for some users. In addition to the market segmentation analysis, we conducted an association rule analysis, a data mining approach, to extract a set of characteristics of a specific bike-share group of interest. We applied association rule mining to extract the socio-demographic characteristics of super users and frequent users. The result suggests that bike-share operators should target low-income and zero-car owners for new recruitment as these groups are more likely to use bike-share frequently. The results provide insights that may be helpful to cities as they consider strategies to increase bike-share demand in a way that enhances social equity.

Mobility & Technology (VPD 116)

Narayan Gopinathan (presenter), UCLA, Environmental impacts of hydrogen and electric trucks,

Transportation is the largest source of greenhouse gas emissions in the United States. For light duty transportation, battery electric vehicles are widely seen as the most viable alternative to those with internal combustion engines powered by fossil fuels. However, for the larger vehicles which haul freight across longer distances, the pathway is less clear. While battery electric trucks are one option, the large quantities of energy required to move heavy trucks over long distances poses challenges related for batteries. Hydrogen fuel cell trucks are another option, but they have their own set of challenges related to production, distribution, and storage of the hydrogen fuel.

This author previously conducted a study of the total cost of ownership of battery-electric and diesel-powered trucks in the context of India. It found that once the technology matures, battery electric trucks could have a lower total cost of ownership than the diesel-powered trucks that currently predominate trucking, and could hedge against fuel price volatility. However, the study did not consider hydrogen as another potential option; and it did not consider the life cycle carbon emissions or water consumption of these different options.

For this reason, the upcoming study will conduct a life cycle assessment of class 8 trucks for hauling freight which are powered by diesel, hydrogen, biofuels, and compare them with their diesel-powered counterparts which are currently predominant. It will consider the life cycle greenhouse gas emissions and water consumption caused the by the manufacture and operation of the vehicles. It will use the ton-mile of freight as a functional unit. It will consider the payload penalty associated with the weight of the batteries or the hydrogen tank, and it will also consider the life cycle of the electric charging or hydrogen fueling infrastructure, along with the supply chain for the electric or hydrogen fuel. One issue to consider with hydrogen is the water that will be consumed for electrolysis. In some regions water is abundant so this will not pose an issue, but in California and the American West more broadly, water is a scarce resource so the water consumption will have to be assessed, quantified, and accounted for.

By June, this author expects to have preliminary findings on the greenhouse gas emissions and water consumption of the battery, diesel, and hydrogen powered trucks. Later versions of the study will expand the study to incorporate the impacts of rail transportation of freight, comparing the environmental impacts of freight transportation by road with those of freight transportation by trains powered by diesel, electricity, and hydrogen.

Zheyu Wang (presenter), USC, Pickup and delivery problem with hard time windows considering stochastic and time-dependent travel times, co-authors: Petros Ioannou, Maged Dessouky

Due to the uncertain nature of the traffic system, it is not trivial for delivery companies to reliably satisfy customers' time windows. To guarantee the reliability of the pickup and delivery service under stochastic and time-dependent travel times, we consider a pickup and delivery problem with hard time windows considering stochastic and time-dependent travel times. We propose a chance-constrained model where the operational cost and the service's reliability are considered. To quantify the service reliability, every node is associated with a desired node service level, and there exists a global service level, both measured by success probabilities. We present an estimation method for arrival times and success probabilities under stochastic travel and service times. We propose an exact solution approach based on a branch-price-and-cut framework, where a labeling algorithm generates columns. Computational experiments are conducted to assess the effectiveness of the solution framework, and Monte Carlo simulations are used to show that the proposed method can generate routes that satisfy both node and global service levels.

Karl Kim (presenter), U Hawaii, Hydrogen Rail Institute: Plans, Partnerships, and Potential

This presentation describes efforts to develop a Hydrogen Rail Institute focused on testing, research and development, safety, permitting, and training and education. The institute involves a partnership with ENSCO, Inc. and the Center for Surface Transportation Testing and Academic Research housed at the

Federal Railroad Administration (FRA) Transportation Technology Center (TTC) in Pueblo, Colorado. University of Hawaii is leading the formation of the Hydrogen Rail Institute with industry and academic partners involved in the development and testing of hydrogen fueled rail projects. The first phase of the project involves testing performance of the Stadler US Zero Emissions Multiple Unit (ZEMU) hydrogen light rail trainset being implemented in San Bernardino for the 9 mile Arrow line segment connecting San Bernardino to Redlands, California. The project involves the development and installation of hydrogen storage, refueling, dispensing equipment at TTC and evaluating safety and performance of equipment and facilities used to support hydrogen, fuel cell, and transportation equipment. In addition to the generation and evaluation of accident and incident scenarios (human error, design flaws, maintenance, hazard events including earthquake, lightning strikes, wildfire, and collisions), the research will also investigate intentional acts (sabotage, criminality, terrorism) with the potential to cause explosions or fires from hydrogen. In addition to reviewing national and state/local permitting and regulation of the siting and construction of refueling stations, the institute will develop training courses for first responders, emergency managers, building inspectors and transportation planners and integrate curriculum and content with professional continuing education and university academic programs. The University of Hawaii is particularly interested in green hydrogen produced by solar, wind, geothermal, wave and other renewable sources. The efforts are part of larger initiatives to support decarbonization, emissions reduction, and alternative energy. Rail provides strategic opportunities for investment in low carbon, alternative energy, and greenhouse gas reduction.

Gary Rostomyan (presenter), USC, Management of Multiple Bottlenecks Using Pricing Under Constraints, co-authors: Ketan Savla, Petros Ioannou

Studies of the traffic congestion have been limited to designing optimal time-varying tolls to eliminate queuing. Moreover, limited studies have considered time-varying rewards that eliminate queuing. This paper is the first to systematically analyze the social optimum under a user equilibrium as well as budget and maximum toll constraints for a single bottleneck and discrete multiple bottlenecks along a freeway. We cast the congestion pricing problem as a bilevel optimization problem and provide several analytical and numerical results. Specifically, we show that the bilevel optimization problem can be converted into a convex optimization problem under some mild assumptions of the schedule delay cost in single bottleneck case with an inelastic demand setting. The methodological contributions are supplemented with illustrative simulation results.

Zhexian Li (presenter), USC, Stability Analysis of the Cell Transmission Model Considering Capacity Drop under MPC-MHE Ramp Metering, co-author: Ketan Savla

We study the stability of traffic flow considering capacity drop under output feedback ramp metering inspired by joint model predictive control and moving horizon estimation. The running and terminal costs are linear in cell densities, the terminal set is the uncongested region, and the output comprises density measurements from a subset of the cells. For the cell transmission model over a line network, we provide sufficient conditions on the subset of measurements, the estimation and control horizons, and the inflows at the ramps under which the traffic system is input to state stable. Our analysis relies heavily on the mixed-monotonicity property of the traffic flow dynamics. We provide computational tools for verifying the sufficient conditions, and also provide illustrative simulations. Simulation results show that the traffic flow is unstable without ramp metering under high inflows and congested initial conditions. In contrast, the designed controller can stabilize the traffic flow with measurements from a carefully chosen subset of the cells.

Koti Reddy Allu (presenter), UC Irvine, Microscopic Trajectory Estimation using infrastructure mounted side-fire LiDAR, co-authors: Zhe Sun, Andre Tok, Stephen Ritchie

This paper presents an advanced Light Detection and Ranging (LiDAR) pointcloud reconstruction based framework to estimate the microscopic trajectories of road users. Microscopic Trajectories of road users are critical for understanding car-following behavior, lane changing behavior and gap acceptance which are core inputs for developing and advancing traffic flow theory. They are also necessary input for traffic emission models and road safety assessment. Currently sensing technologies such as video-based image processing, global positioning systems (GPS), location-based services such as cellular networks,

wireless fidelity (Wi-Fi), Bluetooth based probes, are used to get vehicle trajectories. Except video-based image techniques, all other sensing technologies provide either spatially or temporally sparse trajectories. Image based methods get affected by lighting conditions.

LiDAR is an active remote sensing technology which collects high granular traffic data both in space and time under all lighting conditions. Infrastructure mounted side-fire LiDAR sensor emits near infrared light as a vertical array of beams and collects information about the geometry and reflectivity of the target environment. For the current study, a 32-beam LiDAR sensor which rotates at 10HZ in the 180 degrees horizontal field of view is used. A 12-hour LiDAR dataset collected at State Route 7 (SR-7), Calexico, Southern California is analyzed for this paper.

Side-fire LiDAR sensor will collect a set of individual scans of vehicle as it passes through the Detection Zone (LDZ). Vehicle's scan will have rich information of the front portion when it is entering the LDZ, side when it is in the midsection part of the LDZ rear portion of the vehicle when it is leaving the LDZ. The trajectory of the vehicle can be estimated using data association and tracking of same reference point on the corresponding individual scans. This reference can be a corner point of a minimum bounding box or the centroid of the bounding box either in 2D or 3D. One drawback of this approach is the inherent shift in the centroid of bounding box in successive scans ascribed to the varying size of the vehicle's point cloud as it passes through LDZ. This approach can potentially result in underestimation of vehicle's speed at the start and end portions of LDZ.

To overcome this drawback, we proposed a forward-backward pass point cloud reconstruction-based framework to estimate accurate microscopic trajectories of the vehicle. During the forward pass, the entire scanned body of the vehicle is reconstructed using a suitable pairwise registration pipeline. The centroid of the minimum bounding box for such a reconstructed vehicle is remarkably close to the actual centroid of the vehicle. This fully reconstructed vehicle is projected backward to each individual scan using inverse transformation during the backward pass. The trajectory of the vehicle is estimated using the centroid of the bounding box for these fully reconstructed vehicles. Such high temporal resolution trajectories have immense potential for further use in accurate emission estimates, traffic state estimates and traffic safety applications. This infrastructure-mounted, side-fire LiDAR-based sensing also can estimate traffic states of non-connected vehicles for implementation of connected vehicle-based applications.

Resilience & Mobility (VPD 112)

Edward Smaglik (presenter) NAU, Prioritizing Bicyclist Safety and Mobility: Which Guidance Do I Use?, co-authors: Christopher Phair, Anthony Eschen, Brendan Russo

Balanced transportation, in which multiple modes serve urban trips safely and efficiently, is achieved in part through promoting bicycling as a viable method of transportation. Increased bicycling can improve environmental conditions and the health of road users, as well as reduce the impact on motorized facilities by moving users out of vehicles. Historically, bicyclists may have been an afterthought and expected to share space with motor vehicles, however this outdated attitude is giving way to newer approaches which attempt to allocate user space in a more equitable fashion. Because of this, current design standards and guidance documents for bicycle focused infrastructure have taken on a rekindled importance as operators attempt to improve rider comfort and safety through both geometric (cycle tracks, bike boxes, mixing zones, and protected intersections, to mention a few) and signal timing (bicycle signal) treatments. The Manual on Uniform Traffic Devices (MUTCD) has long been the standard for design and operational treatments in the United States, and contains guidance for bicycle signs, signals, and pavement markings. However, the guidance incorporated in the MUTCD falls short in covering all situations, and the slow process of updating the manual can leave end users searching for other options for design and operational ideas. Because of this and other reasons, the Urban Bikeway Design Guide was released by the National Association of City Transportation Officials to provide additional application based guidance for bicycle infrastructure. Third, the American Association of State Highway Transportation Officials (AASHTO) supports the AASHTO Guide for the Development of Bicycle Facilities, with the most recent version being released in 2012. Lastly, there are countless design guides offered by states and municipalities (an internet search for 'Bicycle Design Guide' identified Oregon, New York State, Maryland, and many others). This availability of information from such varied resources can cause challenges for practitioners. With so much available, which guidance is the most desirable? Which of these manuals has the most up to date information? Which ideas / treatment / guidance has been vetted by research, as opposed to other guidance which might be experiential in nature? Are there liability impacts of using suggestions and design guidelines in these various references?

To address this, this work synthesized available literature and published guides to determine where the state of the practice lies, and determine the roots of the information in various guidebooks (i.e., is it research or experiential based?) as well as surveyed practitioners regarding the use of these guidebooks. Topics of the survey included preferred guidelines for bicycle infrastructure, workplace guidance for using specific references, personal preferences for specific guidebooks, liability reasons for selecting guidance, and external forces driving the use of specific guidance, among others. This presentation will cover the results of this work.

Maria Carolina Lecompte (presenter), UC Davis & UCLA, Lessons Learned from Abroad: Potential Influence of California High-Speed Rail on Economic Development, Land Use Patterns, and Future Growth of Cities. Co-authors: Lucia Rossignol, Anastasia Loukaitou-Sideris

Previous research on high-speed rail (HSR) in California has focused on the project's capital and operating costs and anticipated ridership. Additionally, the economic impacts discussed so far are mostly short-term and namely the creation of construction jobs. Less analysis has been done on the potential economic and spatial development impacts associated with HSR projects. However, the many decades of HSR operation in Europe and other regions show that there are possible short, medium, and long-term benefits, and side effects, that HSR systems could bring to station-cities and regions, but these depend on various local conditions. Accordingly, this study reviews the experience of European HSR networks to understand the possible economic effects that HSR can have on regional and local economies, and their preconditions. A systematic literature review of the economic effects of existing HSR systems was carried out and was complemented through the analysis of case studies of second-tier and smaller HSR station-

cities in Europe, that have experienced some economic impacts since the initiation of HSR services. We chose different city typologies and utilized input from the study's advisory panel to select the case studies, carefully examining the transferability of lessons learned from other countries to the California context. Besides the commonly accounted travel time savings, some of the economic impacts identified in several cities but not in others were population growth and change, jobs and economic growth, tourism, regional growth, real estate development and land value. Impacts varied from case to case depending on different variables that may influence the economic performance and type of impacts stemming from HSR projects. These include the size of a station-city, its position in the regional hierarchy of cities, and its distance from first-tier cities on the network; station location within a city; station connectivity and intermodality, level of HSR service, preexisting cultural or tourist assets and amenities, which may receive a boost from the arrival of HSR, the condition of the local economy, as well as the type and extent of government planning and intervention.

Koti Reddy Allu (presenter), UC Irvine, Heavy Duty Truck operational insights using ALPR systems deployed at Border and Gateway points, co-authors: Andre Tok, Stephen Ritchie

This paper presents key Spatiotemporal operational insights of heavy-duty trucks using Automated License Plate Recognition (ALPR) systems deployed at the Border and Gateway points of California.

ALPR systems collect and provide key data elements of a vehicle being captured such as License Plate Number, jurisdiction, timestamp, location etc. For this study purpose data collected from eight such systems, three deployed in the catchment area of San Pedro Bay ports and five deployed at the main border points of entry to Southern California is used. The primary insights obtained from this study such as penetration rates of the ALPR systems, impact of time of day on performance, Quality analysis of the License Plate reads provided by the system would be presented. Also, neural net models that can predict the jurisdiction and vehicle type based on the License Plate read provided by the system would be presented. Furthermore, the Spatiotemporal analysis of port complex tractor trucks, medium heavy-duty trucks based on fused dataset of ALPR data and IRP registration database is presented.

This analysis objectively inferred the operational characteristics of Out-of-State and California-based heavy-duty trucks and helped identify better ways of getting answers to relevant policy questions.

Peng Hao (presenter), UC Riverside, System-level Evaluation of Low-exposure Truck Routing Strategies using Agent-based Simulation

Heavy-duty diesel trucks (HDDTs) are significant contributors of fine particulate matter (PM2.5) and nitrogen oxides (NOx) emissions. As a result, communities with a large amount of truck traffic often experience elevated levels of diesel-related air pollution. One strategy for mitigating the air pollution impacts of truck traffic, called low exposure routing (LER), is to route HDDTs in a way that reduces the exposure of community members to air pollutant emissions from these trucks. In this research, we develop a novel framework that utilizes an agent-based transportation simulation model for the city of Riverside, California, to quantify the impacts of LER under different technology technology penetration rates in the transportation system. The proposed model is pre-calibrated based on daily commuting car trips from CEMDAP and truck trips from Southern California Association of Governments (SCAG) model. Then, the LER objective is developed to find low exposure routes for HDDTs and integrated into the routing engine of BEAM, an open-source agent-based regional transportation simulation model developed by Lawrence Berkeley National Laboratory. In each iteration, the routing engine uses link speeds from the last iteration to heuristically search for alternative routes until reaching personal maximum utilities. During the process of LER routing, it calculates PM2.5, NOx, and travel time based on link speeds from last iteration, and converts this multi-objective shortest path problem (SPP) into a single-objective SPP. Modeling results show that the inhaled mass of fine particulate matter (PM2.5) for the whole city could be reduced by approximately 30% on a typical workday with the implementation of the proposed agent-based LER truck routing strategy. This research demonstrated the effectiveness of the LER strategy in reducing human exposure to pollutant emissions from HDDTs, while maintaining the mobility performance of the entire transportation system.

Qifan Shao (presenter), USC, Ride-hailing and Transit: Exploring cross-price elasticities in California, co-authors: Marlon Boarnet, Clemens Pilgram

Ride-hailing, provided by transportation network companies (TNCs), such as Uber and Lyft, has emerged as a popular travel mode in cities worldwide. A growing body of literature explores the extent to which TNCs compete for ridership with traditional travel modes, and in particular what this means for public transit operators. Using travel diary survey data from the San Francisco Bay Area's Metropolitan Transportation Commission (MTC), we employed an alternative-specific conditional logit model to analyze how trip characteristics and socioeconomic variables influence residents' mode choices. In addition, we calculated marginal effects for both alternative-specific and case-specific variables to estimate cross-price elasticities between modes. We find that a one-dollar increase in the travel cost of TNC services for the mean TNC trip - representing an 8.3% increase in cost for that trip - is associated with a 0.4 and 0.1 percentage points increase in the probability of choosing a car or public transit respectively for that trip, holding constant all other regressors at the sample means. To our knowledge, this study is among the first to calculate such cross-price elasticities for TNC services versus other modes. These findings provide a nuanced understanding of residents' mode choices and offer valuable insights for policy implications.

Improving Mobility (VPD 105)

Jacob Wasserman (presenter), UCLA, Homelessness on the Road: Understanding and Responding to Homelessness in State Transportation Settings, co-authors: Anastasia Loukaitou-Sideris, Hao Ding, Claire Nelischer

In recent decades, homelessness has become an increasingly major challenge in the U.S. Of the half million unhoused people in the U.S., many seek shelter in settings under the auspices of state departments of transportation (DOTs), such as freeways, underpasses, and rest areas. DOTs are responsible for the health and safety of these settings and of their occupants, housed and unhoused.

This study synthesizes existing literature and findings from interviews with staff from 13 state DOTs and eight service providers and organizations responding to homelessness. Homelessness represents a recognized and common challenge for DOTs, but the numbers and location of unhoused individuals in state transportation settings vary and fluctuate. As DOTs face jurisdictional, financial, and legal hurdles in responding, DOT staff employ both "push" and "pull" strategies, the most common of which is encampment removals. However, the effectiveness of such removals is limited. Other strategies include "defensive design" and, more proactively, establishing or partnering with low-barrier shelters, providing shelters and sanitation on DOT land, and coordinating rehousing and outreach efforts. Our findings suggest that DOTs should acquire better data on homelessness on their lands, create a homelessness coordinating office, establish formal partnerships with nonprofits/service providers, and evaluate the necessity of encampment removals, through the development and utilization of prioritization criteria. DOTs should coordinate with other bodies as they work towards broader housing solutions.

Toby Smith, Maya Hsu (presenters), UC Davis, Toward 'a Wise and Sacred Movement': Mobility Justice as Movement Work, co-author: Sarah McCullough

Mobility justice has emerged as a new paradigm for researchers and practitioners in the past 15 years. Mobility justice challenges those working in transportation and researching spaces to think more broadly about historical, place-based, and identity-based factors that limit people's mobility. These may include histories of highway construction through and disinvestment in communities of color, restrictive migration policies, over-policing of Black and brown people, infrastructure disrepair, high levels of environmental toxicity, as well as other systemic issues. For each challenge, mobility justice offers a path forward rooted in feminist intersectional research/praxis. This presentation will outline these challenges and next steps, based on the preliminary results of an in-progress study on the origins and spread of the mobility justice framework in mobilities and intersectional justice-oriented spaces. Special attention will be paid to the role of overlapping expertise and collaboration in the future uses of mobility justice as a framework for furthering researcher/practitioner partnerships on justice-oriented projects. This project arises from first author Dr. Sarah McCullough's direct involvement in convening early conversations around mobility justice among academic researchers and BIPOC transportation professionals, who collaboratively wrote the foundational "Principles of Mobility Justice."

Justin Flynn (presenter), UC Davis, Transportation and Neighborhood Priorities of Californians with Disabilities: Focus Group Findings, co-authors: Prashanth Venkataram, Giovanni Circella

We conducted a focus group comprising 20 adults with disabilities across California in 2021 November to understand how disability affects their choices and desires for transportation and neighborhood features. The focus group let us efficiently observe common responses upon which participants could further build. Participants with various disabilities and from geographically diverse parts of California, including rural areas far from the major coastal metropolitan areas, uniformly wanted more dense mixed-use development to reduce the immediate burdens in transportation which they disproportionately face as people with disabilities and to move away from broader problems with car-oriented land use patterns. Many participants specifically asked for more street lighting, seating, and shade for users of all transportation modes, greater frequency and coverage of public transit, and similar support for infrequent but critical trips over longer distances. Drivers also wanted assurance that they would not be financially penalized for driving before policymakers implement adequate alternatives. Participants uniformly expressed hope that policymakers would implement their comments. We frame these findings by introducing the terms immediate usability, cumulative usability, and availability, to describe mobility for people with disabilities within the broader framework of accessibility, and by emphasizing the active roles these participants take in their respective communities.

Armando Martinez (presenter), NAU, Exploring neighborhood Differences in Bicycling Accessibility to Physical and Virtual Workplaces

Mobility & Technology (VPD 116)

Anthony Eschen (presenter), NAU, An Empirical Analysis of Fisheye Camera Intersection Traffic Detector Performance: Assessing the Potential Impacts of Camera Position and Lighting Conditions, co-authors: Edward Smaglik, Aneesh Khadka, Brendan Russo

There is a lack of information when it comes to the performance of fisheye video detection cameras at signalized intersections. To address this, this work evaluated the performance of a fisheye camera from an observational standpoint, focusing on performance differences due to camera location and lighting condition by comparing outputs generated by the camera system with those generated manually through video data reduction in an office setting. Examining vehicle counting performance, there did not appear to be a clear connection between the percentage difference of camera vs. manual count and distance from the camera to either the presence detection stop line or camera unit count line, nor did lighting condition appear to be a consistent factor in performance, indicating that other items, such as intersection geometry or unit calibration may be greater contributors to count performance. Looking at differences in activation frequency, the magnitude of camera activation frequency tended to be higher than for manually observed presence, indicating that the camera presence zones changed state more often than the vehicle presence was noted to change, and the duration of these states tended to be higher for the manually observed presence than for the camera presence output. This could be impactful if the presence data output is to be used for higher level data analysis using occupancy, such as Advanced Traffic Signal Performance Measures, as this difference may prove to be problematic in developing metrics based upon occupancy, as the outputs would likely vary greatly from those generated by an inductive loop detector.

Tak Chun Marcus Chan (presenter), UC Davis, Road Pricing in Los Angeles County: Understanding Stakeholder Views and Vision for Transportation Sustainability, co-author: Alimurtaza Kothawala, Giovanni Circella

Road pricing (RP), and congestion pricing (CP) in particular, is widely accepted among experts as an effective way to reduce greenhouse gas (GHG) emissions and mitigate traffic congestion problems. The literature on analyzing major stakeholders' opinions about CP and ways to improve the odds of making a CP plan successful is limited to auto-centric cities in North America. Among some recent efforts in the US,

LA Metro is currently conducting a Traffic Reduction Study to develop comprehensive pricing policies in the Los Angeles region. In this study, we review the relevant literature and conduct interviews with road pricing experts to assess the current and future potential for CP in the US, the challenges that lie ahead, and how likely these will be overcome. We find that public perception, political support, and revenue reinvestment are the most important concerns, though a wide array of aspects within the road pricing scheme, such as legislation, equity, design considerations, and technology, are also involved in these discussions. With conflicting stakeholder interests, the agency must develop its pricing scheme carefully such that a successful pilot program would path its way to being a permanent policy and a role model of other cities with similar characteristics.

Kevin White, U Hawaii, Coexisting with Wildfires: A Comparative Assessment of Wildfire Policies in the States of Victoria and California

Establishing changes in land-use policies within the wildland urban interface (WUI) can support safety of life, reduce damages to infrastructure, and decrease greenhouse gases. The states of Victoria and California experience some of the largest wildland fires in the world, mainly due to a legacy of fire suppression, human settlement, natural climate variability, and climate change. Through a comparative assessment of wildfire policies in Victoria and California we can further improve wildfire adaptation and mitigation for both states. This comparative study illustrates the need for hazard maps to keep pace with a changing climate and demonstrates how each state can increase institutional capacity through social learning and deliberative planning. As urbanization in the WUI continues to increase wildfire risk and the need for fuel reduction continues to grow, the Firewise USA program can learn from Victoria's Safer Together and Cultural Fire programs to promote convergence research for wildfire risk reduction. Furthermore, both states regulate new development in the highest fire hazard zones and need to further promote equitable adaptation measures to strive for a more resilient future for all.