2022 International Conference of the TRF – St. Louis, MO

Begin	End	Room 202 JCP	Room 204 JCP	Room 402 JCP
THURSDAY, APRIL 7, 2022				
9:00AM	11:00AM	**Tours:** Option 1 - America's Central Port / Option 2 - Anheuser-Busch InBev Meet for pick-up in 100 JCP (Main Lobby)		
12:00PM	1:00PM	Registration (JCP Gathering Area) 100 JCP (Main Lobby)		
1:00PM	1:20PM	Welcome & General Sessions 202 JCP		
1:20PM	1:30PM	Break JCP 2nd Floor Lobby		
1:30PM	3:00PM	**UMSL Session:** History of Transportation in St. Louis		Graduate Student Research Session 1
3:00PM	3:15PM	Refreshment Break JCP 2nd Floor Lobby		
3:15PM	4:45PM	**Panel:** Current Trend in Agricultural Logistics	Transportation Infrastructure & Planning	
4:45PM	6:45PM	Reception and Poster Session (JCP Gathering Area) Location: 100 JCP (Main Lobby)		
FRIDAY, APRIL 8, 2022				
7:30AM	8:15AM	Registration 100 JCP (Main Lobby) and Continental Breakfast Summit Lounge		
8:30AM	10:00AM	**USDA Session 1:**Food transportation and wholesale produce access in remote rural regions	Issues in Global Logistics & Transportation	Issues in Transportation Policymaking (1)
10:00AM	10:15AM	Break JCP 2nd Floor Lobby		
10:15AM	11:45AM	**USDA Session 2:**Climate change impacts on U.S. corn and soybean price margins and transportation costs	Innovations & Advances in Transportation (1)	Graduate Student Research Session 2
11:45AM	12:00PM	Refreshment Break JCP 2nd Floor Lobby		
12PM	1:20PM	Lunch and Awards ceremony Summit Lounge		
1:20PM	1:30PM	Refreshment Break JCP 2nd Floor Lobby		
1:30PM	3:00PM	**USDA Session 3:** Alleviating information asymmetry in food supply chains	**Panel:** Trends in University Sponsored Transportation Research	Issues in Transportation Policymaking (2)
3:00PM	3:15PM	Refreshment Break JCP 2nd Floor Lobby		
3:15PM	4:45PM	**USDA Session 4:** Open Data Platform and Research Collaborations	Innovations & Advances in Transportation (2)	Covid-19 Impact on Global Transportation
5:30PM	9:00PM	Dinner Cruise Meet for pick-up in 100 JCP (Main Lobby)		
SATURDAY, APRIL 9, 2022				
8:30AM	11:00AM	**Tour:** Melvin Price Locks & Dam Meet for pick-up in 100 JCP (Main Lobby)		
(You can click on the event name to navigate to event description)				

Podium Session: Transportation Infrastructure and Planning
Room 204 JCP

TIP1: Wage Study for the State of Alabama's Transit Drivers
Mehrnaz Doustmohammadi, Principal Research Scientist, University of Alabama in Huntsville
Ehsan Doustmohammadi, Lead Traffic Engineer, Scalar Consulting Group, Inc

Driving a transit bus for a Federal Transit Administration Section 5311 agency is a difficult job that requires training and commitment. As such, it is important to hire qualified and competent individuals into these positions. Within the hiring process, starting pay is a major factor in hiring both for drivers and the agency. This paper documents the results from a survey which collected wage data for transit bus drivers in the State of Alabama. The results show that average starting full-time pay for transit bus drivers is lower that school bus drivers, other county employees and even fast-food workers in the area where the transit service is provided. The paper concludes that starting pay for Alabama's Section 5311 drivers is below the poverty level for a family of four and this low pay has the potential to make future hiring of qualified and competent bus drivers an issue in the future.

TIP2: Use of Discrete-Event Simulation for Planning Airport Infrastructure and Improving Flight Operations
Canser Bilir, Industrial Engineering Department, Istanbul Sabahattin Zaim University
L. Douglas Smith College of Business Administration, University of Missouri-St. Louis

In this presentation, we discuss the evolution, validation and application of a discrete-event simulation model with embedded multivariate statistical models for planning airport infrastructure and improving flight operations at major commercial airports.
We illustrate features of the simulation model for airport activity and the richness of information generated about simulated system performance in multiple dimensions (by time of day, airline, parking area, runway, etc.). We discuss the model validation process and illustrate its use for studies of airport operations at Lambert St. Louis International Airport (STL), Charlotte Douglas International Airport (CLT), and at Istanbul Sabiha Gokcen Airport (SAW).
The simulation model is constructed in Arena 14.7 as a process-oriented simulation with aircraft as the simulated entities. Represented in the model are final approaches to the airport through airspace that is reserved for approaches to specific runways, landing and clearing the runway, taxiing inbound to assigned parking spots, activity involved in preparing the aircraft for their subsequent departure, taxiing outbound to their assigned runway for departure, and take-offs with appropriate separation for flight safety. Resources include airspace, runways, taxiway segments, intersections, ramps, staging areas on

the airport surface, gates at the airline terminals, tractors for pushing back the aircraft, etc.
The simulation model depicts airport activity as a network of staged queues with two-dimensional geo-spatial characteristics. At CLT, for example, there are 368 queues for 313 resources and 55 logical holding conditions in which entities (aircraft) may be placed as they proceed through the simulation logic. Dozens of attributes associated with the aircraft (flight schedules, aircraft characteristics, critical event times, assigned runways, parking locations, etc.) are used to moderate the process flow. It is, however, very efficient – enabling 100 replications of a daily schedule to occur on a laptop computer in less than 13 minutes.
We discuss hierarchical logistic and regression models calibrated with historical flight data that are used to impose flight delays, inject randomness in times required for ground operations, and generate intensified flight schedules consistently with historical schedule patterns when estimating the impact of possible growth in airport traffic. To calibrate the models at CLT, we employed time stamped Aerobahn microdata data derived from transponder readings from aircraft in flight and on the airport surface for every flight into and out of the airport over the year. We augmented the data stream with other information about the flight (e.g., type of aircraft, scheduled arrival and departure times, number of seats, runways used, whether the flight is international, compass bearing and distance to the airport of origin or destination). These models determine the likelihood and length of arrival delays, times for ground activity required to prepare an aircraft for its subsequent departure, likelihood of departure delays and lengths of departure delays if they occur.
In sum, we present a unique blend of statistical modeling and discrete-event simulation to support collaborative planning for airport infrastructure and operating practice.

TIP3: An Exploratory Comparative Analysis of Rail Freight Service Quality Before and After the 2013/2014 Service Disruption: Shippers' Perspective
Elvis Ndembe, University of Nebraska Omaha

Shipper captivity and service complaints are perpetual issues in freight transportation that have framed U.S. surface transportation policy. The widely reported 2013/2014 service disruption that brought significant delays in railcar delivery and shipment of grains for grain freight shippers from U.S Great Plains states like North Dakota raised questions about freight service provision in markets that are considered captive to rail. Captivity broadly describes a freight market with limited transportation alternatives.
It is reasonable to argue that shippers' expectations about rail service or quality of service in captive markets are comparatively low because in a freight market lacking access to waterway transport, railroads would capture traffic even if their service quality were poor given the big cost advantage rail has over truck. This is particularly the case with shipping bulk freight like grain. On the other hand, one can argue that changes facilitated by innovation have enhanced rail services which has positively affected shippers' views and expectations of rail service even in

markets deemed captive. Quality of service in freight transportation broadly describes service dimensions of a mode ranging from reliability, level of service, and good customer service (Holguín-Veras et al., 2021).

For example, in addition to reducing rates (Ndembe, 2015), the increasing use of shuttle technology in shipping bulk commodities has been shown to improve rail service quality in terms of quicker delivery of grains (Hyland et al. 2016). Other changes include the increasing role of the secondary railcar market and private railcar ownership. The answer to the arguments raised above will address likely dichotomy between shippers' view of service and that which is widely reported. Moreover, as Satar and Peoples (2010) surmised, the disadvantages faced by shippers with limited transportation options could be mitigated if higher rates are associated with improved or better service quality. Few studies have examined service quality in captive freight markets, especially recently. Most have focused on rate competition.

Examining freight service quality in a captive market is an important consideration for policy. For example, the Surface Transportation Board, STB Chairman Martin Oberman recently in response to White House's recent executive order on competition noted that consolidation has created the potential for monopolistic pricing and reduction in service quality to captive rail customers (Booth, 2021). Moreover, an efficient freight transportation system (with higher service quality) has implications on the competitiveness on US. goods and services with supply chains increasingly becoming global.

The aim of this paper is to assess rail freight service quality for North Dakota grain shippers, by comparing shippers view of rail service before and after the 2013/2014 service disruption. The exploratory analysis relies on survey data from the elevator transportation and activities service between 2008 and 2019 obtained from the Upper Great Plains Transportation Institute. The survey which is conducted annually ask shippers to rate rail services based on six dimensions including marketing and sales, timely delivery of equipment, car ordering alternatives, condition of equipment, availability of order information, and access to marketing personnel.

Podium Session: Issues in Global Logistics and Transportation
Room 204 JCP

GLT1: Inequitable Inefficiency: A Case Study of Rail Transit Fare Policies
Zakhary Mallett, Sol Price School of Public Policy, University of Southern California

Research on transit fare equity traditionally measures equity based on the fare-per-mile consumed by riders. This overlooks the cost-sharing nature of transit; as more riders consume a service, the cost-per-rider is less. Using cost-per-rider metrics to assign trip costs and fare revenue to estimate cost recovery through fares, I estimate the spatial and temporal variability of cost recovery across two rail systems. Findings show that cost recovery patterns are

spatially monocentric, the peak period recovers more of its costs through fares than other time periods, and there are effectively no disparate impacts based on race or income.

GLT2: Establishing the first economic regulation of the Mexican rail concessions
Cesar Rivera Trujillo, Director de Regulación Económica Agencia Reguladora del Transporte Ferroviario, Secretaría de Infraestructura Comunicaciones y Transportes

On February 2020, the Federal Economic Competition Commission (COFECE) issued a resolution on lack of competition in 20 routes of freight railway transportation of chemical products originating in southern Mexico, since the existence of alternative railways or other modes of transport available to users for transporting these products could not be found, and therefore the users of these transport services were considered as captive shippers.

As a response to the lack of effective competition determined by COFECE, the Mexican rail regulator, the Regulatory Agency of Rail Transport (ARTF) responsible for overseeing different aspects of rail transportation, such as the economic regulation regarding tariffs, established the regulation and determined maximum rates for the provision of the rail service concerning three different concessionaires in twenty origin-destination pairs for the transportation of chlorine, ethylene oxide, anhydrous ammonia, and caustic soda..

The model used in the economic regulation consisted of establishing a maximum rate per tonne-kilometre for each combination of route and product. The maximum rate was calculated from the average total costs obtained from the concessionaires multiplied by a differentiating factor per product, that recognizes that the costs of transporting a product between two geographical points may be different depending on the physical characteristics of these products, plus a reasonable profit given by the rate that allows a reasonable return on assets, determined through the Weighted Average Cost of Capital that allows the concessionaires to invest in a sector that is particularly capital intensive. Thus, the maximum regulated rate is equal to the rate where the concessionaire breaks even, that is makes zero profit (average cost pricing or "second best"), plus the Weighted Average Cost of Capital.

The results showed a significant reduction of the current rates between 50% to around 70%. Although the implementation is not complete, as the regulation is being analysed in the tribunals, the economic regulation showed that the rates are very far from the average cost in the absent of effective competition. More research needs to be done to evaluate the real impact of the first economic regulation of the Mexican rail concessions.

GLT3: Measuring and tracing airline network overlap in US and European markets
Aisling Reynolds-Feighan, University College Dublin

Load factors in US and European air transport markets have been increasing steadily since deregulation and liberalization. With a growing emphasis and scrutiny on the environmental and climate change impacts of aviation, efficient deployment of capacity will be important not just

for airline financial health but for the health and well-being of society at large. Driving this improvement in capacity utilization has been the growth and restructuring of airline network structures particularly as consolidation through mergers has taken place. This paper examines one aspect of this process, namely airline network overlaps.

The literature on multi-market contact or overlap focuses on the implications for pricing and collusive behavior in airline markets. No study traces the evolution of carrier networks and the extent of competitor overlap to examine the implications for capacity utilization and the overall efficiency of regional airline markets. We review the literature on multi-market contact and critically summarize the metrics used to capture this aspect of airline market activity.

We examine the measurement and extent of airline network overlap among US and European airlines focusing particularly on the most recent period. Using detailed ex-post schedule data for the US and Europe, the extent of network overlap is quantified and described for the US and European markets over the period 2009-2019. The impact of the Covid19 pandemic is summarized for 2020 and 2021. The analysis explores measuring overlap at the airport and/or city level as well as at route level, which is typically the approach in multi-market contact studies. Given the preponderance of hub-and-spoke network structures in the US market, it is suggested that *airport overlap* may be a more appropriate measure as route/segment level counts will not include circumstances where airlines offer different routings/segments whilst serving the same origin-destination market pairs.

We propose a measure of network overlap that takes account of the importance of an airport in the airline's and its competitors' networks. This new Gini index decomposition component is proposed to capture airline network overlap. We identify the top competitors for the largest airlines and examine how network structures and network overlap have changed over time. We further decompose the network overlap measure by mainline and feeder carriers and give insights into the provision of capacity in peak and off-peak seasons. We examine the aggregate load factors at airports and on routes and how these have changed as airline mergers have taken place and the overlap and scale of carriers' operations have evolved. Using US Department of Transportation airline passenger data, load factors are examined in detail and related to the changes in airline network structure, organization, and overlap. Seasonal variations in capacity utilization are examined for the US market.

Podium Session: Issues in Transportation Policymaking (1)
Room 402 JCP

ITP1: The Impact of National Culture on Logistics Performance

Carl Scheraga, Fairfield University
Robert O. Walton, Embry-Riddle Aeronautical University – Worldwide
P. Michael Politano, The Citadel

Logistics is inherently global in nature with a worldwide geographic span that crosses a plethora of national cultures. As globalization increases, it is important to understand how different national cultures may affect the effectiveness of supply chains. Countries and business enterprises that are able to produce goods and deliver their products to the final customer at the lowest cost and with the highest quality will continue to have a competitive advantage. That is, effective logistics is an essential enabler of economic development.

Determining logistics performance of a country is a difficult task due to the many variables that must be taken into consideration. The World Bank produces *The Logistics Performance Index* (LPI) spanning a large number of countries. The LPI quantifies the following six indicators:

1. *Customs*: The efficiency of customs and border management clearance.
2. *Infrastructure*: The quality of trade- and transport-related infrastructure.
3. *International Shipments*: The ease of arranging competitively priced international shipments.
4. *Logistics Competence*: The competence and quality of logistics services.
5. *Tracking and Tracing*: The ability to track and trace consignments.
6. *Timeliness*: The frequency with which shipments reach consignees within the scheduled or expected delivery time.

Hofstede's (2001) work yielded a set of cultural dimensions, which provides a quantitative classification to measure national culture. The six dimensions of natural culture are Individualism, Power Distance, Masculinity, Uncertainty Avoidance, Long-term Orientation and Indulgence. These are defined as:

1. *Individualism* indicates the extent to which a society is a loosely knit social framework in which people are supposed to take care of themselves and their immediate families, instead of a tight social framework in which people distinguish between in-groups and out-groups and expect their in-group to look after them.
2. *Power Distance* indicates the extent to which a society accepts the fact that power in institutions and organizations is distributed unequally among individuals.

3. ***Masculinity*** indicates the extent to which the dominant values in society tend toward assertiveness and the acquisition of things, and away from concern for people and the quality of life.
4. ***Uncertainty avoidance*** indicates the extent to which a society feels threatened by ambiguous situations and tries to avoid them by providing rules, believing in absolute truths, and refusing to tolerate deviance.
5. ***Long-term orientation*** indicates the extent to which a society exhibits a pragmatic future-oriented perspective rather than a conventional historic or short-term point of view.
6. ***Indulgence*** indicates the degree to which a society allows relatively free gratification of basic and natural human desires related to enjoying life and having fun. Conversely, ***restraint*** indicates the degree to which a society controls gratification of needs and regulates it by means of strict social norms.

Regression analyses were run using the overall LPI score and each LPI sub-measure as the dependent variable. There were 62 countries in the sample. This allowed for the measurement of the impact of each of the cultural dimensions on overall logistics performance and specific sub-categories of logistics performance. Using the systematic differences and similarities among groups of countries, found by Hofstede, along combinations of his dimensions, implications are drawn for specific leadership styles that promote superior performance in the global logistics function.

ITP2: Should Outbound Logistics be Considered at the Product Design Stage?
Rajeev Sawhney, Professor, Western Illinois University
Sabita Sawhney, Associate Professor, Western Illinois University

The traditional role of logistics has been to optimize the number, size, and geographical arrangement of plant and warehouse facilities, select different transportation methods, and reduce distribution costs by managing and moving inventory. In the 1980s and 1990s, as supply chain mindset grew the organizations started viewing logistics more than cost saver; they channelized logistics also as a source of enhancing product or service offerings to bring competitive advantages. Besides interface of logistics with demand, supply, and information management capabilities, it also started playing an important role of boundary spanning between internal functional areas of the focal firm and supply chain partners. For example, coordinated with the marketing function, logistics can differentiate product and/or service offerings to fulfill unique customer requirements; and when joined with production, logistics can offer cost and investment reductions while maintaining service levels.

Affecting the use of storage and movement systems a frequent decision concerns the physical attributes of products, such as size, shape, and fragility. These decisions affect the carriers that a firm can use, equipment needed, damage rates, storage ability, use of materials-handling equipment – all of which impact the cost and efficiency, and thus the competitiveness. The transportation cost is impacted by the stow-ability or cube utilization, which is the degree to which a product can fill the available space in a transport vehicle. Similarly, consumer packaging also affects logistics. The marketing manager will be concerned about package appearance. The consumer package is important to the logistics manager for several reasons. The consumer package usually must fit into what is called the industrial package, or the external package. The size, shape, and other dimensions of the consumer package will affect the logistics system in the areas of transportation, materials handling, and warehousing. Yet, the appropriate information about the movement and storage of the new products is not sought from the logistics manager when marketing and manufacturing is deciding upon the physical dimensions of new products or the packaging appearance.

Though, a participative approach to new product development has been advocated in the literature since the mid-1980s, logistics has not been considered as an integral component of the NPD process. The literature offers sparse discussion on how logistics can add value at the product design stage in a cross-functional team. This study is being undertaken with the express purpose to understand how companies can reduce their total cost by introducing the logistics information early in the product-design stage. We will be discussing a few cases to promote the idea that why logistics should be playing a strategic role and should be introduced at the product design stage. As the transportation cost continue to escalate, such decisions will gather significant importance early in the product-design stage.

ITP3: The Future of Interstate Transportation
Ray Mundy, Professor Emeritus of the University of Tennessee, Knoxville, and Director Emeritus from the Center for Transportation Studies at the University of Missouri-St. Louis

What will interstate transportation look like 50 years from now? As a transportation society, TRF should vigorously debate the future as a way to assist public policymakers in making decisions as to where investments need to be made in support of this future. Unfortunately, as this paper attempts to show, public policy decision-makers appear to have a much different view of the future of interstate transportation than that of private sector practitioners. There would appear to be a wide divergence of public policy thinking vs. that of individual preference in transportation. Academics, politicians, and climate change advocates are calling for restrictions on air travel in favor of future passenger rail travel. Some European countries have already banned air travel between cities that are served by train and levied special carbon-based taxes on airlines.
In the U.S., the current Administration plans a 400% increase in Amtrak funding for additional rail lines, believing that if people have a choice of driving their personal car or flying vs. taking the train for short trips, the

clear choice would be the train. Passenger rail enthusiasts are backing a plan to do just this - for a cost of $65-$80 billion dollars! Transportation professionals should be asking questions like, "Are we building out interstate rail services only to require large annual subsidies and disincentives for air and auto to maintain operations?"

On the other hand, while public policymakers are busy trying to change the habits of current auto and airline travelers, private investors are developing new and innovative ways to increase our mobility. One such example is the increasing interest in flying taxis.

The electric vertical takeoff and landing industry is growing rapidly. Vertical Aerospace has taken $5.4 billion in orders globally for up to 1,350 eVTOLs from customers including aircraft leasing giant Avolon, American Airlines' and helicopter manufacturer Bristow. Spain's Iberojet, part of the Avoris tourism group, has ordered up to 100 aircraft that will island-hop between the Balearic and Canary Islands. The landing sites for eVTOL's are being referred to as "vertiports" – several of which are already planned in the U.S. In the future these vertiports may also be used for air service between cities of 200 miles or less.

Finally, consider the future of the automobile itself and how it will be used 35-50 years from now. It can be assumed that most will be capable of Level 5 automation – requiring no drivers. Many futurists feel that today's car will look more like a passenger pod with no driver's seat or steering wheel. Speeds on the interstate roadways likely will be in excess of 100 mph, as centralized and on-board computers control all vehicles on the roadway.

Unfortunately, our national transportation policy seems to see the future only in terms of high-speed trains and public transit.

Is TRF providing advice on investments in transportation infrastructure that will be necessary to bring about a realistic vision of our interstate transportation future?

Podium Session: Innovations and Advances in Transportation (1)
Room 204 JCP

INN1: A Grounded Theory Analysis of Factors Affecting Autonomous Truck Adoption

Christopher Mondy, University of Central Oklahoma
Matias Enz, University of Missouri - St. Louis

Autonomous vehicles have the potential to revolutionize the transportation industry. The trucking segment is no exception as it is being found in recent pilot programs. Self-driving trucks are expected to improve trucking safety, increase shipping velocity, and decrease costs. Additionally, they could be an important tool to alleviate the ongoing driver shortage that the trucking industry is contending with.

However, the adoption of autonomous trucks is not guaranteed even if the technology is available. Transportation equipment adoption decisions are market-based so autonomous trucks must present a compelling business case to transportation professionals. As such, it is imperative to understand the decision-making factors that drive transportation solution adoption, and how autonomous trucks could satisfy those factors to be a competitive force in the transportation marketplace.

In this research, a Grounded Theory approach was used to analyze semi-structured interviews with twelve professionals from the transportation industry. A conceptual model based on the diffusion of innovation theory was developed to explain the major factors that affect transportation decisions, along with a discussion on the constructs affecting the adoption decision. The paper concludes with an identification of avenues of future research to further the information uncovered in this study, and with recommendations for managers to assist them in their AV adoption decisions.

INN2: The Effect of AV/CAV Technologies and Penetration Levels Impact on Basic Freeway Capacities

Niloy Saha, North Dakota State University
Diomo Motuba, North Dakota State University

Autonomous vehicles (AVs) and connected autonomous vehicles (CAVs) will be the standard in transportation in the future. Such vehicles could minimize traffic oscillation and travel time and boost safety and mobility on freeways. The use of AVs and CAVs will potentially increase roadway capacity in upcoming decades due to lower headway. This impact will also be highly dependent on the penetration of Avs/CAVs in upcoming years and the technology in AVs/CAVs. The Coexist project from Europe created three autonomous vehicle technology levels: AV-cautious, AV-normal, and AV all-knowing. These AV levels have different technologies ranging from very aggressive to the less aggressive car following models with significant impacts to capacities. On the other hand, there is ongoing research on forecasts on the penetration levels of AVs/CAVs. The penetration levels of the different AV levels play an important role in determining the impacts of AVs/CAVs on highways. We develop a model that uses the AV/CAV technology levels and penetration levels to evaluate their potential impacts on the transportation system using a microsimulation setup in VISSIM. We use the case study for a basic freeway section using oversaturated traffic data from the NGSIM U.S. 101 in Los Angeles to get Wiedemann car-following model's parameters for further calibration and validation purposes. Based on the state-of-the-art in AV/CAV penetration projections, we develop possible outcomes for different time horizons that illustrate the impacts of AVs/CAVs. Our results show that the impacts of AVs/CAVs ranged from negative capacity impacts (with low levels of only AV-cautious penetration with 75% circa 2070) of about 10% to the maximum capacity gains (with 100% CAVS circa 2080) of about 33%. Our study improves on the literature as it provides potential timelines that engineers and planners could use in travel demand models and for planning purposes. For example, highway capacity will be reduced if the AV mix is largely AV-cautious. However, the solution is likely not to expand capacity but to find ways to manage traffic as new technology develops and moves to CAVs the capacity impacts become positive.

INN3: Crossrail Chicago
David Phillips, Sr. Transportation Planner at TranSystems

Crossrail Chicago is a concept for developing a passenger railroad spine from the south edge of Chicagoland, through McCormick Place convention center, Union Station in the center of the City, and on out to O'Hare Airport on the northwest edge of the City. Crossrail Chicago is modeled on the fast, frequent cross-city rail links such as the RER in Paris, S-Bahns in several German cities, and London's crossrail (opening this summer). The amazing this is that this can be done in Chicago without tunneling through downtown, as all of those systems required.
A key point is that by providing service operating through Chicago Union Station, rather than having all trains terminate there, as they almost always have, this network would serve multiple purposes: work commuting, business travel, tourism, and family visiting. It would improve Chicago's fine existing commuter rail network fast, frequent connections, taking people from underserved neighborhoods on Chicago's West and South sides to job centers in the Northwest suburbs, while simultaneously bringing people to downtown Chicago, McCormick Place, and O'Hare from around from their hometowns around the Midwest. The project is expected to both greatly strengthen economic performance for Chicago and to bring the cities of the Midwest closer together, boosting the economic performance of the whole Midwest by shrinking the time required to travel between them on frequent, comfortable trains with reasonable fares.
Most of the route would have four mainline tracks, providing enough capacity to accommodate different levels of service including both local and express trains operating within Chicagoland as well as intercity trains. Main tracks are all proposed to be electrified. Service could include a range of frequent conventional and high-speed trains between a hub in Chicago, as proposed in the Federal Railroad Administration's Midwest Regional Rail Plan, as well as long distance trains to the coasts. Routes could join and separate from the main spine at various points on Crossrail.
This presentation will describe some of the key conceptual planning that has been performed by a team of professionals volunteering under the auspices of the High-Speed Rail Alliance, a national advocacy organization based in Chicago. They have developed plans for track configurations, junctions, and station platforms. The majority of the necessary infrastructure is already in place or has been planned/designed by owning agencies, including Metra and Amtrak. Concepts for the missing pieces will be presented.

Podium Session: Issues in Transportation Policymaking (2)
Room 402 JCP

IPT4: The interactions among unintentional biases and strategic representation in transportation planning
Jiangbo (Gabe) Yu, AECOM
Anthony Chen, The Hong Kong Polytechnic University

Different types of biases in transportation investment decisions have been studied individually, but how they interact has not been discussed under a rigorous framework. This paper studies the interplay of two eminent types of biases in the decision processes of infrastructure investment under a system dynamics framework – one on the planning bias of individual projects, while the other on the selection bias when choosing among individual alternatives or projects whose evaluations may or may not be biased individually. Instead of arguing for one over the other as the main cause of realized benefit overestimations and cost overruns, we argue that these two types of biases tend to mutually reinforce each other
in the short term and mutually balancing each other *in the long term*. For instance, the selection bias of one round of decisions may reinforce the planning bias in the following round, which, in turn, reinforces the selection bias in the third round. Such a reinforcement,
in effect, penalizes entities that produce accurate estimates and rewards entities that produce biased estimates.
However, such biased estimates may accumulate over time and backfire, which raises the effort of bias mitigation that may even cause "overcorrection." We demonstrate that the mixing evidence about the effectiveness of bias mitigation measures documented in the existing literature may be at least partially due to the change of dominating bias when the corresponding studies were conducted.

ITP5: 15-Year-Old Teen Drivers Driving Outcomes in Relation to Education Provider
Nazia Riasat, Department of Statistics, North Dakota State University
Yun Zhou, Upper Great Plains Transportation Institute, North Dakota State University
Kimberly Vachal, Upper Great Plains Transportation Institute, North Dakota State University
Megan Orr, Department of Statistics, North Dakota State University

Teen drivers are at greater risk for crash involvement during early independent trips. Graduated driver licensing (GDL) has been shown to successfully reduce risk by minimizing exposure in high-risk driving environments as teens gain experience. As part of its GDL, North Dakota policy allows teens to obtain a restricted license before age 16 if driver training and testing criteria are satisfied. One requirement is to complete an approved driver education program. The objective of this investigation was to determine if public and private education courses had similar teen driver safety outcomes. Quasi experimental cohorts were used to assess safety outcomes, in terms of traffic crashes and citations by education type. The study

scope included over 15,000 drivers licensed at 15 years of age in North Dakota. The logistic regression model results showed drivers educated in public driving school programs performed better than drivers with commercial school education. Results were consistent in terms of traffic crashes and high-risk citations safety outcomes. The study was limited to novice drivers in a single state but may be informative for other states with early licensure provisions in their GDL policy. Future studies would benefit from additional insight regarding teen preparation, within individual schools and supplement education or behind-the-wheel experience, that may influence safety during the early independent driving phase.

ITP6: Recent Environmental Justice Developments Affecting the Transportation Sector
Robin Rotman, Assistant Professor, University of Missouri – Columbia
Counsel, Van Ness Feldman LLP
Amber Spriggs, Graduate Student, University of Missouri – Columbia

Environmental justice – the concept that environmental amenities and burdens should be shared equitably among all races and socioeconomic classes – has gained traction under the Biden Administration. This paper discusses recent environmental justice developments relevant to transportation project planning and operation. First, it provides an overview of President Biden's Justice40 initiative and discusses its implications for various shipper sectors and transportation modes. Second, using case studies from the St. Louis area and beyond, this paper illustrates how transportation professionals can use the U.S. Environmental Protection Agency's "EJSCREEN 2.0" GIS platform (released on 2/18/2022) and the Council on Environmental Quality's Draft Climate and Economic Justice Screening Tool (also released on 2/18/2022) to incorporate environmental justice principles into project siting and operation. Third, it analyzes environmental justice litigation currently pending against the Missouri Department of Natural Resources under the Civil Rights Act of 1964, alleging violations of nondiscrimination requirements in relation to public comment periods for transportation facility permitting. The paper concludes that environmental justice factors are likely to play a greater role in transportation related decision-making in the coming years.

Podium Session: Innovations and Advances in Transportation (2)
Room 204 JCP

INN4: A "bathtub chain" view of the mobility-on-demand service operations
Jiangbo (Gabe) Yu, AECOM
Michael F. Hyland, University of California, Irvine

Agent-based simulations of mobility-on-demand (MOD) systems tend to suffer from a heavy computational burden and lack of immediate sense of the policy impact on system performance. On the other end of the modeling resolution spectrum, estimating various econometric and statistical models with empirical (or simulation) MOD system data cannot fully capture complex causal chains, endogenous delays, and quantity conservation of physical entities; hence, these statistical techniques struggle to provide intuitive and convincing insights that can support operational and strategic decision-making. This paper proposes a modeling framework by viewing the MOD operation systems as bathtub chains. The framework complements existing modeling approaches by aggregately considering the state transition of (i) service fleet vehicles and (ii) customers as paired stock chains (or co- flows). We use stock-flow diagrams to provide an intuitive explanation of the state-space representation (SSR) and demonstrate how the representation can explain the system dynamics of an MOD fleet providing service to Manhattan, New York City taxi requests.

INN5: Quantifying the Railway Dynamic Load Factors through Instrumented Wheelset Measurements
Danial Behnia, Department of Civil and Environmental Engineering, University of Alberta
Michael T Hendry, Department of Civil and Environmental Engineering, University of Alberta, Associate Professor, Director of Canadian Rail Research Laboratory

A sustained increase in heavy axle loads and cumulative freight tonnage is increasing demand on revisiting the understanding of the magnitude of loads along the railway track. In North America, many design factors are based on historical wheel loads that may not necessarily represent the current loading condition. Thus, the dynamic load factor (φ) is an essential component in railway design. *In addition,* φ is a practical parameter for selecting rail steel and cross-sections (weight). φ relates the magnitude of vertical wheel-to-rail loads in operation (dynamic loads) to static loads resulting from the rail car's weight and contents as a function of train speed. American Railway Engineering and Maintenance-of-Way Association (AREMA) and others have proposed various equations for φ. However, a limitation of the existing φ equations is that they have been derived from loads measured at instrumented track sections and observed the many wheel loads but with constant track conditions. For this study, measurements of dynamic loads from two Instrumented Wheel Sets (IWS) conducted four passes over 340 km of track operated by a North American Class
1 freight railway through the Canadian Prairies. The IWS system measures forces originating at the wheel/rail contact point. This system is also instrumented with 16 full- bridge Wheatstone strain gauge circuits placed inside the wheel web. These measurements provided dynamic loads from one loaded freight car over various track structures at differing train speeds. This paper compares the magnitude of measured dynamic loads to existing φ equations for freight railways and the development of new φ equations for tangent track and non-tangent track (i.e., bridges, grade crossings, curves, and switches) based on statistical and intelligent approaches. An important finding to emerge in this study is DLF values in the non-tangent track are around

10% more than tangent track. In addition, this difference increases with increasing speed.

INN6: Can Machine Learning Approaches Improve Transportation Analysis?

Andrew Komendantov, KPMG LLP
Pierre Vilain, KPMG LLP
Jung Bae, KPMG LLP

The emergence of big-data sources in transportation analysis, from GPS movements to sensor- or meter-based data, imply a strong case for mixing tools from econometrics and machine learning (ML). ML would seem to provide particular benefits in this new environment of large datasets (see Varian, 2014). We show that applying a clustering algorithm to classify highway routes, based on traffic characteristics, can improve the predictive accuracy of econometric models when they are estimated on groups defined by the clustering algorithm as opposed to groups defined in more ad-hoc ways or with purely geographic considerations. Other work focused on predicting costs of inputs to construction and operation of infrastructure projects similarly relied on a technique - Least Absolute Shrinkage and Selection Operator (LASSO) – usually considered to be part of the data science toolkit. Our findings suggest that practitioners may benefit from considering such mixed approaches. The combination of traditional econometrics (panel models, vector auto regression) with the aforementioned tools improved the performance of the traditional approaches noticeably.

Podium Session: Covid-19 Impact on Global Transportation
Room 402 JCP

COV1: The Response of U.S. Airports to the COVID-19 Pandemic: A Stochastic Frontier Analysis with the Difference in Differences Method.

Fecri Karanki, York College
Siew Hoon Lim, North Dakota State University

In this study, we provide a comprehensive overview of the airport industry during the COVID-19 pandemic. COVID-19 is one of the most devastating incidents in history. Besides its harm to human health, COVID-19 led to economic, social, and psychological challenges across the globe. As the real global GDP dropped by 3.4% in 2020, it was inevitable for the air transportation industry to avoid this crisis. The estimated air traffic loss in North America is 62.4% in 2020 and 40.9% in 2021. The major revenue sources of U.S. airports are aeronautical and non-aeronautical revenues obtained from airlines and passengers, respectively. Therefore, the reduction in air traffic would deal a major financial blow to the U.S. airport industry. Due to the three relief bills provided by the U.S. government in 2020 and 2021, the airports manage to break even. While the international passenger throughput is expected to return to its 2019 level in 2024, a faster recovery for domestic passenger traffic is plausible. On the other hand, the economic impact of the COVID-19 on all U.S. airports is not homogenous due to airports' characteristics such as size, hub status, and multi-airport city system. Moreover, the response of airports to COVID-19 differs based on these characteristics. This paper takes an in-depth look at the impact of COVID-19 on U.S. airports. We examined the productive efficiency of 59 U.S. airports in 2019 and 2020 with a stochastic frontier analysis with the difference in differences method. We found that the production of large airports decreased more than medium airports due to COVID-19. Likewise, hub airports and airports in multi-airport cities have been more affected by COVID-19 relative to non-hub airports and airports in single airport cities, in that order. Although the impact of COVID-19 on the large, hub, and multi-airport system airports were higher, these airports' productive efficiency is better than their counterparts. This indicates that large, hub, and multi-airport system airports could manage the crisis better. Furthermore, we controlled for the effect of the vertical relationship between airlines and airports on the production frontier with the airport's rate-setting methods such as compensatory, residual, and hybrid. We found that compensatory airports led to an upward shift of production frontier compared to residual airports while there is no significant difference between hybrid and residual airports.

COV2: The Effect of Vertical Product Differentiation on Fare and Market Share: Evidence from Delta Air Lines' Middle Seat Policy

Max J. Hyman, University of Chicago
Ian Savage, Northwestern University

During the iniial stages of the COVD-19 pandemic nearly all airlines encouraged social distancing onboard their aircraft by not selling the middle seat. However, as passengers returned to the skies in the early summer of 2020, American Airlines and United Airlines restarted selling all seats. Alone among the legacy carriers, Delta Air Lines continued to withhold selling the middle seat and did so until vaccines were widely available in the Spring of 2021.

This paper analyzes whether Delta raised its prices or increased its market share by engaging in vertical product differentiation. The analysis focuses on domestic routes in the lower 48 states where Delta is in head-to-head non-stop competition with American or United. A difference-in-differences analysis was conducted on quarterly data from Quarter 1, 2018 to Quarter 1, 2021, with vertical product differentiation occurring in the final three quarters. To be included, a route had to have Delta and either American or United present in all thirteen quarters. Rather surprisingly, there were only 54 non-stop routes which met these criteria.

The mean one-way fare was calculated for each carrier in each quarter on each route based on single coupon domestic tickets, meaning that only passengers on non-stop flights were included. Fare data is from the 10% sample of airline tickets in the U.S. Department of Transportation's quarterly Origin and Destination Survey, commonly known as DB1B. By vertically differentiating its product during the COVID-19 pandemic, we find that Delta charged a fare

premium of 10.5%, or about $13 on a typical one-way flight, relative to the prices of its closest rivals American and United. However, even with the premium, Delta's fares were considerably below pre-pandemic levels.

Market share is calculated from the number of one-way or round trip single-coupon tickets in DB1B. We estimate that by not selling the middle seat Delta increased its market share by 4.8 percentage points relative to its rivals. The net effect is smaller as Delta, along with its fellow legacy carriers American and United, were each estimated as losing 2.6 percentage points of market share due to changes in the mix of traffic during the pandemic. Business travel did not recover as quickly as personal and leisure travel. Unlike leisure passengers who also patronize low-cost airlines, business travelers disproportionately favor the legacy carriers.

It is remarkable that Delta charged a fare premium and enjoyed a net positive change to its market share during a period when the market share of the legacy airlines was depressed by a substantial decline in business travel. An open question is whether these gains are entirely attributable to not having to sit next to a stranger. It is possible that part of the fare premium and market share gain could be attributed to Delta operating more flights to keep the middle seat vacant and thereby offering more departure time options.

UMSL Session: History of Transportation in St. Louis
Room 202 JCP
Session about St. Louis Transportation History Sponsored by The University of Missouri-St. Louis Moderated by Ray Mundy, Professor Emeritus of the University of Tennessee, Knoxville, and Director Emeritus from the Center for Transportation Studies at the University of Missouri-St. Louis

STL1: The Disruptive Transportation Technology that Changed the Course of Missouri History
Carlos A. Schwantes, Saint Louis Mercantile Library Professor Emeritus, Mercantile Endowed Professor for Transportation Studies
University of Missouri-St. Louis

My presentation takes the form of a case study that examines the epic battle waged in Saint Louis and across Missouri in the 1840s and 1850s between supporters of the existing and highly profitable network of commercial relationships forged by steamboat traffic along the great river system of the Midwest during years since 1820 and vocal advocates of the new and disruptive technology represented by the railroads. For several years, many Missourians wondered why the state, or Saint Louis, or individuals should spend difficult-to-raise money on railroads to replace a technology that worked well and was very cost-effective. The same money required to extend a

single mile of railroad track west from Saint Louis could purchase several brand-new and likely-to-be-profitable steamboats, and, moreover, the waterways of the Midwest provided many miles of free highways that required almost no additional infrastructure to handle passengers and freight, in contrast to railroads that required an expensive support structure for freight and passenger trains. What makes the Missouri contest even more interesting, if Saint Louis remained wedded to its steamboat transportation technology, regardless of how successful or profitable it had been in years past, Chicago would use railroad technology to amputate the reach of Saint Louis-based steamboats traveling along the Upper Mississippi and Missouri rivers, which in many ways it did during and after the mid-1850s, when the first of several Chicago railroad reached the banks of the Mississippi River at Rock Island, Burlington, Hannibal, and many other locations, much to the detriment of Saint Louis commerce. Railroads prevailed across Missouri, of course, and this was hardly the first example of a disruptive technology at work, nor would it be the last. One need only recall the battle a few years ago between the Beta and VHS systems for showing movies at home, or the current and ongoing contest between land telephone networks and cellular ones. Even earlier, automobiles disrupted and then annihilated a large network of interurban electric railways that stretched across the Midwest and had offered inexpensive, frequent, quiet, and environmentally clean transportation that people would find impossible to duplicate today.

STL2: Overview of St. Louis Aviation History
Daniel L. Rust, Associate professor of transportation and logistics management, University of Wisconsin-Superior.

Dubbed the "City of Flight," St. Louis has a rich aviation legacy. From balloon ascents in the mid-19th century to development of the first carrier-based refueling drone in the 21st century, the St. Louis region is a microcosm of the triumphs and tragedies of flight. This presentation will provide an overview of St. Louis aviation history via brief snapshots of ten significant events such as John Wise's record-setting balloon flight to New York in 1859, the epic 1927 flight of Charles Lindbergh in "The Spirit of St. Louis," Minoru Yamasaki's pathbreaking 1956 terminal design for Lambert-St. Louis International Airport and construction of McDonnell Aircraft's pioneering Mercury spacecraft.

STL3: They Will Run: The Golden Age of the Automobile in St. Louis
Thomas Eyssell, University of Missouri-St. Louis

Were it not for a few quirks of history, St. Louis might have become the center of the American automobile industry, rather than Detroit. The first self-propelled vehicle hit the streets of St. Louis in 1893, three years before Henry Ford's quadricycle left the shed, and within a few years, dozens of automobile firms sprang up here. St. Louis remained an auto manufacturing center through the 1970s, and Missouri is currently the tenth-largest supplier of automobiles and parts in the United States. St. Louis'

role in the early years of the automobile industry remains a largely untold story.

USDA Session 1: Food Transportation and Wholesale Produce Access in Rural Remote Areas
Room 202 JCP
Sponsored by U.S. Department of Agriculture
Moderated by Matt Chang

USDA 1-1: Recent Surges in Ocean Transportation Rates and Their Effects on Grains and Selected Agri-food Product Markets
Dr. Michael Adjemian, Associate Professor, University of Georgia, Dept. of Agricultural and Applied Economics, Athens, GA
Dr. William W. Wilson, North Dakota State U. (University Distinguished Professor) and CHS Chair in Risk Management and Trading

Seaborne shipping is vital to international trade, accounting for 80-90 percent of its volume, and 60-70 percent of its value, and agricultural trade is no exception. More than 80 percent of the world trade in grains and oilseeds occurs via maritime transport, which typically travel by dry bulk carriers. Many other types of agricultural commodities are generally transported via container vessel, which tend to call at different port terminals owing to the need for specialized infrastructure. Beginning in mid-2020 freight rates for both bulk and container shipments began increasing rapidly. Because U.S. agriculture is so dependent on export markets and waterborne shipping, stakeholders in the American agricultural sector expressed concern about the effect of rising prices of ocean freight. We use time series methods to show that ocean freight rates (for both bulk goods and containers) rise with the demand for shipping services, fuel prices, and destination port congestion, and they fall with increases in fleet capacity. Although short-run median (most-likely) effects of freight rates on U.S. agricultural export levels and prices-received by producers are in the expected direction, their effects are not statistically significant. Our findings are consistent with the USDA's forecast that the value of U.S. agricultural exports will, even in the face of rising ocean freight rates, set a record in fiscal year 2022

USDA 1- 2: Alleviating information asymmetry in food supply chains
Michelle Miller, University of Wisconsin

Three multi-institution projects are underway to democratize data for food supply chain logistics. Using publicly available data on food movements, UIUC and UW-CIAS led a project to model food flow, specifically meat (SCTG 5 truck coldchain) and dairy (SCTG7 truck cold chain) from the 2017 CFS and FAF5. Agricultural economists, planners, supply chain researchers and practitioners met monthly to review data and modeling decisions and consider the empirical results. As part of a

USDA study to document food system changes during COVID19, another overlapping study team conducted supply chain surveys in three regions - Los Angeles, Miami and Minneapolis. This study uses both IMPLAN and food flow data and is convening webinars and a workshop to share findings. The third project is funded through NSF and led by Ohio State University to develop cybersystems that democratize data. Thirteen universities and more than 130 participants are engaged in the five-year project. One use case is on Smart Foodsheds. There are several subprojects in this use case, including one team that is creating a visual dashboard for modeled CFS and FAF data for use by small food businesses and public planners. It is developing the dashboard using food flow information from 2017 data, and will be ready to load 2022 data, expected to be released in 2026.

USDA 1-3: Climate change impacts on U.S. corn and soybean price margins and transportation costs
Wyatt Thompson, University of Missouri Columbia
Teo Skevas, University of Missouri Columbia
Ben Brown, University of Missouri Columbia

The margin between corn and soybean prices at collection points in the Midwest and the Gulf price reflect the costs of moving these bulk commodities from farming regions to export facilities. These margins, or crop basis, depend on many factors, including the transportation network, costs of moving goods along that network that are often associated with fuel prices and barge availability, network disruptions, storage costs, and the volume of material being moved (Davis & Hill, 1974; Hart & Olson, 2017; Jiang & Hayenga, 1997; McKenzie, 2005; McNew, 1994; O'Brien, 2009). Climate change projections suggest changes in precipitation and temperature in this region that could stress the existing network for moving crops to export markets. We use over a decade of weekly basis data from many hundreds of collection points and other data to estimate how weather conditions can affect volumes moving through the network, disrupt local operations, or impede barge traffic and consequently the margins between local and export prices. These initial steps will put us in a position to simulate how climate changes to regional precipitation and temperature can affect the distribution network and change corn and soybean basis in the central region in the future.

USDA Session 2: Climate Change Impacts on U.S. Corn and Soybean Price Margins and Transportation Costs
Room 202 JCP
Sponsored by U.S. Department of Agriculture
Moderated by Surajudeen Olowolayemo

USDA 2-1: Logistical Competition for Corn Shipments from the United States and Ukraine to Targeted International Markets
William W. Wilson, Department of Agribusiness and Applied Economics, North Dakota State University
Prithviraj Lakkakula, Department of Agribusiness and Applied Economics, North Dakota State University
David W. Bullock, Department of Agribusiness and Applied Economics, North Dakota State University

Many factors affect competition in international corn, including supplies and capacity, ocean shipping costs, logistical functions, and costs (ocean and interior), quality, and trade interventions. The purpose of this paper is to analyze the impacts of logistics and costs on the global corn market shares focusing on two major exporters, the United States and Ukraine. An optimized Monte Carlo model was used to analyze spatial competition and impacts of logistical costs and functions on market shares and comparative logistical advantage. The United States has a logistical cost advantage over Ukraine in serving China and South Korea (from the U.S. Gulf) and Japan (from the Pacific Northwest (PNW)). Ukraine has a logistical advantage over the United States in serving the European Union (EU) and Indonesia. However, Ukraine's advantage in the EU was mostly due to the EU's additional 25-percent tariff applied to corn imports from the United States and due to the EU's restrictions against genetically engineered corn imports. There was a 0.80 probability Ukraine was the lowest-cost supplier for the EU. Both the U.S. advantage in China and Ukraine's advantage in the EU are also impacted by limited shipments from Brazil and Argentina to these markets. Brazil and Argentina had lower corn-export market shares because of China's Sanitary and Phytosanitary Standards and the EU's import restrictions on genetically engineered corn. Extensive sensitivities were analyzed on critical logistical variables impacting export competition.

USDA 2-2: Impacts of Climate Change and Infrastructure System Failure on Inland Waterway Transportation Performance
Zhenhua Chen, The Ohio State University

Inland waterway transportation plays an important role in promoting the prosperous growth of the economy by moving agricultural goods and other manufacturing commodities efficiently and sustainably via various navigation systems. However, the performance of the systems also faces increasing challenges recent years due to various disruptions caused by climate change-induced extreme weather events and infrastructure system failures. This study aims to provide an empirical assessment of the impacts of climate change and infrastructure system failure on inland water transportation performance. Focusing on the Upper Mississippi River -Illinois River (UMR-IR) region, we estimated the linkages between the variations of inland water transportation performance metrics (e.g., barge transportation cost and productivity) and the environmental conditions (including water levels, temperature, extreme weather events and disruptive events caused by dam and lock system failures) based on a historical weekly data for the period 2013 - 2021, using statistical panel regression analysis. The results are expected to provide a foundation for creating more realistic input data to measure the regional economic impact assessment of inland waterway system failure using computable general equilibrium analysis. Eventually, the project will help the policymakers gain a more accurate understanding of the importance of inland waterway infrastructure and its potential economic impact, and hence, improves the decision-making for future planning and investment that aims to improve the inland waterway system performance.

USDA 2-3: Agricultural Transportation Literature Synthesis
Will Secor, University of Georgia
Peter Sayal, University of Georgia

Recent work has summarized research in agricultural transportation from approximately 2015 to 2020 (Secor, Thapa, and Wyche, 2021). A new project in this area seeks to build on this by providing a synthesis of the state of historical and existing agricultural transportation research. This poster will present a summary of these ongoing efforts. In particular, it will provide an overview of the current literature by transportation mode (e.g., rail, barge, and truck) and cross-modal topics (e.g., agricultural commodity markets and transportation). It will also point to gaps in the existing literature that warrants further research. This poster should be engaging for poster session attendees and develop significant discussion about other areas of literature to review and other gaps in the research literature to address.

USDA Session 3: Alleviating Information Asymmetry in Food Supply Chains
Room 202 JCP
Sponsored by U.S. Department of Agriculture
Moderated by Kranti Mulik

USDA 3-1: Food transportation and wholesale produce access in remote rural regions
Michelle Miller, University of Wisconsin
Regina Hirsch, University of Wisconsin

UW-Center for Integrated Agricultural Systems is collaborating with researchers at the New Jersey Institute of Technology (NJIT) to explore transportation issues related to food distribution and comparing rural and urban transportation for wholesale food markets where food access is low. The CIAS team is investigating cold chain

produce movements in the 13 rural counties of Northern Wisconsin that are identified as food insecure (>12%) and fall under the USDA-ERS designation "Frontier And Remote"(FAR). Thus far, we've worked with the Wisconsin DOT to access relevant TRANSEARCH data and obtained data from other state agencies and NGOs. These data are now mapped and analyzed. While compiling data, we conducted several key personnel interviews to understand supply chain issues and innovations from the practitioner point-of-view. This included participating in a Wisconsin Freight Advisory meeting, presenting to county Extension educators, and interviewing leaders in the field, including those who serve Native American Nations in rural Wisconsin. We are in the midst of interviewing rural independent grocers and their distributors about the challenges they face in providing fresh produce to these communities. This presentation will present our findings to date.

USDA 3-2: Optimal timber truck routing under coordination
Jake Wagner, Washington State University
Eric Jessup, Washington State University
Greg Latta, University of Idaho

The transportation of logs from forests to sawmills currently represents a very costly and inefficient activity, significantly limiting the returns to log truck owners/operators, hampering efficient operation of sawmills, and ultimately reducing the market for U.S. timber products. Advances in technology and information exchange could improve coordination across this supply chain, resulting in improved efficiency, lower transportation costs, reduced roadway damage, and reduced emissions. To analyze potential benefits of advancements in technology, information exchange, and coordination, a transportation optimization model is developed, which identifies efficient allocation and routing of timber from forest plots to mills. The model is solved under two operational scenarios: a status quo scenario under which all trips are roundtrips with empty backhauls; and an optimal scenario which flexibly allows for coordinated routing and non-empty backhauls. The difference in costs and efficiency between the status quo scenario and the optimal routing scenario are used to estimate the value of investing in information technology that achieves improved product flow and efficiency through coordinated, optimal routing. Preliminary results suggest that such an information technology can generate approximately 7% in private transportation cost savings, and an 8% reduction in greenhouse gas emissions.

USDA 3-3: USDA Open Agricultural Transportation Data Platform
Matt Chang, USDA, Transportation and Marketing

USDA's Agricultural Transportation Open Data Platform. This site is a continually growing catalog of publicly available agricultural transportation datasets, visualizations, stories, and a newly established agricultural research compendium. This session provides an introduction and update of the latest platform.

USDA Session 4: Open Data Platform and Research Collaborations
Room 202 JCP
Sponsored by U.S. Department of Agriculture
Moderated by Peter Caffarelli & Matt Chang

USDA4-1: Current and future research of Agricultural transportation research
Kranti Mulik, USDA/Transportation and Marketing Staffers
Surajudeen Olowolayemo, USDA/Transportation and Marketing Staffers
Peter Caffarelli, USDA/Transportation and Marketing Staffers
Matt Chang, USDA/Transportation and Marketing Staffers

Every year, USDA/Transportation and Marketing provides funding through Co-op agreements and inter-agency agreements to support high-quality and timely research projects with a wide of scope of subjects related to agricultural commodity and product transportation issues. USDA staffers will utilize this presentation to provide an overview of the past and current research projects. We also would like to use this opportunity to communicate with the audience for the new research need, ideas, potential future collaboration.

Graduate Student Research (1)
Room 402 JCP

GSR1: A Machine Learning Approach to Predicting Bicycle Demand During the COVID-19 Pandemic
Carolina Baumanis, The University of Texas at Austin
Jennifer Hall, The University of Texas at Austin
Dr. Randy Machemehl, The University of Texas at Austin

Count-based bicycle demand models have traditionally focused on estimation rather than prediction and have been criticized for lacking a direct causal relationship between significant variables and the activity being modeled. Because they are not *choice*-based models, they are doubted for their ability to forecast well. The rise of machine learning techniques has given researchers tools to build better predictive models and the tools to evaluate predictiveness. Extensive previous work in the statistics and machine learning field has shown that the best predictive model is not synonymous with the mos*t true* (or explanatory) model. The non-motorized demand modeling community could leverage these lessons learned to develop better count-based predictive models.
The rise of the COVID-19 pandemic has clearly affected travel patterns, but the extensive data collection has opened up an opportunity to leverage machine learning techniques to build a predictive bicycle demand model. This study uses bicycle count data, COVID-19 data, and weather data to develop a lasso regression model for three facilities in Austin, TX. The COVID-19 variables included both state- and local-level data between March 15th, 2020, and

January 31st, 2021. The final model selects six variables out of 28 variables and reveals that the increase of statewide COVID-19 fatalities, statewide molecular positivity rate, and local precipitation cause a decrease in bike ridership, and maximum temperature causes an increase. The lasso model also has a lower MSE during cross-validation compared to the full model. In the end, modelers can use this approach to improve the forecasting ability of any count-based bicycle demand model.

GRS2: An Investigation on Vehicle Preferences by Ride Sourcing Drivers
Reginald Dupree, South Carolina State University
Judith Mwakalonge, South Carolina State University
Saidi Siuhi, South Carolina State University
Judy Perkins, South Carolina State University

Ridesharing has been on the rise for the past decade. Mainly for its cost efficiency, environmental benefits, and improvement of congestion. New on demand travel services such as Uber, Lyft, and Ztrip have made ridesharing one of the most popular modes of transportation. These services require for hire drivers who provide their own personal vehicles to transport riders. In 2019 a reported estimation of about 800,000 trips were made by ridesharing per day in New York City. Larger companies such as Uber and Lyft have bridged the gap between affordable travel and travel demand without limitations on destination overtaking the demand for taxi services. With enhancements such as allowing group ridesharing and even destination sharing; drivers have been able to increase their range of opportunities. Highly populated large urban areas such as New York City have a higher percentage of riders who are using ridesharing services to conveniently move through the city. In this study, we utilize the NYC Open Database to investigate the vehicle preferences for ride sourcing drivers. The study uses the vehicle identification number decoder to obtain vehicle information. Specifically, the study examines the vehicle features that are more appealing to ride sourcing drivers. This data will be used to further analyze the importance of vehicle preferences and various driver characteristics effects on ride sourcing driver's trips. Recommendations will be provided to further understand driver choice and how we can enhance that experience for rideshare participants. The results will allow a conclusive assessment of the data in hopes of providing further improvements to transportation objectives.

GSR6: The role of Socio-economic and Environmental factors on Pediatric Vehicular Heatstroke (PVH) deaths: An Investigation
Frank Charles Ngeni, South Carolina State University
Dr. Judith Mwakalonge, South Carolina State University
Dr. Saidi Siuhi, South Carolina State University

Heatstroke as physicians calls it, hyperthermia has been among the leading cause of non- traffic deaths among kids in the US. According to NHTSA, more than 900 children have died since 1998 because of being left in cars or accessing the cars without notice by adults. According to literature, kids' body temperature rises five times higher

compared to adults. Additionally, in just 10 minutes, vehicle temperature can increase by 20o and become deadly. Different campaigns and strategies have been employed to increase public awareness. Also, different technologies have been developed to alert drivers on the presence of kids in backseats, but they have been inefficient in some scenarios. Scenarios such as when a child access the vehicle without adult supervision and when caregivers intentionally leave the child in the vehicle are of concern. Of 742 cases that occurred between January 1st, 1990, to December 31st, 2016, 28.5% of fatalities account for children accessing the vehicles independently, and 16.6% of fatalities involved caregivers intentionally leaving the child bar the unknown scenarios. This paper aims to answer the following research questions a) what is the role of socio-economic and environmental factors in PHV deaths? b) what are the statistical significances of socio-economic and environmental factors on PHV deaths? The study will stimulate public awareness and help traffic safety officers to understand the extent of the problem in the societies and help authorities dealing with legislation to enact laws in more informed ways.

Graduate Student Research (2)
Room 402 JCP

GSR5: Deep Learning Model for Road Condition Monitoring by Identification of Flexible Pavement Distresses Using In-built Vehicle Cameras and GPS Sensors.
Cuthbert Ruseruka, South Carolina State University
Judith Mwakalonge, South Carolina State University
Gurcan Comert, Benedict College
Saidi Siuhi, South Carolina State University
Judy Perkins, Prairie View A&M University

Road authorities worldwide need to continuously monitor their roads' conditions to minimize road maintenance costs and maintain road rideability. Existing methods for carrying out road condition surveys involve manual observations of roads using standard survey forms, done by qualified road condition surveyors or engineers either on-foot or vehicle. These methods are expensive, time-consuming, infrequent, and can hardly provide real-time information for road conditions. Also, they cause traffic flow interruptions since they involve either full or partial closure of the road for them to be carried out. Some automated road condition survey methods also exist but are very expensive since they require special vehicles equipped with sensors for data collection together with data processing and computing devices. Various deep learning models have been developed in this area for various distresses. In this research, a single model will be developed using You Look Only Once, Version 5 (YOLOv5) algorithm. This model will be trained to capture and categorize flexible pavement distresses into nine groups. Using in-built vehicle cameras and GPS sensors, these distresses will be detected, their images will be captured, and their corresponding GPS coordinates will be recorded. The vehicle built-in technologies provide a more

cost-effective and efficient road condition monitoring approach that can also provide real-time road condition.

GSR7: Modeling the Impacts of Self-Driving Cars on Land Use
Derek Hungness, North Dakota State University

Transportation shapes and is shaped by the urban environment. Throughout history, cities have been designed and redesigned in accord with changing modes of urban transport. The impacts of Connected and Autonomous Vehicle (CAV) technology on personal trip-making, roadway design, and land development are still largely unknown, but they will be significant. Researchers generally agree on how CAVs will affect traffic flow but can only speculate on the level of impact they will have on land use. This is largely because it will be many more years before there is significant CAV deployment in the United States. With so much uncertainty, it is nearly impossible to develop and validate travel models that tie-in factors like auto ownership elasticities, the public's propensity to travel in driverless vehicles, their effects on public transit, non-construction increases in highway capacity, and modifications in community land use and development. One tactic has been to adjust the parameters of existing regional travel demand models to simulate the anticipated effects of wide-spread CAV deployment. This paper reviews recent research in this evolving area of transportation and land use planning and evaluates reasonable CAV growth factors applied
to an existing regional travel demand model developed for the Fargo-Moorhead urbanized area to draw conclusions on localized impacts.

GSR8: Climate Change-Induced Shifts in Precipitation: Response Of
Missouri Corn and Soybean Basis
Mohammad Mobarok, Recently graduated PhD student, University of Missouri
Toe Skevas, University of Missouri
Ben Brown, University of Missouri
Wyatt Thompson, University of Missouri

We investigate alternative precipitation patterns and their influence on Missouri corn and soybean basis. Basis quantifies separation between prices of corn and soybeans at local collection points, such as elevators or ethanol plants, and a key indicator price. In this case, we use the Chicago Board of Trade (CBOT) price, so basis measures implicitly the arbitrage between a centrally located market price and the prices geographically closer to commodity producers. As such, basis represents an indicator of the crop transportation network costs and efficiency. We estimate the impacts of local, growing season, and regional precipitation on basis to infer the sensitivity of that network to weather conditions. We test for nonlinear relationships, as well, to capture the risks imposed by extreme weather on a weekly basis. Our data represent Missouri corn and soybean basis using a large panel dataset for the 2010–2020 period. Our analysis tests for statistically significant linear and nonlinear basis responses to precipitation. For example, results test whether corn and soybean basis suffer any

immediate effect from normal or abnormal weekly rainfall in the area around the collection point, testing if local disruptions affect local prices. We test whether the growing season precipitation that represents local supply conditions exhibits has an expected U-shaped relationship; we anticipate that good local growing conditions and the consequent high production tend to cause more pressure on the transportation and distribution network and lower basis, whereas bad local growing conditions and lower supply tend to cause less pressure on the network and higher basis. Regional precipitation stands in for the risks that high or low water levels disrupt barge traffic along key crop distribution routes. Moreover, we test if distance to market plays a role in the regional precipitation impacts on the basis of each collection point. Results use actual data to infer the sensitivity of the US crop distribution network to precipitation, indirectly representing the risks of local disruptions, supply and capacity interactions, and barge traffic stoppages. Given the climate projections, there are concerns regarding precipitation's influence on future navigability of major transportation arteries that link Missouri to export facilities down the Mississippi river, crop growing conditions, and local disruptions. Hence, the information generated in this research has even greater utility when studied in the context of the potential impacts of changing weather patterns on the US crop distribution network.

Panel: Trends in University Sponsored Transportation Research: A Panel Discussion
Sponsor: Chicago Chapter of TRF

Moderator: Joseph Schwieterman, Professor, School of Public Service; Director, Chaddick Institute for Metropolitan Development; President, Transportation Research Forum

P.S. Sriraj, Director, Urban Transportation Center, University of Illinois Chicago
C. Scott Smith, Chaddick Institute, DePaul University
Ian Savage, Northwestern University

Brief presentation by a DePaul University student team
This panel will provide insights on notable trends in university sponsored transportation research. Each of the three featured speakers will provide a 10–12-minute presentation that explore a subset of these themes:

- How has the increasingly interdisciplinary nature of transportation research affected the tenor and direction of university sponsored research?
- Describe how the changing expectations and orientation of reputable academic journals are affecting the publishing process. How has this affected faculty and researchers in our field?
- What notable changes have occurred in funding for academic research in our field? How has this affected the choice of projects pursued by researchers?

- How has the pandemic affected the productivity and morale of researchers in our field?

A discussant will offer 10 minutes of formal remarks. Roughly 45 minutes will then be made available for the audience and panel discussion.

Panel: Current Trends in Agricultural Logistics
Sponsor: UMSL Supply Chain Analytics Dept.

Chris Boerm, President, ADM Transportation, ADM Trucking, and ARTCo at ADM
Jon Mosher, Export Operations Lead at Bayer Crop Science
Jennifer Downey, Manager, Oils Supply Chain, Bunge North America
Moderator, Ray Munday, Professor Emeritus of the University of Tennessee, Knoxville, and Director Emeritus from the Center for Transportation Studies at the University of Missouri-St. Louis

Major disruptions to the global supply chain, including the pandemic and world conflict, have strained supply, and altered demand in the agriculture industry both domestically and abroad. In this panel discussion, industry experts will share their insights regarding current risks and disruptions to agriculture logistics, as well as present lessons learned and best practices for moving forward.

Poster Session
JCP Gathering Area

FP1: Air Quality at Public Transport Stations: The Case of Torhailoch-Ayat Main Road in Addis Ababa
Mintesnot Woldeamanuel, California State University, Northridge
Mulugeta Soruma, Wollega University

The increase of population and rapid spatial expansion of urban areas generate high travel demand and increase of motorization, which is directly related to the air quality of the urban environment. The continuous increase in traffic congestion and fuel consumption deteriorates air quality. Like other cities in the developing countries, Addis Ababa is facing air pollution problem due to rapid urban development, ineffective transport system and growth in traffic volume. Previous study of Gebre et al., (2010) indicated that, the concentration of suspended particles in the Addis Ababa city was about 195μg/m3, which is above the WHO safe guideline value that is 120μg/m3. The condition of public transportation and road infrastructure in the city is regarded as one of the poorest among developing countries. The relative rise in automobile ownership together with poor condition and lower capacity of the roads has resulted in high levels of congestion. This causes traffic-related air pollution around the roadside, particularly during peak hours. In addition to congestion, the age of the

vehicles has significant contribution in the deterioration of air quality. The average age of the vehicles in Addis Ababa is about 17 years. Public transportation fleets such as Higer buses, Lada taxis, midi-buses and blue minivan taxis are old aged that emit more smoke and particulate matter. These phenomena raise the concentrations of air pollutant near the roadside and around public transport stations where transit users spend a considerable amount of time waiting for buses or taxis.

Therefore, the aim of this study is to investigate the level of air quality at public transport stations in Addis Ababa city along the major route from Torhailoch to Ayat focusing on the concentration of PM2.5, PM10, Air Quality Index (AQI) and CO2. Observation and field measurements of air quality were used to collect the data. Primary data were collected via field surveying using IQAir AirVisual® pro model air quality measuring device from five public transport stations at peak and off-peak hours.

The study found that increase in peak hour traffic volume at stations contributes the high concentration of PM2.5, PM10, AQI and CO2. High levels of air pollutants were found during peak hours compared to off peak hours. The maximum 30 minutes average concentrations of PM2.5 were found to be 89μg/m3 during peak hours and 61μg/m3 during off peak hours, which is far exceeding the WHO air quality standard (35.4μg/m3). The temporal and spatial distributions of the air pollutants in this study demonstrated that rush hours were the most polluted, having high concentrations of PM2.5, PM10 and AQI while an off-peak hour have low concentration of air pollutants.

Based on the results, it is recommended that the city government should encourage zero emission vehicles, provision of efficient public transport and green development in order to reduce the current condition of transport-related air pollutants.

FP2: The Expansion of Amazon Air: September 2020 to March 2022
Joseph Schwieterman, DePaul University
Borja Manuel González Morgado, DePaul University
Abby Mader, DePaul University

This poster will showcase new results of our research on the growth of Amazon Air, the air cargo arm of Amazon. The poster will place particular emphasis on our analysis of the carrier's size, scope, and evolving logistics role. It will build upon the findings we provided at the 2021 TRF conference while also encompassing new results from our geographic and spatial analysis. The poster will feature data we collected for a Chaddick Institute study on Amazon Air, slated to be published in February 2022.

Among the issues to be addressed will be the extent to which Amazon Air is designed to link fulfillment and sorting centers rather than provide comprehensive coverage across all of North America. We will explore the degree to which Amazon Air's network of flights retains the highly decentralized orientation observed in last year's presentation and evaluate how the network is changing with the development of its Cincinnati hub.

Our poster will present updated analysis based on data from three primary sources.

1 Amazon Air fleet registrations. The primary source used to evaluate fleet changes from May 2020 to the present will be official Federal Aviation Administration data. This data includes the acquisition date, tail number, type and age of the plane, and the name of the lessor if the plane is leased.

2. Data on all the takeoffs and landings of Amazon Airplanes. Our data team will record the origin and destination, arrival and departure times, plane type, and contracted operator. The data team will compare the results of data recorded on six days (with each day of the week represented, except Sunday) during August 2020, February 2021, August 2021 and February 2022. Our preliminary results suggest that Amazon grew by around 12% between August and December 2021, and we expect more growth by February 2022, based on anticipated plane deliveries. Our data set will encompass information on more than 2,000 flights.

3. Geographic analysis of Amazon flights using ArcGIS software and U.S. Census data. Our previous analysis has shown that the population that lives within 100 miles (by air) of an Amazon Air airport grew from 54.0% in May 2020 to 60.1% in February 2021 to 70.2% in August 2021. We will provide updated results on the share in February 2021 as well other relevant metrics. We will also discuss the proximity of Amazon Air airports to the roughly 350 large warehouses and fulfillment centers that we have identified. The locations were clustered by metropolitan region and mapped using ArcGIS.

The poster will feature graphics, statistic findings, and several photos to allow attendees to appreciate the rapidly expanding role of Amazon Air, which is a prominent player in the expanding e-commerce sector.

FP3: Investigating the Correlation between Emergency Medical Service Arrival Delay in Motor Vehicle Crashes

Joshua Hart, University of Alabama in Huntsville
Dr. Vineetha Menon, University of Alabama in Huntsville
Dr. Mehrnaz Doustmohammadi, University of Alabama in Huntsville
Dr. Sampson Gholston, University of Alabama in Huntsville

Efficiency in Emergency Medical Response (EMS) time have a potential to massively affect trauma patient survival. In this study, the correlation between crash severity and variables such as adjusted EMS arrival delay, weather, time of day, and roadway condition will be investigated. The data is obtained from Critical Analysis Reporting Environment. The data will be trained and oversampled using a tool from scikit-learn, and a confusion matrix will be created using the trained and test data. The Binary Logistic Regression will also be utilized to create another tool for evaluating the effects of EMS arrival delay.

FP4: Use of the Social Vulnerability Index in investigating the transit deserts

Mehrnaz Doustmohammadi, University of Alabama in Huntsville
Eric Merschman, University of Alabama in Huntsville
Michael Anderson, University of Alabama in Huntsville

Accurately predicting the true demand of transit is one of the most challenging and crucial matters that various departments of transportation are attempting to solve. One of the tools for predicting the demand and creating the proper infrastructures and facilities, is using a social vulnerability index (SVI). This index will look at the most vulnerable population in regard to old age, poverty, and disability. In this study, an index has been created to help guide us to investigate the most socially vulnerable counties in the entire state of Alabama using the U.S. Census data at county level for 67 counties. This will make a guide for analyzing the transit needs of the state of Alabama and will be used to identify potential transit deserts or where demand exist but there are no service.

GSP1: Assessing and Quantifying the Impacts of Vehicle Automation, Electrification, and Connectivity on Highway Expenditures, Revenues, and User Equity.

Isaiah Mwamba, Purdue University
Samuel Labi, Purdue University

Asset managers continue to prepare physical infrastructure investments needed to accommodate the emerging technologies, namely vehicle connectivity, electrification, and automation. The provision of new infrastructure and modification of existing infrastructure is expected to incur a significant amount of capital investment. Secondly, with increasing EV and CAV operations, the revenues typically earned from vehicle registrations and fuel tax are expected to change due to changing demand for vehicle ownership and amount of travel, respectively. This research estimated (i) the changes in highway expenditures in an era of ECAV operations, (ii) the net change in highway revenues that can be expected to arise from ECAV operations, and (iii) the changes in user equity across the highway user groups (vehicle classes). In assessing the changes in highway expenditures, the research developed a model to predict the cost of highway infrastructure stewardship based on current and/ or future system usage.

The results of the research reveal that CAVs are expected to significantly change the travel patterns, leading to increased system usage which in turn results in increased wear and tear on highway infrastructure. This, with the need for new infrastructure to support and accommodate the new technologies is expected to result in increased highway expenditure. At the same time, CAVs are expected to have significantly improved fuel economy as compared to their human driven counterparts, leading to a decrease in fuel consumption per vehicle, resulting in reduced fuel revenues. Furthermore, the prominence of EVs is expected to exacerbate this problem. This research proposed a revision to the current user fee structure to address these impacts. This revision contains two major parts designed to address the system efficiency and equity in the near and long term. For the near term, this research recommended a variable tax scheme under which each vehicle class pays a different fuel tax rate. This ensures that both equity and system efficiency are improved during the transition to ECAV. In the long term, this research recommended supplementing the fuel tax with a distance based VMT tax, applicable to electric vehicles.

GSP2: Equitable Distribution of Freight Transportation: A Case Study in Tennessee
Mitra Salehi Esfandarani, Graduate Research Assistant, University of Memphis

Transportation policies can sometimes reinforce ethnic, racial, and disability disparities amongst various localities. To address this issue transportation equity is a concept to form the distributive justice concerns regarding how government institutions shape the distribution of transportation benefits and burdens in a society. In other words, the study of transport equity investigates the multiple ways through which transport policies can build conditions for broader transport systems that allow different groups of people to flourish. Equity is defined as a systematic and consistent, just, fair, and unbiased treatment of all individuals including, underserved communities such as people of color and minorities. Due to a recent executive order, the federal government needs to pursue a thorough approach to improve the civil rights, racial justice, equity, and equal opportunity to strengthen the underserved and marginalized communities that are adversely affected by consistent inequality and poverty. Over the recent years, research on transportation equity has emerged on distributive outcomes of transport policies. A fundamental question to these equity studies is finding the population group(s) who suffer all the consequences while others gain all the benefits from transportation policies as well as determining the distribution of benefits and burdens among the different population groups. Transportation equity analysis investigates the fairness of impact distribution from transportation planning and analyzes that a certain community experiences a smaller share of the benefits or greater burden of the harms. Transportation equity is classified into several categories based on how fairness is evaluated (geographical, procedural, and social). In this study we focus on social equity and more specifically, vertical equity and examined the relationship between the freight traffic and disadvantaged communities. This paper provides an analysis of negative impact from freight activity in rural/suburban areas to help decision-makers identify the extent of this impact in multiple contexts and provide metrics to quantify equity.

In this study socioeconomic data including, race, income, population, educational level, age, and gender as well as freight transport related data such as congestion, crashes, emissions, and freight flows at TAZ level for year 2010 and forecasted year 2040 is used to estimate various metrics to quantify and evaluate equity for four different groups of population i.e., people of color, people in poverty, older adults, and young people. The proposed methodology is implemented in three counties in TN. Hotspots of externalities and freight flows besides the equity metrics are determined and a complete set of the public-sector initiative such as program, project, and policies are provided to assist decision-makers in mitigating the externalities resulting from freight activity in rural/suburban communities while optimizing costs net benefits for all the stakeholders and enhancing the equity among people. Web-based and desktop GIS tools are also developed to provide timely knowledge and awareness to the public.

GSP3: Stakeholder acceptability of freight policies to improve transport systems in tourist areas
Marlyn Marte Genao, Pontificia Universidad Catolica Madre y Maestra
Trilce Encarnacion, University of Missouri-St. Louis

The aim of this research is to analyze the perceptions of key stakeholders to a set of policies designed to address freight transportation issues in a tourist mountain town in the Dominican Republic. Survey data was collected from different sets of stakeholders including commercial establishment's representatives, drivers, and citizens. Respondents provided their opinion about a set of urban freight policies commonly considered to alleviate freight-related congestion in urban areas. The results suggest that different stakeholders perceive policies differently and serve as a reference for the creation of outreach programs to educate the public on the benefits of different urban freight policies.

GSP4: Measuring the Evolving Status of Bus Lines Operating from Asian Neighborhoods in U.S. Cities
Allison Woodward, DePaul University
Abby Mader, DePaul University
Borja Gonzalez, DePaul University
Sarah Hollock, DePaul University

Specialty bus lines operating from ethnic neighborhoods have long been niche service providers in the American transportation system. Among them are bus companies that operate from curbside addresses in neighborhoods with larger Asian populations, some of which leave from the commercially oriented Chinatown districts. Several academic studies (e.g., Klein, 2009) have credited these lines with sparking a resurgence in intercity bus travel in the early 2000s. This study evaluates the characteristics of the services and routes provided by bus lines in urban neighborhoods with majority Asian populations as the industry emerges from the COVID-19 pandemic. It explores the geographic orientation and transportation role of these carriers as well as the competition they face from major bus networks managed by Greyhound Lines and Coach USA. It also explores the types of facilities they use for stopping and station locations.

GSP5: Modelling the Effect of Traffic Reduction on the Severity of COVID-19 Outbreak in U.S. States
Tate Grant, Embry-Riddle Aeronautical University

The SARS-CoV-2 virus, the cause of coronavirus disease (COVID-19) led to a global pandemic following its emergence in 2019. The COVID-19 pandemic brought unprecedented levels of economic and social disruption. In response to the pandemic, public officials throughout the world issued health directives to limit person-to-person contact. However, despite the nearly ubiquitous adoption of social distancing measures, governmental actions varied from country to country, and even within the United States, from state to state. Transportation, e.g., the movement of

people and goods, has been used as a surrogate measure of societal interaction. Typically, for members of separate households to meet and intermingle, one or more trips must first be taken, therefore traffic counts correlate with exposure. It is therefore no surprise that stay-at-home orders led to drastic decreases in traffic volumes throughout the U.S.

This paper investigated the relationship between traffic reductions through the various phases of COVID-19 outbreaks across the US in 2020 and 2021. The initial wave of COVID-19 outbreaks began in the US in March and April of 2020. During this phase of the pandemic, compliance with stay-at-home orders and other social distancing guidance was highest, as measured through significant and sustained traffic reductions. However, as the first wave of COVID-19 infections began to wane in the Spring and Summer of 2020, phased re-openings of the economy occurred; as such, traffic slowly crept toward normal pre- pandemic levels. As cases began to increase again during the Fall and Winter of 2020, traffic data suggests that social distancing and stay-at-home orders were not as effective at reducing travel in this phase. Traffic volumes from 2019-2021 and case infection rates between initial and second wave outbreaks were analyzed for ten states. This data was used to obtain the rate parameters for the Susceptible-Infected-Recovered (SIR) model for ten states for the two phases separately. These rate parameters are then correlated to traffic reductions compared to 2019 baseline.

For various states throughout the U.S., the second peak of COVID-19 cases was much greater than the original peak in March of 2020. However, the traffic reduction was much higher in the first phase, indicating more effective social distancing and reduced exposure. The increased number of cases in the second peaks were likely due in part to the reopening of states, resulting in a higher number of vehicles counts and trips being made throughout the country. This modelling approach analyzes the counterfactuals, as to how the infections would change if this modelling approach analyzed the counterfactuals, as to how the infections would change if lockdown procedures and people's behavior, in terms of travel movements, were the same in late 2020 as they were when COVID-19 initially broke out in the U.S. This method results in the simulated infected curves that peak below the observed data for each state.

GSP6: Developing an Interactive Map of Rural Bus Lines Operated by Public Transit Agencies in the United States

Abby Mader, Chaddick Institute for Metropolitan Development, DePaul University
Allison Woodward, Chaddick Institute for Metropolitan Development, DePaul University
Borja Gonzales, Chaddick Institute for Metropolitan Development, DePaul University
Harrison Horst; Chaddick Institute for Metropolitan Development, DePaul University

This project develops both an inventory and creates an interactive map of rural public transit services operated by public transit companies in the continental United States. It fills a void in understanding the network of bus services that reach remote areas, small towns, and villages with no other public transportation options. It shows how this transit service supplement the country's intercity bus system, which is served by such carriers as Greyhound, FlixBus, and Megabus. Many rural services are eligible for federal funds through the U.S. Department of Transportation's 5311b Program, which facilitates mobility is communities with populations of less than 25,000. We are aware of previous efforts to list and use cartographic tools to display these services.

The study considers both services in which General Transit Feed Specification (GTFS) data is publicly available (this allows schedules to be displayed on Google Maps and other virtual programs) and those in which schedules are only in text format on agency websites. Carriers with GTFS feeds were identified using several prominent portals, including the Transit Feed feature of openmobilitydata.com and various data portals maintained by state governments. Many carriers were found to have schedules displayed only in PDF format. To identify the country's network of rural routes, the team evaluated the route maps and/or posted schedules of 350 transit operators. To be included, routes had to extend to areas outside of a metropolitan region, connect two or more communities, and have a linear orientation akin to traditional bus routes. We excluded routes operated by traditional intercity bus lines, such as those provided by Greyhound Lines, and limited our consideration to routes that are at least 10 miles long. Subsidized routes operated by major bus lines under a private company's brand name, such as Greyhound Connect or Jefferson Lines, are excluded, as our focus is on routes that are provided by public transit providers.

The process of identifying routes required dealing with a variety of challenges. In New Jersey, for example, NJ Transit had a consolidated map shows hundreds of services, making it difficult to identify routes that met the criteria. In other instances, it was unclear if posted schedules reflected actual schedules due to pandemic-related disruptions. Some websites were unclear whether service was "on demand" or regularly scheduled. Many route maps did not list the communities served and instead listed the names of local landmarks or buildings, requiring additional research. Our results show that rural service by public transit providers is available in at least 40 of the 48 states on the U.S. Mainland. We found 369 routes operated by 90 different providers. We identified 12 routes that are over 100 miles and 13 routes that are over 150 miles. We found routes on which GTFS feed is available tend to be clustered on the East and West Coasts, with many "non-GTFS" schedules concentrated in the interior. Cumulatively, these routes span more than 15,000 miles. Many have fares that are less than $5 to be accessible to low-income groups.

Creating the interactive map required geocoding the start and stop locations of routes and using ArcGIS to display routes and each route's endpoints. In this initial phase of the project, we displayed routes as straight lines between endpoints of routes, with only major intermediate stops on longer routes. The interactive map shows the route's approximate length, operator, and key stops when the user

"clicks" on a particular route. In future analysis, we hope to show the routes in greater detail by expanding upon the GTFS provided and using other tools.

GSP7: Modeling the spread of COVID-19 in high pedestrian density crosswalks

K Karnati, Embry-Riddle Aeronautical University
Y Wu, Embry-Riddle Aeronautical University
D Liu, Embry-Riddle Aeronautical University
S Namilae, Embry-Riddle Aeronautical University
M Scotch, Embry-Riddle Aeronautical University
GK Thiruvathukal, Embry-Riddle Aeronautical University
YH Lu, Embry-Riddle Aeronautical University
A Srinivasan, Embry-Riddle Aeronautical University

The movement of people is inherently connected to the spread of viral diseases. There is direct evidence for the spread of COVID-19 clusters in various high-people density locations, including transportation hubs like airports and train stations. Busy crosswalks in urban areas can exhibit significant pedestrian flow and act as sites of COVID-19 spread, however there have been no empirical or modeling studies related to disease spread in crosswalks. In this work, we utilize a pedestrian dynamics based multiscale model to investigate the spread of COVID-19 in typical pedestrian crosswalk, and further analyze the effect of mask usage in mitigating the disease spread. Pedestrian dynamics models enable the analysis of contact evolution due to non-uniform mixing between susceptible and infected individuals in crosswalks, which is combined with an infection transmission model to estimate the disease spread and mitigation strategies. A challenge for such modeling is the uncertainty in initial conditions and pedestrian behaviors. We utilize data from public webcam videos to identify inputs to the initial conditions to reduce the uncertainty. Many organizations including departments of transportation deploy network cameras and make the real-time data available which is captured and analyzed for this purpose.
We used AnyLogic 3D simulation software to simulate pedestrian movement in crosswalks, and to generate the pedestrian trajectories. The composition of pedestrian groups is varied based on the inputs from the static pictures obtained from the webcam data. The model simulates movement of 597 pedestrians over a period of 3 hours. The pedestrian trajectories are used in conjunction with a stochastic dose-response infection model to estimate the infection probabilities. The infection model has been parameterized to infection events in early stage of pandemic and validated by comparing with known superspreading events. Mask usage is modeled by varying the parameters in the infection transmission model. Since the position of index cases is not known apriori, many variations are considered to analyze the disease spread. Results suggest that mask usage would significantly reduce infection spread in this situation. Use of cloth masks would reduce infection spread by 40% while N95 masks would eliminate secondary infections.

GSP8: Comparative Performance of Food and Nutrition Security Operations

Maya Harter, Supply Chain Management Department, University of Missouri-St. Louis
Trilce Encarnacion, Supply Chain Management Department, University of Missouri-St. Louis

This research presents a systemic characterization of the different operational features of food and nutrition security supply chain operations. The results provide insight into the level of effectiveness of different approaches to mitigate food and nutrition insecurity. In-depth interviews were conducted in the St. Louis Metropolitan Area to gather data about the supply chain configurations employed by these organizations. Using a grounded theory approach, the authors extracted the common themes that characterize the organizational structures and supply chain dynamics from the organizations interviewed. The results discuss the chief conclusions and policy implications.

GSP9: Resilience to Unknown Unknowns: Lessons Learned and Emerging Effective Practices from the COVID-19 Pandemic

Nakeia Jackson, Georgia Tech

This study will investigate how transportation agencies have been affected by COVID-19 and how they are recovering. The proposed research will contribute potentially useful findings to ongoing work to implement risk and resilience strategies effectively across transportation and other agencies to address uncertainty. This includes how state DOTs have been negatively and positively impacted by COVID-19, how they have recovered and adapted to this disruption and what additional measures they are envisioning to be better prepared to similar or different disruptions in the future. This will also include identification of the costs of the pandemic to these agencies, the gaps they have revealed in existing planning and decision-making processes, and the knowledge that has been discovered across a range of agencies. Part of the research efforts will include working with practitioners in a variety of contexts to develop contextually relevant definitions of resilience. The results of this study will help practitioners and academics to understand how best to prepare for unknown unknowns and other disruptions by managing risk and reducing vulnerabilities.