# ORAL PRESENTATIONS

## Stream 1: Connecting People

### Session 1.1: Safety Innovations

#### Ethical Dilemmas in Disaster Evacuation Network Planning: Concepts and Frameworks

*Junxiang Xu, University of NSW*

Ethical considerations in disaster evacuation network planning are used to ensure the effectiveness and equity of the strategy, as well as to increase public trust in the government and the emergency management system and to help develop a more scientific and humanitarian evacuation strategy. But what is ethical evacuation network planning? What are the current ethical dilemmas facing evacuation planning? Why is existing research more interested in equity, prioritisation, or humanitarianism than in directly analysing ethics? These are all issues that need to be addressed through our work, and another motivation for this study is to find possible ways of solving ethical dilemmas based on the existing literature analysis, to develop a framework for future ethical research, and to provide a basis for further expansion of ethical evacuation planning. The scope of this work allows for exploring all existing literature on RNDP, where screening for titles, abstracts, keywords, and main contents, a total of 155 relevant articles are preserved. Our main contributions in this study are threefold: (1) Examines ethical concepts and dilemmas in disaster evacuation planning, detailing key relationships of concepts and literature analysis. (2) Summarise and evaluate qualitative and quantitative research approaches on disaster evacuation ethics, highlighting their importance. (3) Identifies research gaps in disaster evacuation ethics research and proposes a framework to address these issues and guide future work.

#### Fatality Risk Curve for Road Head-on Crashes: A Systematic Review and Meta-Analysis

*Kardina Ayuningtyas, University of NSW*

Crossover, head-on crashes are one of the most dangerous types of road crash. These crashes typically occur on roads without median road safety barriers at higher speeds that exacerbate the risk of fatal injury. A previous report suggested a 10% probability of a fatality at an impact speed of 70 km/h; however, no data was used to support this relationship. The purpose of this study is to systematically review all published studies that report delta-V and fatality in a head on crash, and to synthesis this data in a meta-analysis. Thirty-nine studies were initially selected by systematic review, and only 3 studies reported sufficient data to be included in the meta-analysis. Study authors were contacted for the remaining 36 articles, with two providing data and the rest not providing data or responding to our emails. The studies originated from the United States, the United Kingdom, and Sweden, spanning crash years from 1969 to 2020. The results estimated the risk of fatality for head-on car/SUV into car/SUV crashes was 5% at 50.8 km/h, 10% at 60.6 km/h, 15% at 66.6 km/h, 50% at 89.3 km/h, 75% at 103.7 km/h, and 90% at 118.1 km/h. As delta-V increased by 1 km/h, the estimated odds of a fatality for the occupant (passenger or driver) increased by 8% (OR = 1.08, 95% CI: 1.07, 1.09).

#### A simulation platform to study motion planning for AVs in shared spaces

*Sam Andaryan, University of Sydney (ITLS)*

The integration of autonomous vehicles (AVs) into smart cities presents challenges in managing interactions between AVs, human-driven vehicles, and pedestrians, especially where their paths intersect. This study proposes a new motion planning algorithm based on the A* algorithm, which not only provides waypoints for the AV but also determines the vehicle's velocity at each time step. The algorithm ensures safe navigation around both stationary and moving obstacles by incorporating elliptical safety zones for collision avoidance. It accounts for obscured vision and defines a cone of responsibility for the AV, generating energy-efficient trajectories. The proposed method was evaluated across various scenarios involving moving obstacles in shared urban environments, demonstrating smooth trajectory guidance and successful collision avoidance.

**Lane-Free Autonomous Intersection Control with Dynamic Path and Conflict Avoidance**

*Alireza Soltani, The University of Sydney (TransportLab)*

This paper introduces a fully decentralized approach in a distributed system to manage autonomous vehicle (AV) navigation at intersections within a lane-free, communication-free environment. In this system, autonomous vehicles do not follow predefined paths. Instead, they dynamically adjust their trajectory and acceleration at every time step based on real-time sensor data and predictions of other vehicles' movements. By removing lane constraints, vehicles optimize the use of road space while adhering to road boundaries, effectively creating a more efficient traffic flow. The system's core principle is conflict avoidance at intersections, with vehicles positioning themselves to minimize potential conflicts while maintaining smooth movement. The algorithm prioritizes efficient space utilization, allowing vehicles to navigate dynamically and independently, adjusting both their paths and accelerations as they approach and traverse the intersection. This research builds upon the Communication-free Distributed Control Algorithm (CfDCA) method, expanding the scope to fully embrace the concept of lane-free traffic and providing a robust solution for autonomous vehicle interaction at intersections.

## Session 1.2: Transformative Technologies

**AI-Assisted Pedestrian Network Mapping: Enhancing Urban Mobility through Automated Computer Vision and Human Collaboration**

*Ahmad Emami, University of NSW*

The scarcity of accurate and up-to-date pedestrian network data poses a significant challenge in urban planning, especially given the growing importance of active transport infrastructure in promoting sustainable and accessible cities. Mapping pedestrian pathways is typically done manually, a labour-intensive and time-consuming process. To address these limitations, we are developing an AI-assisted approach that automates the mapping of pedestrian networks, significantly enhancing both scalability and precision. Our method leverages cutting-edge computer vision techniques to extract pedestrian networks from aerial imagery. Unlike existing approaches, our model learns graph patterns unique to urban environments, enabling it to predict network topology and fill in gaps within the mapped infrastructure. To support this, we are building a dedicated pedestrian network dataset that will serve as the foundation for training and validating our models. Furthermore, we are developing heuristic methods that inspect, validate, and identify any missing links, ensuring the accuracy and completeness of the final network. Beyond automated mapping, this research explores human-AI collaboration, where the AI system defers specific tasks to human mappers when faced with uncertainty, leading to greater accuracy and reliability. By combining AI's efficiency with human judgment, our approach offers a scalable, high-quality solution

to pedestrian network mapping,Äîa critical component in the development of active transport infrastructure that is essential for creating more walkable and livable cities. The research outcome is expected to contribute to initiatives like OpenStreetMap, enriching the global repository of open-source geographic data and supporting broader community-driven efforts to map pedestrian infrastructure.

**Autonomous vehicle control on lane-free roads: A level-k game approach**

*Zhaohan Wang, The University of Sydney (TransportLab)*

Autonomous vehicles (AVs) play a crucial role in understanding future traffic flow theory. We propose a decentralized control strategy for AVs in a lane-free traffic environment. We consider a pipeline highway setting with no ramps. The problem is formulated as a receding horizon optimal control problem (OCP) with nonlinear dynamics, costs, and constraints. The optimal controls are obtained by discretizing and solving the nonlinear OCP using the continuation/GMRES method. Level-k game theory is adopted to account for the strategic interactions between vehicles. The ego vehicle uses this recursive framework to predict opponents' states and actions, which are then used to optimize its own actions. The performance of the controller is tested through three simulated scenarios: one where the initial vehicles are sparsely located, one where they are more closely gathered, and one with an initially stopped vehicle. Results show that the proposed control framework is effective in controlling the vehicles to their desired states while avoiding collisions at all times.

**Designing Demand Responsive Transport for Environmental and Social Sustainability: A Systematic and Context-dependent Evaluation Approach**

*Chia-Jung (Robert) Yeh, University of Sydney (ITLS)*

Demand Responsive Transport (DRT) has been developed over half a century to promote social inclusion and address sustainability. Despite the high failure rate due to low ridership and unaffordable costs, there is a need to explore planning strategies to have a better understanding of DRT services. This research aims to develop an integrated approach to designing DRT from strategic to tactical perspectives. It will begin by clearly defining the success of DRT based on its service intention through an empirical review. After defining success, the research will identify the crucial success factors across various contexts. This enables the research to incorporate the key factors as indicators to evaluate the service performance through adaptive Data Envelopment Analysis (DEA). In addition to the performance assessment, from the tactical point of view, this research will apply the crucial factors to the process of planning and operating DRT services such that DRT can play a significant role in moving people. An agent-based modelling approach will be utilised to simulate and seek the optimal service layout in a certain area. By combining DRT performance evaluation and service optimisation, this research can serve as a decision-support system to identify the service area in priority and its service typology.

**RL-Based Online Updating of Anticipatory Routing in On-Demand Ridepooling**

*Xinyu (Ricardo) Wang, The University of Sydney (TransportLab)*

On-demand ridepooling systems, where passengers share vehicles, offer substantial efficiency benefits but face significant control challenges. Traditional models often decouple vehicle rebalancing from routing and assignment decisions, limiting system performance. Recent

approaches, such as Fielbaum et al.,Äôs reward-based method (2021), optimize vehicle assignments toward high-demand areas, reducing rejection rates.
This study introduces a novel reinforcement learning (RL) framework that dynamically updates routing and rebalancing decisions by adjusting the key system parameter, theta, which influences vehicle assignments. A larger theta directs vehicles toward imbalanced areas, potentially increasing user costs. To capture the geometric structure of the system state, we employ a Graph Neural Network (GNN) for state encoding, incorporating key features such as idle and active vehicle counts, request dynamics, rejection rates, and theta values from prior iterations.
The RL agent, using the Twin Delayed Deep Deterministic Policy Gradient (TD3) algorithm, is trained to minimize rejection rates while controlling user costs, achieving a dynamic balance between supply and demand. Results show that the proposed RL-based model significantly reduces rejection rates compared to fixed or zero-theta approaches, improving overall system efficiency in real-time. This work presents a promising direction for enhancing the performance of on-demand ridepooling systems through anticipatory, RL-driven routing strategies.

## Session 1.3: Autonomous Technologies

### An Investigation into How Autonomous Vehicles Change Travel and Activity Behaviour Among Transport Disadvantaged People

*Arkar Than Win, University of Sydney (ITLS)*

Autonomous vehicles (AVs) represent a significant advancement in transportation technology, capable of independently and self-sufficiently performing all driving functions in any environment. Fully AVs could improve accessibility of transport-disadvantaged individuals including the elderly, the disabled, and other non-drivers (Martens et al., 2022; Milakis & van Wee, 2019). To what extent transport disadvantaged people accept autonomous technology and if so, how they might change their travel behaviour is a question that remains largely unanswered. This research aims to investigate the potential change in the travel and activity frequency of transport-disadvantaged individuals due to AVs.
Previous studies (Harper et al., 2016; Truong et al., 2017; Wadud et al., 2016) have estimated the impact of AVs on travel and activity patterns of transport-disadvantaged populations. These studies have generally assumed that AVs will mitigate barriers caused by old age and disability, predicting that these elderly and disabled individuals will travel as much as their younger and non-disabled counterparts. However, two critical gaps exist in the current research. First, socio-economic factors such as education, income, and employment status have not been adequately controlled for, potentially compromising the research credibility. Second, existing research has often overlooked the perceptions of transport-disadvantaged individuals regarding the practical utility of AVs, which could provide valuable insights into the actual acceptance and effectiveness of AVs. To address these gaps, this study will employ a propensity matching score analysis using data from the Sydney Household Travel Survey, complemented by qualitative insights gathered from focus group discussions in Greater Sydney with transport-disadvantaged individuals.

### Does a dense reinforcement learning approach with safety guarantees truly generate socially acceptable behavior in distributed autonomous vehicles?

*Ruihao Zeng, The University of Sydney (TransportLab)*

Developing a safe and trustworthy autonomous driving strategy remains a significant challenge and a prerequisite for successfully deploying algorithms in the autonomous driving field. Various reinforcement learning approaches are frequently used to shape the driving behavior of

autonomous vehicles due to their potential to enhance training safety and improve sampling efficiency. The core of these methods is to impose safety constraints on the agent, ensuring it avoids actions that could endanger its own safety while following traffic rules and coexisting harmoniously with different types of agents on the road.

Driving, as a complex human behavior, involves not only explicit, written rules but also numerous unwritten conventions that rely on drivers,Äô accumulated experience. These conventions are crucial for maintaining order and efficiency in urban traffic. However, in learning-based approaches, can numerically defined safety constraints truly guarantee that these distributed agents demonstrate socially acceptable behavior?

In this study, we simulate an urban, lane-free, unsignalized intersection to assess the social driving behavior of individual autonomous vehicles. All vehicles are unconnected, and dense reinforcement learning is employed to train them, with safety driving rules defined through reward functions. After training, we analyze whether those distributed agents, while navigating safely through the intersection and reaching their designated destinations, affect the normal driving patterns of surrounding vehicles. Specifically, whether their jerky actions, such as sudden or erratic maneuvers, negatively impact the driving efficiency or even the safety of nearby vehicles.

**IncidentResponseGPT: Generating Traffic Incident Response Plans with Generative Artificial Intelligence**

*Arthur Grigorev, University of Technology Sydney*

Urban traffic congestion caused by road incidents leads to increased travel times, pollution, and economic losses. Traditional traffic management systems often face challenges in responding fast and efficiently due to the high complexity of urban networks and diverse incident types. This paper introduces IncidentResponseGPT, a generative AI framework that rapidly generates adaptable and informed traffic incident response plans. By integrating real-time incident reports with region-specific guidelines, the system suggests actions such as dynamic lane closures, optimized rerouting strategies, and dispatching appropriate emergency resources. It employs the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) to rank response plans based on impact minimization and resource efficiency. This approach expedites decision-making for traffic management authorities, reducing incident resolution times and minimizing the overall impact on urban traffic networks. By integrating generative AI capabilities into intelligent transport systems, our proposed framework aims to reduce congestion and enhance urban mobility.

**Investigating Platoon Formation and Retention Using Reduced-Scale Mobile Robots with Established Car-Following Models**

*Zhuopeng Xie, The University of Sydney (TransportLab)*

This research investigates platoon formation and retention in various traffic conditions using five well-known car-following models implemented on reduced-scale mobile robots (RSMRs). Our study moves beyond traditional simulations by directly applying these models in a controlled physical environment to observe and measure the dynamic interactions within a platoon of RSMRs. The models tested include the Gazis,ÄìHerman,ÄìRothery (GHR) model, Gipps model, optimal velocity model (OVM), intelligent driver model (IDM), and adaptive cruise control (ACC) model. Experiments were designed to assess model performance across free-flow, congested, and stop-and-go traffic conditions. Findings indicate that the IDM consistently maintains efficient and safe platoon operations across all conditions, characterized by the shortest maximum following distance, the

largest minimum time headway, the least speed fluctuations, and a quick response. The results also demonstrate a noticeable difference between the outcomes of physical and simulation experiments, highlighting the necessity to investigate platoon formation and retention in the physical environment, and confirming the usefulness of RSMRs in such research.

## Stream 2: Connecting Places

### Session 2.1: Active Transport

#### Contextual behaviour into Active Transport Infrastructure

*Sara Haider, University of Sydney (ITLS)*

Active travel, including walking and cycling, supports healthy, sustainable, and equitable societies. Despite investments in active transport infrastructure in car-centric nations like Australia, car usage remains dominant. This research examines the influence of utilitarian (practical), psychological, and social factors on active travel behaviour. By synthesizing secondary data, conducting a state-wide survey in New South Wales, and an immersive virtual reality experiment, the research aims to develop a framework for designing place-based active transport infrastructure. Factoring in demographic and location contexts, the framework will guide investments into infrastructure that supports the greatest uptake in active travel, fostering healthier and more sustainable communities.

#### The impact of the built environment on active travel to school

*Laya Hossein Rashidi, The University of Sydney (TransportLab)*

My PhD research addresses active transport to school (ATS) and its built environment determinants through the '6Ds' framework,Äî density, diversity, design, distance, destination accessibility, and demand management. Using data from the 2015 School Physical Activity and Nutrition Survey (SPANS) and enriched environmental data, I examine the factors shaping students' transportation choices, with a focus on promoting ATS.
In the initial phase, I employed a logistic regression model to analyse active travel patterns and assess the elasticity of active mode choice concerning distance. The findings revealed that elasticity varies by age, gender, school sector, and land-use types, with even small increases in distance around the 2-3km range significantly deterring ATS. In the second phase, I investigated the impact of Omitted Variable Bias by excluding specific 'D' categories from transport models, finding that this led to variations in predicted daily active distance benefits of up to 16% compared to the fully specified model, highlighting the importance of comprehensive model specification for accurate policy advice.
To support this research, I estimated travel distances using reported travel times across modes, trained XGBoost and bivariate regression models using data from the Google Distance Matrix API and validated the result alongside a fixed-speed model. While the models predicted walking distances effectively, predicting distances from automobile and transit trips proved more challenging. This study concludes that distance estimation accuracy greatly impacts travel behaviour research and policy assessments. In the final

phase, I will analyse how attitudes and lifestyle factors influence students' mode choices using models based on the latent variable concept.

**Understanding Walkability Perception: Resolving Street View Imagery Biases for Inclusive Metrics**

*Moloud Damandeh, University of New South Wales*

Urban environments are visually diverse, and these visual characteristics shape how people perceive and interact with their surroundings. Despite significant advancements in understanding and measuring visual walkability perception, significant gaps remain. Recent studies have utilised street view imagery and computer vision techniques, alongside crowdsourced data, to analyse urban visual perception. However, street view imagery, which serves as the primary data source in many recent studies, may introduce biases in evaluating human perception, as it does not accurately represent the true pedestrian perspective. Another major challenge in measuring walkability indices is the diverse range of human experiences, which limits the applicability of these indices across different population groups. This research examines the biases and inaccuracies associated with using street view imagery for walkability measurements. Our study utilises semantic segmentation, fine-tuned on sidewalk view images, to demonstrate how residents of urban, suburban, and regional areas encounter different proportions of features that affect walkability. Preliminary findings reveal significant variations in the visual elements across these environments, resulting in diverse walking experiences and expectations. This supports the hypothesis that a single walkability index may not be universally applicable to all population groups. In our future work, multiple surveys will be conducted to examine the biases in human perception resulting from the use of street view images compared to sidewalk view images, and to explore how perceptions vary across different groups. These insights will contribute to developing a more accurate and inclusive walkability index.

**Developing a transport equity-based decision support system to evaluate active travel initiatives**

*Ashikur Rahman, University of Sydney (ITLS)*

Active transport, despite having an established positive impact on health and well-being, is often subject to being the most vulnerable mode of transport. Pedestrians, bicyclists, and other active travellers typically encounter the highest exposure to air and noise pollution, crash risks, harsh outdoor weather, uneven topography etc. In addition, active travel initiatives, whether in the form of social and behavioural intervention or infrastructure development, essentially create a divide in the population at different scales by making the target group privileged and the non-target group deprived. Although transport equity researchers tend to assess the benefits and costs of active travel primarily from an accessibility point-of-view and secondly from a health perspective, other crucial elements such as affordability or safety may notably contribute towards the comprehensive understanding of active transport equity. Besides, as active travel is solely a human-powered means of transport, people’s subjective perceptions towards the provision of existing and proposed active transport facilities have a critical role in scrutinising the

(in)efficacy of any intervention. This research advances with a vision of how active travel could become more equitable to all, with the principal objectives of exploring the key components and distribution principles of active transport equity, and how a more inclusive equity assessment framework could be derived through a proposed, visual-programming-language based decision-support-system that can accommodate these components, principles, and processes in a more transparent, justifiable, and communicable way. The research relies on a systematic literature review, structural equation modelling, and advanced GIS to attain the research objectives.

## Session 2.2: Transport Policy

### Designing a Comprehensive Survey Structure with an Innovative Stated Preference Time-Use Survey to Estimate Components of Value of Travel Time Saving

*Maliheh Tabasi, University of NSW*

Understanding the components of the value of travel time saving (VTTS) is crucial for making well-informed decisions about infrastructure investments and service pricing. However, obtaining the necessary revealed preference (RP) data for such estimations is challenging, both in terms of cost and the high response burden on participants. This study introduces a survey structure that includes an innovative stated preference (SP) time-use and expenditure survey, capable of providing the data required for estimating the components of VTTS. To achieve this, the classical random utility maximisation framework and the econometric consumer theory-based time-use modelling need to be brought closer to one another and considered in the survey design process. Our survey imposes a considerably lower response burden on participants compared to current RP time-use and expenditure data collection methods, and it is more cost-effective. The findings confirm that our designed survey structure effectively captures individuals' time-use behaviour and provides the necessary data for estimating the components of VTTS. Moreover, the innovative SP time-use and expenditure survey can serve as a complementary source of data to understand individuals' time-use preferences. This data might also help adjust RP time-use and expenditure data, as well as the value of leisure estimated based on RP data.

### Access-based cost-benefit analysis

*Isaac Mann, The University of Sydney (TransportLab)*

Current methods of cost-benefit analysis (CBA) for transport investments rely on travel-time savings for potential users. This approach presents a consistent and significant historical trend of forecast inaccuracy, and thus has been questioned and criticized. Access, or the ease of reaching valued destinations, can be used as an alternative. Access features a strong correlation with land value which can be measured through hedonic analysis, and subsequently, access gains offered by a transport initiative can be monetised via property uplift. We test this hypothesis and evaluate Sydney's South West Metro Link (SWML).

We first develop linear and semi-log ordinary least square hedonic pricing models for house sales in the Sydney region. The models are set up with structural and neighbourhood attributes in addition to access measures, and result in a statistically significant fit.

Next, we model changes to job access induced by the SWML. Benefits are then quantified by land value uplift and are estimated at $1.87 Billion in 2031 and between $1.53–$3.08 Billion in 2061, which reflect base and transit-oriented development (TOD) scenarios. The project is thus feasible should certain land use and economic conditions be met, including TOD to occur about station localities by 2061 and if project costs are minimal. Although limitations are noted, access-based CBA exhibits significant promise as an alternative approach to appraisal and has direct application in value capture strategy.

**Parking Policy for Transit-Oriented Development**

*Kendall Banfield, University of Sydney (ITLS)*

The New South Wales (NSW) Government is seeking to improve housing affordability by increasing housing supply in areas with ready access to public transport and services. A number of transit-oriented development (TOD) precincts have been identified across Sydney that will accommodate additional housing. Good practice parking policy has a critical role to play in creating affordable, functional and sustainable TOD precincts, but to date there has been little in the way of informed dialogue on what is good practice. This presentation examines parking policy and management nationally and internationally to define good practice. It outlines how this could be applied to five TOD precincts in Sydney,Äôs Inner West: Marrickville, Dulwich Hill, Ashfield, Croydon & Bays West. Whilst focusing on the relationship between parking policy and housing affordability, the presentation also outlines the full range of benefits that would flow from good practice.

**Incorporation of Machine Learning to Mitigate Conflicts Among Ethical Paradigms in Active Network Design**

*Mehrdad Memarpour, University of New South Wales*

During recent decades, a paradigm shift toward sustainable environment has led transport planners to develop micro-mobility and active mode infrastructures to improve the sustainability of the transport networks. One critical issue in designing active networks is its safety. While based on utilitarian ethical rules it is crucial to have the minimum possible number of accidents on a network, the distribution of safety risks among users is also critical from an egalitarian point of view. In this study, we aim to address the potential conflicts between these ethical principles with respect to safety risk. To this end, we develop a mixed-integer non-linear bilevel optimization model to account for a planner's set of actions regarding the safety of an active network as well as users' travel behaviour in choosing their mode of travel. The planner aims to minimise the Gini index of accident numbers throughout the network, by either imposing speed limit or developing bike lanes, while keeping the absolute number within a specified level. A new approach based on a machine-learning (ML) model is developed to solve the model through training it with a combination of easy-to-implement policies to obtain well-performing solutions. The training outcomes suggest that the Gini effect of bike lane development is higher. Also, the primary results and subsequent sensitivity analysis show the superiority of the ML method in determining effective interventions to improve the fairness of safety risks while maintaining the total safety risk at a desirable level.

## Session 2.3: Sustainable Transport

**The Influence of Recycled-Rubber Energy Absorbing Grids (REAG) on Railway Ballast Performance: A Review**

*Suwan Hettiyahandi, University of Technology Sydney*

Domestic freight transportation in Australia has grown approximately tenfold over the past fifty years, accompanied by a significant increase in construction and maintenance activities in the railway sector. Consequently, it is crucial to upgrade materials and techniques to meet the rising demands effectively. This study examines the use of recycled rubber inclusions, specifically Recycled-Rubber Energy Absorbing Grids (REAG), which are derived from end-of-life rubber conveyor belts from the mining industry, as a potential solution to reduce track damage. A comparative analysis of traditional polymer geogrids, Under Ballast Mats, and rubber grids will be conducted, focusing on their effectiveness in reducing track deformation and ballast breakage. The study will highlight the additional advantages of using rubber, such as enhanced resiliency, improved damping properties, and better interlocking with granular particles.

**Sustainable Use of Recycled Crushed Glass for Soft Railway Subgrade Improvement**

*Isabella Novais Silva, University of Technology Sydney*

In recent decades the volume, speed, and axle load of railway traffic has grown significantly worldwide. In Australia, the expansion of the rail network faces challenges due to soft soil deposits along coastal lines where most railways are constructed. These soft subgrade soils compromise track performance and often require stabilisation to withstand the substantial loads emanating from moving trains and to ensure long-term track safety. The use of recycled crushed glass (CG) for soil stabilisation offers a promising and sustainable approach to enhancing the geotechnical properties of soft subgrades while reducing the amount of glass waste diverted to landfills. This study presents a comprehensive experimental investigation into the geotechnical properties and monotonic shear behaviour of soft subgrade soil mixed with varying percentages of CG by dry weight, ranging from 10% to 50%. The results demonstrate that CG significantly enhances the geotechnical performance of soft subgrades, particularly in terms of compaction, stiffness, compressibility, and shear strength. Notably, the addition of 20% CG led to an optimal soil-CG interaction where the coarse particles formed a more interconnected skeleton within the soil matrix. This skeleton provided more efficient load transfer paths, greatly increasing the stiffness and reducing the elastic modulus degradation. These findings suggest that incorporating 20% CG into soft subgrades would substantially enhance soil performance, particularly in terms of its shear strength and stiffness.

**Green Liner and Feeder Shipping Network Design**

*Jzolanda Burhani, University of Sydney (ITLS)*

Container liner shipping is the backbone of international trade. In 2019, a total of 152 million twenty-foot equivalent units (TEU) were shipped around the world on 5,200 container ships. Liner shipping is one of the most energy-efficient forms of transportation; however, the newer mega-vessels still emit 3 grammes of CO2 per kilometre and a tonne of cargo transported. Due to the industry's size, maritime transportation's global environmental impact is still significant. In 2017, shipping consumed around 3.5 million barrels of bunker daily, which was half of the global fuel oil demand. According to the fourth International Maritime Organisation (IMO) greenhouse gas (GHG) study, GHG emissions from shipping in 2018 were 1.076 million metric tonnes, which corresponds to around 2.89% of the global emissions. In response, the IMO adopted a new GHG policy at MEPC 80 with a goal of net zero emissions by 2050. For the sector to attain this aim and become carbon neutral, as many national governments demand, freight rates must reduce (although from extremely high levels). New liner shipping business models and ship and navigation technology like weather routeing, air lubrication, and wind assistance are all part of this progression. This method optimises operations using analytical tools. This study aims to develop a model to help optimise the design of

liner and feeder networks to assist in decarbonising the shipping sector by considering climate change, the transition to carbon-neutral fuels, alternative fuel supply chains, and more energy-efficient ship designs.

**Carbon communication in the airline sector and its potential impact on decarbonisation and improving consumer trust**

*David Li, University of Sydney (ITLS)*

This study aims to investigate the risk in airline sector,Äôs existing decarbonisation strategy and argues the importance of the role carbon offsets will play in reaching the sector,Äôs decarbonisation targets.
The research encompasses a literature review, a proposed carbon communication framework that integrates existing airline decarbonisation strategies into the context of carbon supply chain transparency. Based on this framework, it develops a hypothesis that improved carbon communication transparency can increase the adoption of carbon offsets, help deliver imminent carbon reductions, and improve consumer trust. A discrete choice experiment using real-world data was conducted. The results indicate various levels of willingness-to-pay (WTP) for the attributes tested. This study compliments existing literature in better understanding carbon offsets, especially in relations to sustainable aviation fuel (SAF) development and its cost impacts, and have the potential to help the airline sector improve its decarbonisation outcomes.

## Stream 3: Connecting the Economy

### Session 3.1: Urban and Rail Traffic Management

**Stability of railway tracks built on jointed rock subgrade**

*Majid Jazebi, University of Technology Sydney*

In several areas along the eastern coast of NSW, railways are built on coastal cliffs with highly jointed rock. Over time, these joints can weaken due to the repeated passage of heavy haul trains, leading to two major issues: instability of the rock joints and deformation of the track, which can potentially cause train derailments. To prevent unsafe designs, reduce maintenance costs, and extend the lifespan of railways built on fractured sandstone or limestone, it,Äôs crucial to understand how joint conditions and train loads impact track stability. A new cyclic shear behavior model is developed, which can adjust shear strength and stiffness to account for joint degradation and scale effects. This model is then incorporated into FLAC 3D to assess the stability of railways built on jointed rock formations near cliffs. In addition to evaluating rock joint stability, track deformations under heavy-haul railway loads will be analyzed based on three factors: longitudinal differential settlement, lateral alignment, and cross level, while providing implications to design.

**Safe-Efficient Urban Corridor Control using Model Predictive Control**

*Hamidreza Babaeighazvini, The University of Sydney (TransportLab)*

Urban congestion and intersection incidents pose significant economic and safety challenges, costing billions annually and impacting road users. This paper proposes a hierarchical approach to reduce traffic congestion and increase safety in urban corridors. The top layer of the approach,Äîthe multi-intersection coordination layer,Äîuses a Model Predictive Control (MPC) strategy to minimize and

balance link queues, reducing the risk of spillback. In this method, both the prediction model and traffic flow process are modelled using the store-and-forward approach. Predictions generated by the model are used in an optimization problem to determine the green time duration of each phase for both current and future intervals. Based on the receding horizon principle, only the first element of the control vector is applied, and the optimization problem is resolved using updated information. The lower layer,Äîthe individual intersection control layer,Äîselects the signal timing at each signalised intersection to achieve two goals: minimising the tracking error related to the desired link outflows determined by the top layer and reducing safety risks for all urban transport modes. Simulation results using an AIMSUN model of the Nicholson arterial network in Melbourne, including a wide variety of junction layouts (100 control inputs and 100 traffic flow stages), demonstrate the efficiency of the proposed approach when compared with traffic strategies based on fixed-time control.

**Using Pre-Signals to Reduce Start-Up Lost Time at Intersections**

*Tingsen Xian, The University of Sydney (TransportLab)*

Traffic lights experience significant efficiency losses during start-up and clearance/end lost times. Pre-signals have previously been used to provide transit signal priority by allowing buses to skip the traffic queue or to improve intersection efficiency by pre-sorting traffic to maximize lane use during green time. This study uses Aimsun simulation to investigate the implementation of pre-signals, positioned approximately 50 meters upstream from the main intersection, to reduce start-up lost time. The pre-signal turns green before the main signal, allowing vehicles to pre-accelerate before reaching the main intersection signal. This approach enables an additional 2-3 vehicles per lane to cross the intersection at the beginning of each green phase. Our findings indicate that applying pre-signals can significantly improve intersection efficiency, though there are safety concerns regarding increased approaching speeds. With no major geometry changes required, the pre-signal can reduce traffic congestion at a relatively low cost.

**A Decentralised Agent-Based Model to Adapt to Disturbances in Rail Systems**

*Kevin Malysiak, University of Wollongong*

This research focuses on the application of intelligent, agent-based, adaptive approaches to address delays in transport services in the presence of multiple, overlapping service disturbances. The objective is to develop efficient, effective and cooperative approaches to adaptive rescheduling in a decentralised context in which agents representing transport entities take actions to reduce the impact of disturbances.

Agent-based solutions of various architectures have been increasingly been applied to this problem. While approaches have varied, a common aspect is deference to central and or regional decision-making centres. Agent-based solutions of various architectures have been increasingly been applied to this problem. While approaches have varied, a common aspect is deference to central and or regional decision-making centres. The model presented is fully decentralised in terms of decision-making. Central or regional control structures are avoided.

Agents are modelled to represent the key entities, being trains and stations, and exhibit proactive and reactive behaviours in to response delays. This approach provides a scalable framework within which to study and solve problems in uncertain, dynamic environments such as real-world public transport systems.

Schedule disturbances are introduced into the model as delays at given times and locations. Such schedule disturbances necessarily require trains to alter their speed and travel times. Train and station agents cooperate to deal with resource contention to facilitate the completion of journeys. Experimental work has focused on passenger travel on a segment of the South Coast line. This presentation describes the current model and early results.

## Session 3.2: Freight and Infrastructure

### A national level CGE model for freighting infrastructure policy planning

*Jason Wang, University of NSW*

Infrastructure investments are being undertaken to improve efficiency, economic activity, and growth. Therefore, policy makers are increasingly looking for modelling tools that can evaluate the impact of transport infrastructure on the economy, firms and households from the lens of economic activity and equity. We have developed a large scale national CGE model for India that is calibrated to economic data as well as validated to data observed from the Indian Railways. The novelty of the work lies in two main areas (1) The CGE model incorporates multi-modal freight transport with road and rail (2) Validation of the CGE model. A case study of a dedicated rail corridor (DFC) upgrade in Western India shows the CGE model was able to predict the tonnage freighted to within 3.9,ÄØ% accuracy. Said DFC also contributes a 2.94,ÄØ% increase in the revenue for the railways, as well as a 0.08,ÄØ% increase to India,Äôs 2019 GDP (equivalent to INR 160 billion; 2 billion AUD). The CGE model distributed the benefits of faster and cheaper alternatives to the entire economy. This was observed during the evaluation of the road projects that were found to improve GDP, household welfare and rail revenue for rail, as well as improved equity.

### Market effect on liner shipping alliances, formation and dissolution

*Mosleh Amiri, University of Sydney (ITLS)*

Market demand has a notable impact on the extent of collaboration among the liner shipping companies. By employing evolutionary game theory, this study explores the relationship between market demand and the liner companies, choice of collaboration mechanism and the emergence of alliances, which is affected by the profitability of the companies in various market conditions. Since collaboration is a joint effort and requires coordination among several companies that are also competitors, market collaboration dynamics gradually change according to the market demand until it reaches stability. Collaboration among liner companies intensifies with increasing market demand. In high market demand, liner companies benefit from both high prices and reduced cost. High enough demand ensures convergence to cooperation in the market, in the forms of temporary collaboration or strategic alliances. On the other hand, in lower market demand, the choice of collaboration mechanism depends on parameters that can vary across different firms and markets. Key features regarding the demand that determine market collaboration dynamics include demand capacity, demand fluctuations over time, and the average demand level in the market.

### Application of Pile - Prefabricated Vertical Drains (PVD) to improve soft soil beneath transport embankment

*Sachini Dissanayake, University of Technology, Sydney*

In Australia, many coastal areas are underlain by soft clay deposits, which present significant challenges for transportation infrastructure due to their high compressibility, low permeability, and

reduced bearing capacity. To ensure stable and durable transport embankments capable of withstanding both static and dynamic loads, ground improvement is essential. This research focuses on stabilizing these soft subgrades using pile foundations in combination with Prefabricated Vertical Drains (PVDs). PVDs help mitigate negative skin friction on piles by pre-consolidating the soil and dissipating excess pore water pressure caused by piling and applied loads. This combined technique offers a more efficient solution than using piles alone and will be tested under cyclic loading to replicate realistic field conditions.
The study includes an analytical approach to account for smear effects from both the pile and PVDs, utilizing a varying permeability method within the smear zone. A numerical model will simulate the cyclic behaviour of soft clay and determine the optimal pile-to-PVD length ratio to minimize negative skin friction. The model's effectiveness will be validated through experimental analysis using a Large-Scale consolidation Apparatus, examining the influence of cyclic loading with and without PVD assistance. This research aims to provide a more effective and economical method for improving soft subgrades in coastal regions, enhancing the long-term performance of transportation infrastructure.

**Transitioning Coal Ports to Circular Economy Precincts: A Case Study of the Port of Newcastle**

*Veronica Schulz, University of Sydney (ITLS)*

The global transition from traditional coal-based economies to sustainable circular ecosystems is both an imperative environmental challenge and a strategic economic opportunity. This study focuses on diversifying the Port of Newcastle, the world,Äôs largest coal port, which is at risk of becoming a stranded asset if diversification is not achieved. This research explores strategies for diversifying the port,Äôs economic base through the development of circular economy precinct. Such precincts leverage the principles of industrial symbiosis, where waste and by-products from one process become valuable inputs for another, enhancing the overall efficiency and sustainability across the precinct.
This research uses system dynamics to model the economic feasibility and outcomes of a circular economy precinct, with processes such as sustainable ship recycling, biofuel production, and green steel production, at the Port of Newcastle. System dynamics is chosen for its capability to analyse complex, dynamic systems with feedback loops, making it suitable for modelling synergistic relationships between circular economy activities. The model, developed using PowerSim software, integrates data on material flows and economic factors to simulate the potential benefits. Establishing a circular economy precinct at the port aligns with broader regional and national goals of economic diversification and decarbonisation, by creating new jobs, stimulating local innovation, and enhancing the port,Äôs competitiveness in a rapidly evolving global market. By fostering a closed-loop industrial ecosystem, the port can serve as a model for sustainable industrial development, illustrating how traditional fossil fuel-based industries can reinvent themselves to meet contemporary environmental challenges.

## Session 3.3: Future Logistics

**Virtual parking locations for micromobility sharing systems**

*Elnaz Emami, The University of Sydney (TransportLab)*

One of the most critical aspects of bike sharing systems is the location of parking. Dockless bike sharing systems allow users to park bikes anywhere, introducing challenges for operators, users, and non-users alike. Bikes parked on pathways can obstruct pedestrians, while bikes parked in hard-to-access areas pose difficulties for users attempting to retrieve them. For operators, bikes in inaccessible locations tend to remain idle for longer periods, reducing profitability and increasing the

risk of damage. Conversely, docked bike-sharing systems require users to pick up and return bikes to designated stations, leading to longer walking distances and higher maintenance costs for operators.,ÄØThis study introduces a virtual parking (v-parking) strategy to address these challenges. V-parking are kind of parking without any lockers or fence. The location of each v-parking is dynamically determined and introduced to users upon bike pickups. The objective is to minimize the total distance each user walks to his/her destination and maximize the grouping of bike, while respecting regional capacity constraints.

**Optimizing EMS Dispatch with Agent-Based Simulation: A Focus on Vehicle and Incident Prioritisation**

*Changle Song, The University of Sydney (TransportLab)*

Effective allocation of ambulance resources is critical in Emergency Medical Services (EMS) as it directly impacts patient outcomes. This study explores optimal dispatch policies for ambulance deployment with a focus on whether specialised ambulances, designed for specific incident types, should be allocated to other emergencies when they are available. An agent-based simulation model is employed, incorporating multiple vehicle types, varying patient demands and distinct phases of emergency response, to assess these dispatch policies. The findings reveal that patient survival rate is sensitive to the dispatch policy, the proportion of specialised vehicles in the fleet and the frequency of incidents requiring specialised care. The agent based simulation is a flexible framework for evaluating EMS that can be adapted to geographical regions, providing a robust tool for evaluating the potential benefits of emergency fleet management decisions.

**Optimising Urban Mobility: An Agent-Based Model for MaaS and Multimodal Transport Solutions**

*Ruiyi Zhao, University of New South Wales*

This study presents an advanced and versatile Agent-Based Model (ABM) designed to compare Mobility as a Service (MaaS) with traditional car share, bike share, and public transport systems. The ABM incorporates powerful algorithms, such as Dijkstra for single-mode trips and RAPTOR for optimizing public transport routes, allowing commuters to make real-time, efficient travel decisions. The model uses utility functions and logit models to simulate commuter behaviour, enabling agents to select the best transport options based on price, travel time, and accessibility.

By simulating multimodal travel and analysing MaaS bundles,Äîsuch as combining public transport with car or bike shares for first and last-mile solutions,Äîthe ABM explores strategies for reducing reliance on private vehicle ownership. It offers insights into how MaaS can address equity issues, ensuring even those with low value of time (VOT) or no access to a car can still use car-sharing for parts of their journey. This helps low-income individuals avoid inefficient modes like walking and provides more equitable access to faster options.

Additionally, the model evaluates policy interventions aimed at promoting shared mobility, reducing private car usage, and encouraging MaaS adoption. Through flexible control parameters, it enables the analysis of urban mobility policies, examining how to optimise transport systems, reduce congestion, and improve equity. This ABM serves as a powerful tool for analysing the far-reaching effects of transport policies, helping cities transition toward reduced dependency on private vehicles and fostering more sustainable, equitable urban mobility solutions.

**Up in the Air: How Drones are Taking Warehouses and Last-Mile Delivery to New Heights**

*Mujtaba Hussain, University of Sydney (ITLS)*

Drone technology represents a fundamental change in warehouse operations and last-mile delivery. The present work focuses on evaluating the financial impact as well as the cost trade-offs of drone technology in a fourth-party logistics framework. The work concentrates on the highest potential use cases of drones within a warehouse as well as in the last-mile delivery. There is a potential for a drastic decrease in operational cost if most of the mundane tasks are automated using drone technology. However, a limited understanding of operational improvements offered by drone technology continues to be a barrier. The interactive nature of drones with other technologies including RFID readers and Warehouse Management System (WMS) is leading to technology convergence and this would help warehouses to make smart decisions based on data analytics. However, the current literature shows that most studies on drones within warehouses and last-mile delivery focus on technical limitations and developing logistics optimization algorithms rather than the impacts of drones on economic and productivity outcomes. The proposed research aims to evaluate current practices, identify the gaps, and provide cost-effective solutions to all the potential businesses that are looking to adopt drone technology. The integration of drone operations at the warehouse/last-mile delivery interface has the potential to significantly reduce cost and hence improve the efficiency and competitiveness of supply chain. The research further aims to investigate whether it is commercially viable to deliver via drone and how this would affect the logistics ecosystem.

# POSTER PRESENTATION

**P1. Chance-Constrained Programming for Electric Cargo Bike Route Planning: Incorporating Rider Fatigue**

*Zahra Nourmohammdi, University of NSW*

Electric cargo (e-cargo) bikes are increasingly adopted for last-mile logistics due to their sustainability and efficiency. However, existing models often overlook the critical factors of rider fatigue and environmental conditions, such as ambient temperature, that can significantly impact delivery efficiency. This study introduces a comprehensive load-dependent heterogeneous vehicle routing problem with time windows (LDHVRPTW) model, which uniquely incorporates rider fatigue and varying ambient temperatures into the energy consumption calculations for e-cargo bikes. Our approach includes a novel energy consumption model that accounts for both the rider and the bike's energy expenditure, considering factors such as load, street gradient, and rider characteristics (weight, age, etc.). We utilize a Grey Wolf Optimizer (GWO) algorithm to solve the LDHVRPTW and conduct a detailed numerical analysis. The results demonstrate that our model can reduce energy consumption by up to 16.63% and improve rider well-being by retaining 49.64% more energy at the end of shifts, compared to traditional routing models. This work provides valuable insights for optimizing fleet management in sustainable urban logistics, highlighting the importance of considering human factors and environmental conditions in route planning.

**P2. Integrated network perimeter and corridor control based on MFD**

*Shuyan Jiang, The University of Sydney (TransportLab)*

The Perimeter Control (PC) method based on the Macroscopic Fundamental Diagram (MFD) can dynamically adjust the green time of intersections by optimizing the boundary in and out flows. However, when the congestion of the road network shows heterogeneity, it is difficult to achieve the full effectiveness of the perimeter control. When traffic congestion occurs, congestion within the region often transfers and spreads in a corridor-like manner. Therefore, while applying the perimeter control, the heterogeneous corridors should be identified, and the signal control scheme should be optimized in real-time, which can reduce the overall congestion and homogenize the road network. An automated corridor identification algorithm based on link density is proposed. We propose a two-layer integrated signal control method to improve the overall homogeneity of the road network and the operation efficiency. The upper control level is based on the model predictive control approach and the lower control level is the corridor control algorithm for the cooperative optimization of the common signal cycle, phase sequence, green time, and offset.

**P3. A Cross-Cultural Study on the Risky Behaviors of E-bike Food Delivery Riders in China and Australia**

*Wanlin Liu, University of NSW*

Food Delivery services have gradually become a daily routine for people all over the world, with delivery drivers serving as the bridge to construct this convenient service. Many delivery drivers ride electric bikes, navigating through streets and alleys, and their safety during travel has become a challenging issue. This study aims to identify and compare different risky behaviors during food

delivery influenced by cultural factors between China and Australia. This study expects to make a horizontal comparison of the risky behaviors of e-bike delivery riders in different cultural backgrounds. Conducting a combined study involving both countries is beneficial for road safety and for reducing the accident rates in the electric bicycle and food delivery industries. This study aims to investigate the influence of different electric bicycle riding rates on the engagement of delivery personnel in risky behaviors during deliveries, as well as the relationships between rider characteristics, work pressure, riding environment, and risky behaviors. A comparison and mutual validation of data from three aspects,Äîactual risky behaviors of delivery personnel, self-reported behaviors, and voluntary online comments,Äîwill be conducted. This research will employ observation, surveys and content analysis to analyze electric bike delivery drivers, exploring the factors that influence their engagement in risky behaviors at work. This research can contribute to understanding the current safety status of electric bike delivery drivers in China, Australia and even other countries. This study aims to elucidate the prevalence of risky behaviors among Australian food delivery riders and to uncover the factors influencing the engagement of Australian and Chinese e-bike delivery riders in risky behaviors.

**P4. Spectral-based solutions for novel infrastructure designs: consolidation analysis of multilayered soil under variable drainage conditions**

*Binhua Xu, University of Technology Sydney*

The consolidation and settlement of soft soil layers present significant challenges for geotechnical engineers, particularly in transportation infrastructure. Precise settlement prediction is critical for the sustainability and resilience of transport infrastructure. This study proposes a spectral-based approach for consolidation analysis of multilayered soil, offering a novel solution that improves design accuracy by addressing the impact of varying drainage boundary conditions. Traditional methods often overestimate settlement by neglecting the variability of drainage conditions. The spectral method, however, captures excess pore water pressure (EPWP) and settlement across multiple soil layers through a unified matrix expression, enabling a more precise and efficient prediction model. Laboratory and field validations show that the spectral method significantly improves the prediction of soil behavior, offering greater flexibility in infrastructure design, especially in transportation and foundation projects. By integrating this method into the design process, engineers can better anticipate the effects of complex drainage conditions, reducing risks of overestimation and optimizing resource allocation. Parametric analysis further highlights the method,Äôs capacity to assess the impact of drainage conditions on soil consolidation, ensuring more resilient and adaptable infrastructure designs. This approach is especially applicable to transportation projects, where accurate settlement predictions are crucial for the long-term stability and functionality of roads, railways, and other critical infrastructure.

**P5. Evaluating Demand Responsive Transport in Low-Demand Urban Areas: Insights from a Case Study in Canberra, Australia**

*Amir Mortazavi, University of Technology Sydney*

This paper explores the potential of Demand Responsive Transport (DRT) as a viable alternative to traditional public transport (PT) systems in low-demand urban areas. Focusing on the case of Belconnen, Canberra, Australia, the study examines the replacement of conventional local bus services with DRT. A multi-objective framework is developed to evaluate the performance of DRT, considering factors such as operational costs, environmental impact, passengers,Äô travel times, and inequity. Through a detailed simulation, the analysis compares DRT and local bus services in terms of number of utilised vehicles, operational cost, fuel consumption, average travel time, individual

passenger travel time, delay, and inequity in passengers' delay distribution. The simulation results reveal that DRT has higher adaptability to demand changes, resulting in lower operational costs and fuel consumption throughout the day. In addition, DRT improves passengers,Äô average travel time and leads to a more equitable distribution of excess travel times, enhancing the overall passengers,Äô travel experience. These findings can provide insights into the operational and social implications of adopting DRT in similar urban settings.

**P6. Reducing Unreliability In Ridepooling Systems**

*Amir Elmi, The University of Sydney (TransportLab)*

Transportation systems worldwide face challenges such as congestion, pollution, and inefficient resource use. Ridepooling, where multiple passengers share a single vehicle, offers a promising solution by reducing the number of vehicles on the road and optimizing routes. However, for ridepooling to become a viable alternative to private car use, it must be perceived as reliable. A major challenge is the inherent unreliability of ridepooling systems due to their dynamic nature: adding new passengers to a route can cause unexpected delays for existing passengers, leading to dissatisfaction.

To address this, a concept called the ‚Äúshareability shadow‚Äù is introduced, representing the area around each moving vehicle that determines whether new ride requests can be shared with existing passengers. The shareability shadow predicts both the probability and magnitude of a negative impact on passenger travel times when new requests are added.

Based on these predictions, a modified assignment and routing algorithm is proposed to balance system reliability and performance. This strategy aims to reduce the likelihood of unreliable events while maintaining efficiency. Simulations using a real-world dataset from Manhattan yellow taxis are designed to analyse these dynamics. Specific indices will be defined to measure unreliability across different scenarios, and it is expected that the proposed strategy will improve ridepooling reliability, making it a more practical option for urban transportation.

**P7. Strengthen Logistic Port Utilisation for Animal Feed Production in Gorontalo: Addresing Port Infrastructure Needs**

*Annisa, University of New South Wales*

Indonesian domestic feed demand deficiency is caused by the low availability of animal feed production. This will be projected to be insufficient by the fact that more than 3,000 million tonnes of animal feed are still in need to meet domestic demand. Gorontalo, as one of the largest corn producers in Indonesia, has the prospective province to produce the animal feed products with 40,Äì60% animal feed production mix with corn. Even though close to the raw material availability in that area, the industry still needs 40,Äì60% supporting materials that come from outside the area. Hence, this project needs to be facilitated by a reliable logistics infrastructure to make Gorontalo,Äôs investment plan successful. To support potential projects, the Indonesian ministry of investment through regional investment potential (BKPM PIR) has made an investment opportunity map classified by strategic priority project ready to offer the investor. One of the projects is the animal feed industry in Gorontalo. Infrastructure readiness as one of the important aspects that influence investor decision-making needs to be addressed. This research is trying to sort out the accessibility, especially in logistic port utilisation in Gorontalo. Anggrek port and Gorontalo port are the feasible alternatives to deliver the access logistic choices. By analysing the logistical aspect's

capabilities, this study aims to provide insight into optimising port access and facilitating Gorontalo,Äôs investment potential in the animal feed sector.

**P8. Breaking Barriers: Governance and Liberalization Strategies to Boost Rail Freight Competitiveness**

*Maryam Safarnezhad, University of New South Wales*

The global decline in rail freight transport share, particularly in non-bulk sectors, poses significant challenges for policymakers seeking to enhance the competitiveness of rail over road transport. This paper examines governance structures, reforms, and liberalization efforts aimed at reversing this trend, with a focus on enhancing competition and access in the rail freight sector. The study employs a multi-layered institutional economic framework to assess key regulatory and structural reforms, including vertical separation and deregulation, across selected countries such as the United Kingdom, Sweden, and European Union member states. Successful examples, such as the Port of Gothenburg, which have effectively increased rail freight market share, will be compared with other regions to identify the challenges and barriers they face in achieving similar shifts from road to rail. The analysis highlights the varying effectiveness of different governance models, the role of state aid and grant programs, and the impact of integrated versus separated rail structures on market outcomes. Findings reveal that while liberalization and access reform can enhance competition, the success of these initiatives largely depends on tailored institutional arrangements and strategic infrastructure investments. The paper concludes with policy recommendations for fostering sustainable growth in the rail freight sector.

**P9. The Effects of Built Environment and Land Use on Pedestrian Road Trauma in Sydney**

*Ray Adrian Macalalag, University of Sydney (ITLS)*

This research investigates the effects of land use and the built environment on pedestrian road trauma in Sydney. Using data from the New South Wales Road Crash Database (2010,Äì2022), the study explores how different environmental factors and land use characteristics, such as walkability, road geometry, and proximity to points of interest, correlate with pedestrian-related crashes. A binomial logistic regression model was developed to predict crash severity based on these factors. The model accounts for various built environment variables leveraging the available crash information from the database and identify high-risk locations for pedestrian incidents.

The data processing workflow incorporates Python with Biogeme for the modeling and GIS for spatial analysis. The analysis also highlights the spatial distribution of pedestrian crashes across Sydney, linking walkability measures to rates of pedestrian incidents. This study questions whether walkability inherently increases pedestrian risk or whether other factors, such as unsafe infrastructure or behavior exacerbated by the built environment, contribute to higher crash rates. By identifying patterns and high-risk zones, the research aims to inform urban planners and policymakers to improve pedestrian safety, especially in densely populated urban areas.

**P10. Finite element analysis on the distribution of stress through layered soils**

*Isuri Wijayarathne, University of Technology, Sydney*

Evaluation of stress distribution through soil strata is one of the fundamentals of geotechnical analysis. Vertical stress is attributed to the loading intensity and geostatic stress. Even though many analytical methods have been developed idealizing the soil as a homogeneous, isotropic, and elastic material, the soil consists of layers of different characteristics in reality. In this study, stress distribution under a strip footing through a two-layered system consisting of purely sandy and purely clayey soils where the sand at the top was analysed with the finite element method using Plaxis 2D geotechnical software. The Mohr-Coulomb model was used to feed the characteristics of the soils to the computer software. Different test cases were simulated by changing the soil strength parameters: friction angle of sandy soils and cohesion of clayey soils and the thickness of two layers for selected soil types while the total depth of the soil system was 8 m. The numerical results were compared with Boussinesq solutions which are linear elastic solutions. It shows that stress at a selected point is low when the soils are loose and soft compared to the soils which are dense and stiff. The lower the thickness of the sand layer higher the stress at a selected point. Vertical stress values of Boussinesq solutions agree with the finite element analysis values when moving away from the footing both in horizontal and vertical directions.

**P11. Origin-Destination Demand Estimation in Aviation using an Optimisation-based Gravity Model**

*Mohammad Rahiminia, University of Sydney (ITLS)*

Demand estimation as part of forecasting is a critical phase in airline management since it affects other downstream decisions such as network design and fleet assignment. In this study, an optimisation-based gravity model is developed to estimate the Origin-Destination (O-D) demand matrix of Australia,Äôs domestic aviation network. The developed optimisation-based gravity model is superior to the traditional model in terms of: 1. application of this framework in the aviation industry considering different data sources; 2. ease of implementation; 3. addressing the network autocorrelations; 4. extracting the approximation of calibrating factors via looking at them as decision variables in the optimisation model. The proposed methodology is applied to the case study of Australian domestic air passengers to validate the applicability of the approach. Population and distance data are used for extraction of priors for the O-D matrix. The inbound and outbound number of passengers for each airport in Australia are used as the production and attraction vectors to extract the observed O-D which ignores transfers. The final O-D matrix is extracted based on the prior and observed O-D matrices. This study presents a publicly available demand prediction/estimation of Australian air passengers, which can be useful for predicting demand in 2050 and for network design decisions of airlines. Methodologically, the proposed framework can be used for the estimation of the O-D matrix in any transport network.

**P12. A Hybrid Transit Network Design for Ridership Fluctuation**

*Haoran Zhao, The University of Sydney (TransportLab)*

Buses are significant components of metropolitan areas worldwide, offering the advantage of high capacity. Nevertheless, fixed routes have limited ability to deal with the inevitable ridership fluctuations. We introduce a hybrid design using a continuous approximation model, in which the stops of two express lines are connected through the integration of on-demand and fixed-route bus

services, leveraging the capacity advantage of fixed-route buses and the flexibility of on-demand services. We refine a formulation to quantify the costs of the hybrid model, and we develop an optimisation model to determine the optimal frequency of fixed-route buses, fleet size of on-demand services and vehicle capacity for both. Results show that the hybrid design outperforms traditional bus services when the ridership variance is significantly high, whereas traditional bus services remain the optimal design with no significant ridership variance.

**P13. Analysing the effects of food delivery systems affec6ng food delivery workers,Äô behaviour to improve safety**

*Minjun Song, The University of Sydney (TransportLab)*

One major sector of the gig economy is the food delivery industry, which utilises various forms of transportation to deliver food and drinks from a range of restaurants directly to customers' doorsteps. In Australia, the gig economy saw significant growth, expanding ninefold from its 2015 market size, and surpassing $6 billion in consumer spending by 2019. This surge was primarily driven by food delivery companies, contributing $3.8 billion to the food delivery business. However, since 2017, at least thirteen delivery workers have tragically lost their lives in this sector. Additionally, a survey revealed that about half of gig workers in the transportation sector earned less than the minimum wage, with 56 percent reporting they felt pressured to rush in order to earn a liveable income.

This study investigates various factors contributing to risk-taking behaviours among food delivery workers, particularly in light of the industry's rapid growth and the associated increase in the delivery workforce, raising concerns about worker safety and well-being. Through surveys and in-depth interviews with food delivery workers, the study explores the relationship between individual risk-taking behaviours and the influence of delivery platforms.

The research provides essential insights into mitigating risks faced by delivery workers and improving their safety. Furthermore, it offers critical evidence to encourage delivery platforms to restructure their systems to prioritise worker safety.

**P14. Application of Computer Vision in Detecting Suspected DUI**

*Amin Shaer, The University of Sydney (TransportLab)*

Driving under the influence (DUI) of alcohol or drugs plays a considerable role in road crashes worldwide, posing serious threats to public safety. To curb DUI-related road casualties, it is crucial to detect DUI instances on the roads. One approach to achieving this is to develop an object detection algorithm capable of identifying instances of impaired driving. To be more precise, by collecting data from traffic cameras and applying video processing techniques, we train an object detection algorithm to identify DUI cases. We employ Minnesota traffic cameras as the primary data source, along with Minnesota road crash data. Additionally, we utilize DataFromSky for the analysis of traffic videos. Speeding, weaving, lane violation, and close headway (car-following) are the most common indicators of DUI investigated in this research. The qualitative approach of this study involves watching traffic videos to identify and label suspect DUI cases, or ‚ÄúobserveD suspected DUI‚Äù. The quantitative approach refers to developing a model to identify them, which gives ‚ÄúPredicted suspected DUI‚Äù. Then we calculate the accuracy between observed suspected DUIs and predicted ones. Using a Decision Tree model, we found that a headway time threshold of 0.80 seconds maximizes the model's accuracy (96%), while a headway time threshold of 1.78 seconds eliminates false negatives and correctly identifies all true positives. True positives represent suspected DUI

cases and false negatives signify suspected DUI instances that are not identified by the model. In terms of comparing DUI-related crashes with suspected DUI cases in each link, further findings indicate that alcohol-related crashes have a positive relationship with the lane violation rate (the number of lane violations per flow) and the headway rate (the number of close headways per headway opportunities). There is also a positive correlation between drug-related crashes and headway rate.

**P15. Empirical evidence of habits and patterns in public transport use**

*Durba Kunda, The University of Sydney (TransportLab)*

People tend to change their travel behaviour around disruptive events. We hypothesise that a substantial fraction of public transport users has detectable regularised travel patterns and for some travellers, those patterns change in response to a disruption. This research tries to identify how travel behaviour patterns change in response to disruptions like home relocation, the introduction of a new mode and weather conditions employing evidence from transit smartcard data of 5.5 years from Canberra.

This research uses a long baseline of transit smartcard data to identify patterns in traveller behaviour and analysis those to understand how those patterns can identify or respond to the disruptions. This study proposes to infer home locations using the Spatio-temporal boardings and alightings from smartcard data. The approach builds on spatial patterns where stops near the home are used more frequently and reinforced with temporal habits where days begin and end at home. The inference of a home location is a necessary foundation for examining patterns in home-based travel and the behavioural impact of home relocation.

In contrast, the opening of Canberra's light rail transit system is a disruption experienced by the entire network, and the timescale of new habit formation can be directly compared across card IDs. Building upon the earlier work inferring home location, the spatial proximity of the cardholder to the light rail transit system is used to understand variation in the impact.

The outcome of the study can be used to understand better how public transport users might be susceptible to changing their travel behaviours in response to disruptive events. It is essential that the ACT government should monitor travel behaviour changes during key moments relevant to disruption. Our findings will inform network design, and service design, and enable public transit providers to improve how information is conveyed to users.

**P16. Enabling Sustainable Practices in Construction: A Policy Framework for Effective Stakeholder Engagement**

*Ze Wang , University of Sydney (ITLS)*

The construction industry plays a pivotal role in global economic growth but also significantly contributes to environmental degradation. Despite increasing focus on green construction and net-zero emission targets, the shift towards sustainable practices remains hindered by profit-oriented developers, high implementation costs, and limited public awareness. This transition is a complex process involving interactive decision-making among government entities, developers, and customers. However, existing research inadequately addresses the intricacies of this decision-making process across these key actors. This study investigates the dynamic interactions and environmentally responsible behaviors of government entities, developers, and customers. By integrating evolutionary game theory and system dynamics modeling, we explore how government

taxation, public awareness initiatives, and green financing influence the adoption of sustainable construction practices. Our model identifies four evolutionarily stable strategies, with the optimal scenario featuring government-imposed green taxes, developers producing green products, and customers prioritizing these products. Simulation analyses reveal that government regulation is crucial for driving green practices among developers and customers. The results indicate that a combined policy strategy,Äîfeaturing dynamic green taxes for customers, starting low but progressively increasing, along with public awareness campaigns and green credits to reduce developers' operational costs,Äîis more effective than any single policy. Notably, the customer dynamic green tax strategy reduces the time required for customers to achieve sustainable behavior stability by over 57%. Additionally, the study underscores the importance of a threshold in stakeholder engagement and highlights diminishing returns in behavior change as policy intensity escalates. These insights provide actionable recommendations for governments to dynamically adjust policies, facilitating a smooth transition to green construction practices while managing expenditures. Ultimately, the findings emphasize the necessity of a balanced and multifaceted policy approach to fostering a sustainable construction industry.

**P17. An Analysis of Factors Contributing to Rail Freight Volume and Strategic Modal for Economic Growth**

*Chamila Danthanarayana, University of Sydney (ITLS)*

Rail transport provides efficient and effective mobility and accessibility through long-haul freight operations by carrying volumes of freight compared to roadways. Road freight transport has made rail freight less attractive due to the comparative advantages of roads. Since rail transport provides wider socio-economic benefits as an environmentally friendly mode, transport policymakers seek strategic solutions to enhance the modal shift from road to rail. In Australia, the modal share of rail freight transport varies in major freight corridors with some corridors being less attractive. Understanding the influential factors of rail freight volume is imperative to attain a better modal share and develop rail freight transport to meet future national freight demand. This research examines how different external and industry-level factors impact the rail freight volume to develop rail freight transport through a strategic modal. The research adopts a mixed-method approach to collect and analyze data to identify the impact on rail freight volume. First, the study identifies key external and industry-level variables by mapping the history of rail freight transportation through literature, theoretical framework, and obtaining expert views. Secondly, the study uses econometric analysis to determine the impact of the macro-level factors and conduct an industry survey to ascertain the impact of industry-level factors. Thirdly, the study provides a strategic framework to develop the rail freight transport using the research findings. The study provides guidance to transport policymakers and planners with comprehensive insights for strategic solutions that improve the volume of freight and its modal share connecting to economic growth.

**P18. A Spatially Transferable Pedestrian Demand and Network Modeling (STePNet) Framework**

*Fatemeh Nourmohammadi, University of New South Wales*

Pedestrian demand models are often transferred across different locations in the absence of comprehensive local data. However, the spatial transferability of these models remains poorly understood. To address this gap, we propose the STePNet framework. This study examines the spatial transferability of both aggregated (Local Government Area, LGA, and Statistical Area Level 1, SA1) and disaggregated pedestrian trip generation models. We estimate Negative Binomial Regression, Bayesian Regression, and Random Forest models to capture trip generation in

aggregated active travel patterns, as well as Poisson Zero-Inflated, Two-Step Logit-Bayesian, and Two-Step Random Forest models for individual walking trip generation.
Using data from the Household Travel Surveys of Sydney, Melbourne, and Brisbane, Australia, we found that aggregated models exhibit reasonable transferability under certain conditions, while disaggregated models demonstrate greater limitations. Among these, Bayesian Regression models effectively balance interpretability and performance in estimating walking trip generation and its transferability, while other models have their distinct characteristics and interpretations. The combined use of these models can effectively capture walking trip generation behavior at different scales, offering valuable insights for policymakers and urban planners at both city-wide and localized levels, especially in data-scarce areas. To our knowledge, this is the first study to develop walk trip generation models and evaluate their transferability across both aggregated and disaggregated levels.

**P19. Evaluating Long-Term and Short-Term Travel Mode Shifts and the Future Impact of Remote Work: Insights from COVID-19**

*Wenyang Ho, The University of Sydney (TransportLab)*

This study investigates the impact of the COVID-19 pandemic on travel behavior, focusing on two primary questions: which groups exhibit long-term versus short-term shifts in travel modes, and what factors influence these shifts or the decision to maintain previous travel modes. Additionally, the study examines the potential impact of remote work on future travel choices. Using retrospective travel behavior data from Shanghai, the findings indicate that private car and non-motorized travel users were more resilient, exhibiting fewer shifts to other modes. Conversely, public transportation users, particularly regular bus commuters, were more likely to experience long-term shifts. Key influencing factors for these shifts include socio-economic characteristics, household composition, and pre-pandemic car ownership. The analysis also reveals that the number of days working from home during the pandemic significantly affects future remote work willingness, which in turn impacts travel behavior. These insights are crucial for developing adaptive urban transportation policies to accommodate evolving travel preferences and support resilient, inclusive transportation systems.

**P20. Analysing aviation safety issues in Australia**

*Siavash Farzadnia, University of Sydney (ITLS)*

This study provides a comprehensive overview of Australian aviation safety issues, identifying systemic risks and offering a data-driven foundation for enhancing safety protocols. For this purpose, we applied NLP techniques and a text clustering algorithm, BERTopic with ERNIE as the embedding layer, in analysing Australian aviation safety reports in light of critical questions around Australia aviation safety. We pursued investigations into the anomalies that could serve as a warning for systemic safety problems, emerging risks, human factors, and environmental impacts on aviation safety. Preliminary findings after data analysis and identifying 22 topics in all reports show that the trend of topic occurrences varies over time from 2006 to 2023, reflecting evolving safety incidents and accidents for which further analysis would assist in pointing out a changing landscape of aviation safety risks and thereby facilitate better understanding and mitigation. While understanding emerging risks and human factors contributes to improving safety practices, the identification of environmental impacts contributes to addressing external threats to the aviation sector. Our findings offer valuable implications for industry stakeholders and regulatory bodies aiming to mitigate emerging aviation risks in Australia.