

Honours and Masters Seminar Presentations

TRANSPORT ONLY



Transport Engineering (Room CE G6)

Time	zID	Student	H/M	Topic	Supervisors
9.00	z5170360	Chen, Tianzhou	M	Mapping Urban Noise Data in Sydney	Saberi Kalae, Meead
9.15	z5143748	Cui, Yanhao	M	Studying passengers reaction to train disruptions due to trackwork maintenance in Sydney	Saxena, Neeraj
9.30	z5018505	Tu, Robert	H	Traffic flow characteristics of automated vehicles	Saberi Kalae, Meead
9.45	z5115302	Rung, Patrick	H	Equity in public transport	Ghasrikhouzani, Milad
10.00	z5151155	Li, Mupeng	M	Traffic flow theory and characteristics of automated vehicles	Saberi Kalae, Meead Gu, Ziyuan
10.15	z5199300	Feng, Li	M	Mapping Urban Noise in Sydney	Saberi Kalae, Meead
10.30	Morning Tea Break				
10.45	z5171840	Xi, Kangyu	M	Mapping urban noise in Sydney	Saberi Kalae, Meead
11.00	z5172610	Zheng, Xiaofeng	M	Mapping Urban Noise in Sydney	Saberi Kalae, Meead
11.15	z5097558	Yu, Chun Ting	H	Traffic flow characteristics of automated vehicles	Saberi Kalae, Meead
11.30	z5169399	Ligawan, Kane	M	Traffic flow characteristics of automated vehicles	Saberi Kalae, Meead
11.45	z5061476	Wang, Jason	H	A modified approach to residential location choice modelling, and its potential effects within larger frameworks	Robson, Edward Nguyen
12.00	z5142327	Qing, Taiyu	M	Urban Transport Expenditures & Life Satisfaction	Ghasrikhouzani, Milad
12.15	z5097925	Xu, Kaiyu	H	Practicality analysis of a macroscopic network model for pedestrians	Saberi Kalae, Meead
12.30	Lunch Break				
1.00	z5131347	Li, Xin	M	Traffic flow characteristics of automated vehicles	Saberi Kalae, Meead
1.15	z5076726	Indradi, Anindya Rachmani	H	Comparison of traffic data from different crowd-sourced platforms: Pros and Cons	Saxena, Neeraj
1.30	z5115780	Ching, Ada Lok Yee	H	Investigating the impact of adverse weather conditions on public transport reliability and accessibility	Ghasrikhouzani, Milad
1.45	z5137394	Chang, Xiaoli	M	Traffic flow theory and characteristics of automated vehicles	Saberi Kalae, Meead Gu, Ziyuan
2.00	z5089066	Kilayko, Elysia Mae Rodrigo	H	Evaluating Accessibility to Public Transport for People with Disabilities	Grzybowska, Hanna Rey, David

2.15	z5155822	Dai, Qingwen	M	Traffic flow theory and characteristics of automated vehicles	Saberi Kalae, Meead Gu, Ziyuan
2.30	Afternoon Tea Break				
2.45	z5143812	Wang, Yanjing	M	Mapping urban noise in Sydney	Saberi Kalae, Meead
3.00	z5039395	Liu, Jierong	H	Dynamic Dial-A-Ride for On-demand Public Transport	Rey, David
3.15	z5144865	Ji, Guanglin	M	Quantifying the relationships between air quality and transport and urban development	Liu, Wei
3.30	z5062403	Yoo, Hae-Lim	H	Emerging mobility solutions	Rey, David
3.45	z5061525	Rabbani, Adnan Saad	H	Modelling Human Mobility for Outbreak Control	Rey, David
4.00	z5175608	Zhao, Yiyun	M	Understanding the destination choice behaviour of pedestrians	Saberi Kalae, Meead
4.15	z5183309	Zhang, Xu	M	Quantifying the relationships between air quality and transport and urban development	Liu, Wei

Mapping Urban Noise Data in Sydney

Tianzhou Chen

Meead Saberi Kalae

Noise pollution has become one of the major hazards of modern life, especially in areas with the highest degree of industrialization. For many countries, noise research is an important project for road traffic in large cities. This project is to help improve urban noise pollution by modeling noise data and scientifically studying the influencing factors of road traffic noise.

The project performs software simulations by measuring the amount of noise on road traffic and performs very precise mathematical modeling of the environment, sound source and sound propagation patterns. First of all, using the instrument that measures noise to carefully collect noise data from the studied road traffic area and obtain predicted road information on the Openstreetmap. This project mainly uses a software called OrbisGIS, an open source geographic information system that generates noisemodelling maps by inputting different functions and codes to model noise data and geographic information.

Then, using software such as Qgis that can import geographic structure information, generate different layers and combine these layers. Analyzing the collected road traffic information such as noise volume, traffic volume and building information. From this, the predicted noise amount can be obtained, and the final comparison analysis can be made between the measured and actual measured noise levels, and the final conclusion is obtained. It is found that the noise data is affected by many road parameters such as vehicle speed, road structure and distribution of different buildings.

Overall, it is indeed assumed by changing the parameters that from different road traffic information can have different effects on the final noise results. Therefore, for the noise pollution research in Sydney, the collection and modeling of noise data is a very effective project.

Studying passengers reaction to train disruptions due to trackwork maintenance in Sydney

Yanhao Cui

Neeraj Saxena

As one of the most popular transportation in Sydney, train is an essential part of our life. Meanwhile, the regular trackwork is necessary which results in train disruption. This essay aims to discover the reaction of the passengers who have experienced train trackwork: whether will they continue their plan; what transportation will be utilized as a replacement; and what factors will lead to dissatisfaction. All these concerns might lead to short-term effects or form long-term habits on how passengers select their transportation methods. Severe consequences, such as growth in using private vehicles or passengers build up a negative attitude towards public transportation, would further impact the financial profit of the operators and deteriorate the urban traffic condition. The passengers who take the replacement bus, as a substitute provided by the NSW Transport, will be chosen as the research target. One hundred samples will each be collected from Central to Chatswood and Central to Newcastle to demonstrate how passengers react in short-distance journey and long-distance journey. ANOVA(Analysis of Variance) and Multinomial Logit Model have been applied to analyze the discrete data in order to find out the validity and relations of different factors. There are several findings including: (1) There are more passengers who have cancelled or changed their plans during train trackwork in short-distance than long-distance journey. (2) Long waiting time and extra transfers were the two main factors that directly result in dissatisfaction of the passengers. Furthermore, those factors have greater impacts in short-distance journeys. (3) Comparing to the train services, passengers are more satisfied with the replacement bus services in long-distance journeys. The passengers travelling in both short-distance and long-distance are overall satisfied with the replacement bus services. Meanwhile, this satisfaction survey could also provide feedbacks for the replacement bus services.

Traffic flow characteristics of automated vehicles

Robert Tu

Meead Saberi Kalae

The occurrence of traffic jams on highways is a phenomenon people experience from a day-to-day basis, but the reason is often poorly understood. The manifestation of stop-and-go waves, commonly known as phantom jams results from no apparent reason. With the recent rise in popularity and availability of automated vehicles, the prevalently known traffic flow behavior is bound to be affected.

Based on the research conducted by Sugiyama et al. and Stern et al., this paper will explore the formation of stop-and-go waves from human drivers and examine how automated vehicles are able to dissipate stop-and-go waves. This paper hopes to build upon the research by examining the benefits automated vehicles provide to traffic flow.

Making use of UC Berkeley's FLOW software, an open sourced Reinforced Learning framework, we are able to simulate traffic scenarios with the incorporation of automated vehicles. The traditionally known configuration of the Fundamental Diagram is bound to change from the addition of a single reinforced learning automated vehicle to a traffic system. Extracting data obtained from simulations conducted, we are able to derive the Fundamental Diagram for a mixed autonomy traffic system.

How will the Fundamental Diagram of a modern mixed autonomy traffic system alter, in comparison to the classical homogenous human driven traffic system? And to what extent will automated vehicles benefit other human drivers? Our research hopes to shed some light on the questions raised above.

Equity in public transport

Patrick Rung

Milad Ghasrihouzani; Gregory Aouad

The purpose of the study is to explore if the public transport system in the Australian Capital Territory (ACT) is equitable from the perspective of a high school student commuting to school. The research thesis seeks to identify a relationship, between the degree of accessibility for high school students travelling to school with the school demographics (such as the number of Indigenous Australian and non-Indigenous Australian enrolment) and different land-use classifications. The methodology proposed to explore this concept consists of a combination of MATLAB, QGIS, and multi-variable linear regression in R. The data obtained from MyWay (30th July 2018) (2nd September 2018) identifies the location, time and passenger type for both 'Tap-Ons' and 'Tap-Offs'. This anonymous data set forms the foundation of the analysis of student travel patterns during the morning peak. This data is filtered to contain trips conducted by school students which occurred during the AM peak, with a travel time under 30 minutes. Bus maps containing trips with travel times not exceeding 30 minutes were generated with the filtered criteria in combination with General Transit Feed Specification data. This allowed for a multi-variable linear regression to be conducted to explore the relationship between the number of accessible trips being made by school students during the morning peak, with school demographics and land-use factors. The results of the multi-variable linear regression illustrated no apparent relationship or bias between the number of enrolments and the degree of accessibility for students. However, there appears to be a relationship (of 95% confidence interval) between specific land-use factors and the degree of accessibility for students. Thus, warranting further analysis to understand the combination of land-uses that determines supplied bus services and how commuters travel within the ACT.

Traffic flow theory and characteristics of automated vehicles

Mupeng Li

Meead Saberi Kalaei; Ziyuan Gu

Vehicle automation has been a hot topic and it supports autonomous vehicle development. As the fact that more autonomous vehicles will be on the roads, some researches have modelled simplified scenario of mixed traffic flow of autonomous vehicles and human-driven vehicles like highway scenario and loop scenario. However, limited effort has been made to simulate the realistic urban traffic scenario of mixed traffic flow incorporating autonomous vehicles and human-driven vehicles. This thesis will simulate the real urban network in Sydney and analyse the impact of autonomous vehicles on the urban traffic system. In this thesis, the autonomous vehicles and human-driven vehicles are modelled by intelligent driver model (IDM) with disparate parameters. The microscopic simulation framework is generated by Flow and the visualization of the modelling process is created by Simulation of Urban Mobility (SUMO). Experiments are conducted to collect the time and speed data of all vehicles in the network. After applying the control variate method, the results show that autonomous vehicles improve the traffic flow in the loop scenario, which verifies the previous finding. Nevertheless, vehicles which choose random route in urban traffic system produce unstable and extreme statistics. The outcome demonstrates that the urban traffic flow characteristic is complex and hard to capture using a random route method. This thesis illustrates the difference between ring scenario simulation and urban traffic simulation and proves that the randomness has a significant impact on the urban traffic simulation result.

Mapping Urban Noise in Sydney

Li Feng

Meead Saberi Kalae

Urban noise, the harmful environmental pollution, is a by-product from cities development, growth of population and expansion of road networks, which may lead to some undesired diseases for citizens on both physical and mental health. Regarding the noise annoyance, researchers intend to build noise model aiming to achieve the visualisation of noise distribution by using computer technology, which is convenient for the result to display, analyse and manage. The present work used the plugin in OrbisGIS which comply with two standard methods: one is French standard method of calculating the road noise emission; another is NMPB of computing the noise level in sound propagation. While based on the real traffic volume, researchers generate a 2-dimensional noise map of the Sydney CBD by OrbisGIS which implemented to predict and monitor the noise level with the geospatial and traffic information; and then make a comparison of the noise model with the real collected data after calibration and validation in terms of finding out the best fit of models.

In statistical analysis, changing the output of the noise map by setting a single variable of 12 essential parameters to evaluate the impact of these parameters in the noise model. The calibration result implies that two parameters, the maximum wall reflection order and the maximum sound diffraction order, have a great influence on the noise model while other parameters have a small impact. Specifically, the higher of these two parameters, the lower value of the mean absolute error(MAE) and the root-mean-square error(RMSE) which makes the noise model more close to the real measured sound level. The noise map illustrates that the high traffic volume area accompanied by the high noise level has a relatively concentrated noise distribution than other regions, which increase the inaccuracy of computing the noise level of the car-free area.

Mapping urban noise in Sydney

Kangyu Xi

Meead Saberi Kalae

With the rapid development of the metropolitan areas, noise pollution has gradually become a critical issue in those areas owing to its adverse effects on the health of human. Producing noise maps could be an effective way to conduct investigations and make decisions in the implementation of urban construction plans to decrease noise pollution. Consequently, mapping urban noise in Sydney contributes to the construction of a low-noise metropolis. The noise mapping approach is composed of two steps: the evaluation of noise emission according to the actual traffic volume and the computation of sound levels in consideration of the propagation of noise from each source to receivers. Based on a set of SQL functions from NoiseModelling, a noise map could be created in the OrbisGIS platform by importing traffic data and geographical data including topography, buildings and roads. However, a series of parameters such as the maximum propagation distance, maximum wall seeking distance, roads width, wall absorption value, sound reaction order and sound diffraction order in the noise prediction model determine the accuracy of the noise map. In order to adjust the parameters, the noise map created by the prediction model would be compared with the actual sound level obtained from the noise collector. The observed sound level and the predicted noise level would be regarded as two variables which could be analyzed by the calculation of their MAE (mean absolute error) and RMSE (root-mean-square error). After the comparison and adjustment, a relatively accurate noise prediction model could be obtained to produce the 14-level noise map.

Mapping Urban Noise in Sydney

Xiaofeng Zheng

Meead Saberi Kalae

With the rapid development of the economy and the explosive growth of urban traffic, urban noise has become a serious environmental problem in modern social life. Long-term exposure to noise can lead to a series of physical and mental illnesses. To better understand the noise situation, modelling noise is an effective method. Noise modeling can visually and effectively present the noise intensity level and impact range on the noise map. As a convenient tool to simulate noise levels, noise modelling provides an important reference for environmental managers to reduce noise pollution. In this project, the researchers used the Orbis-GIS software with plug-in functional noise modeling to simulate the noise map of the CBD area in Sydney based on the actual traffic data.

In order to find the model that best represents the traffic noise of the Sydney CBD, the researchers used field noise data collection and data comparison with the simulated noise model. Sensitivity analysis was performed on the simulation results to evaluate the effects of different parameters in the noise propagation model on the results. The sensitivity analysis results present that the maximum depth of sound diffraction and the maximum depth of the wall reflection are the most critical parameters, and they have the greatest influence on the noise propagation process. By comparing and modifying various parameters, a noise model that best matches the actual noise situation in the CBD area of Sydney is established. In addition, the noise map indicates the relationship between noise concentration and traffic volume. As expected, the higher the traffic flow, the stronger the noise level.

Traffic flow characteristics of automated vehicles

Chun Ting Yu

Meead Saberi Kalae

This thesis is studying the mixed traffic of autonomous vehicle and human-driven vehicles using macroscopic models. Autonomous vehicles are one of the emerging solutions to the increasing road demand and congestions. While autonomous vehicles being introduced to the public, the traffic would be a mixed traffic consist of two types of vehicles which are not experienced. It would be useful to predict and model the possible behaviours.

Macroscopic modelling has been used on studying traffic behaviour. In this thesis, a homogenous PDE model and a heterogenous PDE model are used with MATLAB. It is attempted to estimate the behaviour by altering one fundamental diagram in the homogenous PDE to represent different mixture of autonomous traffic. While the heterogenous model assumes two fundamental diagrams for each autonomous vehicle and human-driven vehicles. Densities graphs are plotted on space-time dimensions on both models and the results are studied. Different graphs are plotted with different boundaries conditions and compared.

The densities graphs do not always show clear wave speeds boundaries and the wave speeds have to be estimated and the proportions of autonomous vehicles along the space-time domain are plotted and discussed. However, since there is no real world data calibration and simplifications and assumptions are made, it is uncertain on the reliabilities on the models, however, some preliminary could be useful for predicting the mixed traffic.

Traffic flow characteristics of land automated vehicles

Kane Ligawan

Meead Saberi Kalae

Nowadays, automated vehicles are starting to be known on the market, so there are two objectives in this research. Firstly, this research aims to analyse the traffic impact that is caused by the act of lane changing of autonomous vehicles and regular vehicles on mix traffic. Next, the secondary objective is finding out the effect of different market penetrate of AV in mix traffic by using the same framework which is Flow. This study will compare normal vehicle traffic and mix between normal and autonomous vehicle traffic. Both traffic will apply lane changing behaviour. As modelling input data, the mix traffic simulation will use FLOW in SUMO and the lane changing behaviour will use SUMO lane-changing model. Whether the vehicle is performing lane changing or not can be known from the time-space diagram. Intelligent Driver Model (IDM) car-following model will be applied as the normal regular human driver and the autonomous vehicles. The analysis for normal and autonomous vehicle traffic aims to analyse the average speed, flow and occupancy by calculating the output result from the simulation. During the simulation, congestions happened and caused the shockwave effect in the lane that does not have an autonomous vehicle. Meanwhile, the other lane that has autonomous vehicle did not experience congestion. The autonomous vehicle helps to reduce congestion. As a conclusion, adding an autonomous vehicle in the lane could improve the average speed and flow of the traffic. Hopefully, the result may be useful for controlling the rate of the autonomous vehicle in the traffic.

A modified approach to residential location choice modelling, and its potential effects within larger frameworks

Jason Wang

Edward Nguyen Robson

Current approaches to modelling cities and the effects of policy on a city try to model supply and demand of goods and services to understand how changes to policy can affect cities. An example of this combines multiple models under a single computer-generated equilibrium (CGE) approach to simulate and observe how changes in general traffic conditions can impact agents in the city and their decisions such as where they live. For this to work, the models being used must reflect real world behaviours of the agents. One such model predicts housing location choice of household agents (civilians in the city) as a function of income, travel time to work and other income-related factors. This function is combined with a regional amenities term, a calibration term for the CGE framework. This calibration term implies that other predictors for residential location choice exist; if a model can perfectly predict residential location choice, there should be no additional calibration-assistance term. If these other predictors are known, it will be possible to more accurately predict city behaviours and the effects a change in policy have on the city. This thesis examines the validity of income-related predictors for residential location choice models and identify possible additional predictors. The findings of this thesis mainly focus on how the neighbours one expects in an area influences their view of that area as a residential location, and in doing so reveal facts about human residential choice behaviour, including the effects multi-ethnic populations have on residential choice. A case study on Sydney will be conducted using the improved model within a CGE framework as a sample application of the findings. The thesis also discusses the general difficulties of detailed residential modeling, possible predictors that can be investigated in the future, and other possible improvements.

Urban Transport Expenditures & Life Satisfaction

Taiyu Qing

Milad Ghasrikhouzani

According to previous studies, analysis of life satisfaction is helpful for government to make policy to improve the life satisfaction of people which leads to many positive characteristics. In Australia, with the development of public transport and the improvement of living standard, the expenditures on transport have been an important part of daily life. The life satisfaction of people may be impacted by the different transport expenditure. The purpose of this study is to examine the relationship between transport expenditure and life satisfaction, controlling for the influence of other variables on life satisfaction, based on structural equation model. By using exploratory factor analysis, eight life satisfaction domains in the Australian Household, Income and Labor Dynamics in Australia (HILDA) are summarized into two latent variables. One, including employment, finance and health domains, is called personal life satisfaction. Another, including safety, community, home, neighborhood and leisure, is named social life satisfaction. Furthermore, five latent variables, expenditure, health, loneliness, social situation and education, and socio-demographic variables are used to estimate their impact on two life satisfactions and overall life satisfaction. According to the data collected from 1046 observations in HILDA, it is found that expenditures on vehicle fuel, vehicle repairs and public transport have a negative impact on personal life satisfaction, but the influence of the public transport expenditures is not significant. In addition, positive relationships between personal life satisfaction, social life satisfaction and overall life satisfaction indicate that higher expenditures on transport will reduce overall life satisfaction of people. Besides transport expenditures, health situation, socio-demography and job situation also have significant impact on life satisfaction. Furthermore, more transport variables can be added in the future study, such as transport mobility and transport mode, which can help to better understand the influence of transport on life satisfaction.

Practicality analysis of a macroscopic network model for pedestrians

Kaiyu Xu

Meead Saberi Kalae

A multi-directional macroscopic pedestrian model has been tested for practicality applications (Hänseler, Lam, Bierlaire, Lederrey, & Nikolic, 2017). Stream-based Fundamental Diagram is selected for the simulations because of its high density-speed relationship accuracy when representing the real-life network. There are two scenarios tested in this paper, Scenario 1 tests the traffic light modelling capability of the macroscopic pedestrian model. It is observed that the model is able to replicate the bottleneck effect at where pedestrians wait for the signal to cross, with a general decrease in density and increase in speed when green time of the signal increases. Scenario 2 further tests the model's capability when replicating a larger real-life dense walking area network. Three tests were conducted under this scenario, Test 1 and Test 2 investigate the impact on the average density of the walking area when placing obstacles on various density areas. The results show that placing obstacles at most dense areas will have a larger negative impact on the overall pedestrian density comparing to placing obstacles at least dense areas, which is in agreement with reality expectations. Test 3 is a special case of Test 1 and 2 which includes a low-density pedestrian circle that acts as a large obstacle in the walking area. The simulation shows that the model is not able to capture such behaviour due to its algorithm and configuration. The two scenarios show that the model is able to reproduce the regular situations which are widely present in real-life, however, it fails to reproduce one special case.

Traffic flow characteristics of automated vehicles

Xin Li

Meead Saberi Kalae

This project aims to find out the relationship between the penetration rate of autonomous vehicle and the current traffic flow in Sydney. The project consists of two main parts. The first one is to research the characteristics of autonomous vehicles by using FLOW, which is a deep reinforcement learning framework. In this process, I can train an autonomous vehicle in a closed network. These training could help me understand the difference between autonomous and human driven vehicles. The second part of this project is to use Simulation of Urban MObility (SUMO) to set up a model to simulate the traffic condition with various parameters. SUMO is an open source microscopic, multi-modal traffic simulation. I can import real network of CBD in Sydney from OpenStreetMap into SUMO, and then introduce variable penetration rate of autonomous vehicles into the network. Finally, I can acquire the traffic condition about each vehicle, including speed, position, time, emission and route.

From the results of simulation, there is a critical value between the penetration rate of autonomous vehicles and traffic flow. When less than the critical value, they are negatively correlated. When large than the value, they are positively correlated. In other words, the penetration rate of autonomous vehicles will not improve the traffic flow until it reach a critical value in the network.

Comparison of traffic data from different crowd-sourced platforms: Pros and Cons

Anindya Rachmani Indradi

Neeraj Saxena

Travel time is a form of traffic data required for infrastructure planning to overcome traffic congestion, a rising problem for the community. Reliance on intrusive methods such as loop detectors or floating cars to obtain data can be costly. There has been a rise in the use of online navigation applications by the public as a means of estimating travel time. However, more research is needed to address the reliability of these navigation apps and their performance in comparison to one another. The aim of this study is to compare the travel time forecasts of two navigation apps, namely Google Maps and Bing Maps. Additionally, the forecasts are compared with real travel time data from a survey to assess the accuracy of the data collected through the APIs. Results have shown that data from Bing Maps generally provided higher travel time forecasts, some as much as 17% higher than that of Google Maps for the same origin-destination pair. The study also aims to compare the APIs in terms of the services available, costs and ease of use. It can be concluded that Google Maps provide more services for Australian users, including routes and travel time data for public transit, which is not available from the Bing Maps API. The results of the study will serve as a guide to help users make an informed decision of which API to use for conducting research that requires travel time forecasts.

Investigating the impact of adverse weather conditions on public transport reliability and accessibility

Ada Lok Yee Ching

Milad Ghasrikhouzani

This thesis investigates the quantitative and qualitative effects of adverse weather conditions on the travel time reliability and accessibility of bus users, represented by the MyWay users of the ACT bus network. The available datasets included the trip records of all bus users on the ACT bus network during August 2018 and weather data from the Bureau of Meteorology. Multiple linear regression was conducted to develop a regression model linking the actual user travel time to the predictor variables of precipitation, temperature, wind. From the model results, an additional millimetre of rainfall was found to add approximately 5 seconds to an individual user's travel time during the morning peak period of 7am - 9am, demonstrating the adverse impact of rainfall in delaying a user's trip. Moreover, alongside accessibility plots, mapping software QGIS was used to create accessibility maps which reflected negative changes to the levels of accessibility in the presence of rainfall, represented by buffers covering areas accessible via the bus network, in the 15-, 20-, 25- and 30- minute periods. By correlating the negative effects of weather on travel time reliability and accessibility with transport supply and demand, this study provides findings that aim to reinforce bus schedules against adverse weather by placing equal emphasis on transit user behaviour during rainy days and how the current state of the public transport network could contribute to delays in user travel time.

Traffic flow theory and characteristics of automated vehicles

Xiaoli Chang

Meead Saberi Kalaei; Ziyuan Gu

With the rapid development of autonomous driving technology over the past few decades, the large-scale use of autonomous vehicles is becoming more and more feasible. The objective of this study was to investigate the possible impact of autonomous vehicles on the Sydney urban traffic flow. By using a recently proposed computational framework: FLOW and the open-source simulation software: Simulation of Urban Mobility, both the autonomous vehicles and human vehicles were created in the heterogeneous traffic flow. In particular, the acceleration behaviors for autonomous vehicles and human vehicles were depicted by the intelligent driver model and optimal velocity model respectively. The route choices for both kinds of vehicles were random. Simulations were conducted under different penetration rates of autonomous vehicles in the heterogeneous flow. The impact of autonomous vehicles on the average speed of the urban traffic flow was studied. The simulation results indicate that the average speed of the pure autonomous vehicle flow is even lower than that of the pure human vehicle flow. As the simulation progresses, the average speed will decrease in both cases. When the penetration rate of the autonomous vehicles is 20%, the average speed of the mixed traffic flow reaches 10m/s and can sustain until the end of the simulation. Similar results are obtained under the penetration rate of 60% and 80% while the maximum speeds that can be sustained in these two cases are slightly lower. Whereas, the speed variation trend of the mixed traffic flow with the autonomous vehicle penetration rate of 40% is similar to pure traffic flow. The relationship between the autonomous vehicle penetration rate and the traffic flow speed is analyzed, providing some insights into the possible impact of the autonomous vehicles on Sydney urban traffic systems.

Evaluating Accessibility to Public Transport for People with Disabilities

Elysia Mae Rodrigo Kilayko

Hanna Grzybowska; David Rey

Public transportation is a necessity for one to get to places. Despite it being available in many metropolitan cities, it is not entirely accessible to everyone. Within Australia, 47% of the train stations were inaccessible to about 4.4 million people with disabilities as of 2018. Based on statistical findings through the Survey of Disability, Ageing and Carers (SDAC) 2015 and public feedback for the Whole of Journey Guide 2017, people with disabilities suffer from daily barriers such as lack of modern accessible facilities and social discrimination.

The contribution of this thesis is the proposal of a new measure in evaluating the accessibility of a train station and clearly identifying any physical barriers for people with disabilities. The proposed approach addresses the accessibility issue, ensure that the needs of people with disabilities are met and prepare the public transport network system for the imminent demand of an ageing population.

This proposed approach includes a unique ratings-based assessment. It has been inspired by the industry which uses condition assessments to determine the condition of existing structures. The assessment judges and rates the train station environment against each disability type to determine whether the needs are fully met. These ratings are then used to calculate the amount of accessibility with an appropriate Gravity-based formula.

The assessment was applied to four train stations of different characteristics within Sydney. Sydenham Station was rated 74.6% accessible, Mascot Station 74.5%, Banksia Station 60.2% and Tempe Station 53.9%. Across all stations, sensory aids lacked some accessibility, followed by signage, real-time informational boards and Opal machines. These results had proven that these stations were not truly accessible as one might think, despite some of them being modern and standard-compliant.

Traffic flow theory and characteristics of automated vehicles

Qingwen Dai

Meead Saberi Kalae; Ziyuan Gu

Recent years have witnessed the emergence and development of automated vehicles. This inevitably aroused interests on the impacts of the application of automated vehicles on traffic flow characteristics. This paper reviews the development and concerns about automated vehicles, different traffic flow models and the impact of automated vehicles on the traffic flow. This study conducted two sets of experiments to explore the impact of automated vehicles on the transport network of a suburb in Sydney. Flow and Simulation of Urban Mobility are used to generate the simulation framework. The Intelligent Driver Model is used to develop an understanding of how traffic dynamics are impacted by different parameters of vehicles. It is designed to change several parameters, which are safe time headway, desirable speed, jam distance and time delay to distinguish human-driven vehicles and automated vehicles. The analysis uses the control variable method to explore the impact of automated vehicles under different parameters. The result shows that with higher safety time headway for human-driven vehicles, automated vehicles show a greater impact on average traffic speed. At the same time, the research explores the impact of the penetration of automated vehicles on the traffic network. It is designed to change the percentage of automated vehicles in the same traffic network. However, the result shows that with the increase in the percentage, the average speed of the traffic network does not show obvious improvement. The reason for this is considered as the randomness of the routing, which cannot be captured by five rounds of tests for each scenario. It can be concluded that the application of automated vehicles could lead to a little improvement in the traffic system under a certain assumption and simulation conditions.

Mapping urban noise in Sydney

Yanjing Wang

Meead Saberi Kalae

Current official rules and scientific efforts both concentrate on large metropolitan agglomerations, but according to the recent studies, it hints that the noise levels are now excessive growing in the major part of city district. According to the research by United Nations, longstanding exposing in noise can lead to many health issues, more serious may affect the life-span. In this days, the traffic noise is widely recognized as one of the most serious threats to the environment and physical health.

Noise map is known as the most reasonable and useful tool to show the noise level in different part for a designated district. In a noise map, different colors are used to distinguish the noise levels of different regions to find out the areas most affected by noise and to rectify them. Since the noise source is more reliable, the noise map shows the noise level in different regions more clearly and intuitively than the analog data. Based on the background aforementioned, this research project is aiming to build a 2D traffic noise model about the traffic noise level in CBD. To generate the map, it is needed to measure the traffic noise in Sydney central business district by an appointed application on smart phone called Noise Capture, simply walked on the street and control the location error less than 20 meters to make sure the data can be used and calculated accurately in the following process. The data used to compared in the last procedure is collected from the receiver on the street, combines data from diffraction, reflection and direct reception of vehicle noise calculations. Connect all measured and calculated values through a scatter plot, then correct the error by modifying the different parameters in the code to get the most accurate noise map.

Dynamic Dial-A-Ride for On-demand Public Transport

Jierong Liu

David Rey

This thesis researched on a new dynamic dial-a-ride algorithm for on-demand public transport at off-peak periods. The traffic congestion problem is getting more severe in large cities in Australia. Transport researchers are finding new paradigms to run public transport with the development of mobile technology. The on-mand application allows requests to be considered and provide an immediate response to the customer. The outcome of the research is able to be utilized on on-demand mobility services for public transport, including the mini-bus. In the dynamic dial a ride problem, users request to travel from a specific origin (pick-up point) to the destination (drop-off point), and the service is carried out by a fleet of vehicles. The request arrives dynamically, and the system has no knowledge of future demand. An online routing algorithm is proposed, which objective is to maximize the number of requests accepted subject to constraints such as pick-up time windows, trip duration, and vehicle capacity. The proposed online algorithm is to work dynamically to schedule the new request into the system and provide an immediate response of whether their request is accepted or rejected to the customer. Customers are informed of their departure time when the request is accepted. There are four algorithms to solve the problem. Computer experiments were implemented in Python on two sets of synthetic instances a and b used in Ropke et al. (2007) to test the performance of the algorithm. The algorithms are tested on customer experienterequest acceptance rates and computational time. The result indicates these algorithms could accept most of the requests with reasonable travel time for the customer. In conclusionthe system could take around 20 passengers in a low demand areaand it's possible to operate dynamic DARP in off-peak periods.

Quantifying the relationships between air quality and transport and urban development

Guanglin Ji

Wei Liu

Transport and urban development have been approved that they have an impact on air quality. However, how these two factors affect the variation trend of air quality is controversial in lots of research. This study, using China as a case study, aims to quantify the relationships between them and investigate the degree of influence of each variable by analyzing the data of 276 cities between 2014 and 2017. The model that can describe the relationships of them is established in the first stage. 7 variables of air quality (i.e. AQI, SO₂, CO, NO₂, O₃, PM₁₀ and PM_{2.5}) are designed to be the response variable in the model and 23 variables (i.e. quarters, geographic position, city level, inner or seaside city, developed or developing city, population and High-speed Rail) are designed as the explanatory variables. 0 and 1 variable can be set based on variables to each city. After that, the statistical software SPSS is used to run the multiple liner regression and achieve the result of analysis. The results of this research are that the variation of the population has the highest impact on the AQI, PM_{2.5}, PM₁₀ and SO₂, the variation of GRP has the highest impact on O₃ and NO₂ and CO are highly affected by the variable of High-speed Rail. In conclusion, the relationship between transports and urban development and air quality is positive correlation except for the GRP to NO₂, Population to CO and High-speed Rail to SO₂ which they have the negative correlation between 2014 and 2017.

Emerging mobility solutions

Hae-Lim Yoo

David Rey

Australia's rapid population growth and urbanisation cause heavy traffic congestions in all over Australia's cities as well as other significant problems, affecting the quality of lives of Australians and global environment. Manly, as one of city in Australia provides limited and poor transport services to commuters and residences which contributes to increase its traffic issues and other problems. This paper proposes the implementation of the most practical and clean transportation mode, Hybrid Active Transport in Manly with Ridesharing services as a solution to these chronic traffic congestion problems and to improve long term economic, social and environmental outcomes. A range of scenarios with simulations analyse and evaluate the impact of this emerging transport mode by different perspectives and offers a guideline for further study has to be made.

Modelling Human Mobility for Outbreak Control

Adnan Saad Rabbani

David Rey

Predicting the dynamics of the next epidemic outbreak is a key area of research in the areas of Public Health and Transport Engineering. According to the World Health Organization, Infectious disease was the cause of 5.7 million deaths per year in 2016. This problem is further compounded by the emergence of new pathogens such as the 2009 H1N1 virus, which can threaten global health due to the lack of previous immunity, densely populated urban cities, and the interconnectedness of the global air travel network. This study aims to determine the dynamics of epidemic spread at a local level. Disease spread parameters calibrated for previous epidemic outbreaks, as well as hypothetical scenarios, are modelled to determine attack rates, transmission rates, and peak infection times, for use in the creation of Public Health Policy. The effect of implementing control strategies is also considered.

Although the literature on epidemic modelling is rife, a lack of centralisation makes this information difficult to access or review. A major feature of this thesis is a Table of Reference, which condenses the parameterized diseases modelled, spatial scope, and optimisation strategies tested for 50+ studies, providing the basis for more substantial efforts in condensing current findings in an easily accessible format.

To analyse disease outbreak scenarios, datasets from the Transportation Networks for Research Core Team were used to create graph structures representing Sydney, Australia, with real node populations and link flows. An SIR (Susceptible, Infected, Recovered) model was created using the NetworkX package on Python, and a sensitivity analysis was carried out, with various outbreak cases being compared. As the scope of this study is limited to select networks and control techniques, further research is necessary in developing accurate models for the implementation of different local outbreak controls across varying networks, and also in determining realistic outbreak cases.

Understanding the destination choice behaviour of pedestrians

Yiyun Zhao

Meead Saberi Kalae

Most researchers focus on mode choices or route choices as the main points to establish walking behavior research. However, this paper concentrates on the destination choice behavior of pedestrians to understand what may affect their choice. Through deep-dive analysis of 20215 trips records of Melbourne VISTA data from 2012 to 2016, this paper establishes a discrete choice model with independent variables encompassing distance, travel time and other census data such as population and job density of the destinations. In this model, trips are divided into home-based and non-home-based. Transportation purposes for each category are separated into five subcategories, which will be demonstrated further for the comparison of compares the differences by employing both qualitative and quantitative methods. Lastly, the model will emphasize that firstly, distance variable poses a more negative significant impact on home-based trips than non-home-based trips. Secondly, the population and employment densities of destinations result in a more positive influence than that of origin zones. In conclusion, the destination choice behavior model can be adopted in predicting the pedestrian's behavior, thus it can be recommended in contributing a better allocation of the public infrastructure of city construction, a sound indicator for reasonable economic investments as well as transportation-related economic activities.

Quantifying the relationships between air quality and transport and urban development

Xu Zhang

Wei Liu

The research topic is quantifying the relationships between air quality and transport and urban development. The purpose of this study is to collect and analyze air quality as well as the social and economy data which indicates the development of transportation and urbanization. The mainly methodology behind this paper is using multiple linear regression to analyze the relationships among air quality, the development of transport in high speed railway and population associated with more than 300 Chinese cities' geographical distribution, the economy and political tier of cities and time dimension of a year. There are various kinds of tools used in this research, when collecting data from the certain source, Python is used to programming and downloading data automatically. Because the air quality data involves more than 300 cities and 6 years, it is not really suitable manually. When processing the data, SQL database and Excel is used to manage all the data base and make it the formation which can be easily accessed. The multiple linear regression in SPSS is used when analyzing the relationships in all kinds of data. At this stage, multiple zero-one dummy variables are defined to help with the linear regression analyze such as different tier cities and different geographical distributions. It can be seen that air quality is strongly fluctuate with time change in a year, also has very high correlation with the geographical distribution. There are also some deep relationships with the cities development that air quality has become better. Generally speaking, air quality index(aqi) is associated with various kinds of variables as time change, geographical distribution, social and economy development which indicates urbanization as well as different air pollutants. This paper is to analyze the relationships among all of them and observe how the air quality fluctuate.

Transport Engineering II (Room CE G8)

Time	zID	Student	H/M	Topic	Supervisors
9.00	z5108672	Gu, Zishuo	H	Assessing traffic congestion patterns using crowdsourced data	Chakka, Mohana Naga Sai
9.15	z5059124	Cheng, Vincent Hin Sing	H	Energy Management in Smart Distribution Systems with Vehicle-to-Grid Integration	Hossein Rashidi, Taha Ardeshiri, Ali
9.30	z5020273	Mand, Gurpinder Kaur	H	Urban Goods Movement Data Collection and Modelling	Hossein Rashidi, Taha
9.45	z5019556	Nguyen, Andrew Hieu Chi	H	Changing landscape of mixed-use development resulting from autonomous vehicles	Grzybowska, Hanna Virdi, Navreet
10.00	z5115289	Qiu, Esta	H	Recalibration of Strategic Modelling Parameters for Use with Connected and Autonomous Vehicles	Grzybowska, Hanna Virdi, Navreet
10.15	z5115842	Cashel, Jordan James	H	The impact of automated vehicles on human driver behaviour in transport networks	Prabhakaran, Prasannah
10.30	Morning Tea Break				
10.45	z5077191	Shen, Jane Zifan	H	Assessing the Validity of Hazard Perception Tests (Driving Simulator Study)	Prabhakaran, Prasannah
11.00	z5114047	Rahme, Stephanie Christianne	H	Optimization of Air Traffic	Rey, David
11.15	z5143024	Huang, Rong	M	Modelling and simulation of the stochastic aircraft boarding process	Liu, Wei Zhang, Fangni
11.30	z5098354	Chen, Yuhui	H	Modelling and optimizing an integrated network of autonomous vehicle lanes and non-autonomous local roads	Liu, Wei
11.45	z5115097	Yeung, Mark	H	The Impact of Individual Waiting Time and Maximum Waiting Time on Illegal Pedestrian Crossings at Signalised Intersections in the Sydney CBD	Regan, Mike Prabhakaran, Prasannah
12.00	z5147455	Zhang, Weihao	M	Analysing the impact of autonomous vehicles on the network traffic flow	Gu, Ziyuan
12.15	z5077148	Li, Joel	H	Identifying User Concerns, Problems and Needs relating to the Design and Operation of Off-Street Parking Facilities	Regan, Mike Prabhakaran, Prasannah

Assessing traffic congestion patterns using crowdsourced data

Zishuo Gu

Mohana Naga Sai Chakka

Purpose of study

The analysis of the road network structure of cities can provide invaluable information to transport authorities in managing traffic congestion and improving safety and accessibility. This paper analysed road networks for 93 cities worldwide, the relationship between road network structure and congestion and safety have been conducted.

Methodology

Cities were divided into major and small cities based on their population, developed and developing based on their country economics. Drivable public road network data were collected through OSMnx, it can extract and input data from OpenStreetMap to analyse network properties; the graph drawing ability also enables direct visualisation of the city network. The coverage area of major and minor cities was limited to approximately 100 - 200 km² and 20 - 50 km² respectively centred at CBD. If water or mountain bodies exist within the selected area, polygon were drawn using Google Earth and their areas were measured to be excluded from the total area and the density related metrics calculation. OSMNx can calculate basic descriptive metrics and extended complex metrics.

Summary of results

Circuitry for all cities are low with values slightly above 1, and all standard deviations are close to 0. Node degree centrality and betweenness centrality are significantly less in value and less spread out among major cities than smaller cities. ClusterConclusions

Highly populated cities have a higher proportion of motorways, and primary roads and lower proportion of residential roads. A network with higher node density and shorter edges means a high number of conflicting movements spaced shortly apart, which can have implications on safety as well as congestion. The average weighted clustering coefficient showed a significant variation with more populous cities, typically having a lower value than the others.

Energy Management in Smart Distribution Systems with Vehicle-to-Grid Integration

Vincent Hin Sing Cheng

Taha Hossein Rashidi; Ali Ardeshiri

Sydney is undergoing rapid population growth which has led to large urban sprawls, congestion and dependence on fossil fuel-based vehicles in their journey to work. These conditions have continued to worsen and as such, impacts on air quality, public health and travel times are exacerbating. However, a clean alternative to fossil-fuel dependent vehicles is becoming readily available in the form of plug-in electric vehicles (EVs) with vehicle-to-grid potential.

This thesis explores the possibility of a sustainable workplace-based energy and transport approach which would encourage the adoption of electric vehicles, zero-carbon mobility and an innovative new energy supply chain which envisions take-home-power using vehicle-to-grid (V2G) technology. Two online surveys were distributed to current NSW-based employees and employers to understand their interest and willingness to adopt on-site workplace charging facilities to transfer and discharge energy utilising V2G. Best-worst scaling (BWS) techniques were used as part of the choice modelling exercise to determine the most and least important factors of a workplace-based V2G in terms of benefits, incentives and salary packaging.

The BWS results indicate that employees find that long-term fuel and electrical cost savings and the prospect of a company-owned electric vehicle to be the most appealing. Employers generally favoured the economic prospects of efficient after-hours usage of V2G to generate revenue but were indecisive of what government incentives could be used to ameliorate their concerns about the upfront investment costs. The overall employee and employer perceptions of V2G was that it was an environmentally friendly solution with utility and fuel cost savings, but the initial investment costs were potentially prohibitive.

This study is an important insight into understanding future potential Sydney V2G consumers' mindset. Importantly, it will assist further research and due diligence for preparing policies and workplace strategies to encourage V2G adoption and zero carbon mobility.

Urban Goods Movement Data Collection and Modelling

Gurpinder Kaur Mand

Taha Hossein Rashidi

The efficient delivery of goods and services is pivotal to the success of economies, individual businesses' and ultimately the satisfaction of consumers needs and wants. To better understand the current freight operations, and the impact on the transport network, we need to have the capacity to develop functional freight demand models. These improvements are derived from the quality of data available to feed analysis and modelling techniques. Recently, the need for data in Australia was formally established following the release of the National Freight and Supply Chain Strategy and National Action Plan.

This study aims to develop a better understanding of the movement of goods and services, which can be utilised to better inform infrastructure and policy decisions in urban areas. The data used in this study focused on the Retail Industry and was collected in 2014-15 through an establishment, shipment and driver survey. The survey provided detailed information on 180 establishments in the Sydney Greater Metropolitan Area (GMA) and 478 individual shipments, which were used for the analysis of freight behaviour in this study. Results of the analysis and the model were used to understand the patterns of behaviour related to freight in urban areas and understand its impact on the economy, businesses and ultimately the consumers.

Changing landscape of mixed-use development resulting from autonomous vehicles

Andrew Hieu Chi Nguyen

Hanna Grzybowska; Navreet Viridi

Connected and automated vehicle (CAV) technology has rapidly advanced due to the increase in demand and population. To combat the increasing population, mixed-used developments have been a solution that has been utilised this past decade. Whilst changes in Australian building codes continue to develop, there have been no explicit design changes or guidelines in relation to autonomous vehicles. As CAVs will continue to increase in prevalence, there will be a period in which all vehicles will be connected and autonomous. This presents an opportunity to explore how autonomous vehicles would impact building design. To perform further analysis, sections of a mixed-use building design that were impacted by autonomous vehicles were categorized into carparking and storage, entry/exit paths and logistics. A proposed site plan was based on a case study done in Green Square, Sydney. This was used to develop a new building structure that was influenced by autonomous vehicles. The main assumption for the newly proposed design is that all vehicles would have level five autonomy. The analysis specifically examined the three sections of the building which were altered from the original design. By applying current constructability metrics, a comparison was made between the original site plan and CAV influenced design. Preliminary results showed overall constructability to be improved by 12 percent for a CAV influenced mixed-use building. From the preliminary results, improvements would be beneficial by having potential for different usages of space that was previously used to accommodate normal vehicles and allow for quicker construction. This can be beneficial for the construction project as well as accrue social benefits from better land usage.

Recalibration of Strategic Modelling Parameters for Use with Connected and Autonomous Vehicles

Esta Qiu

Hanna Grzybowska; Navreet Viridi

Strategic models are critical in city-planning and traffic management; they are used to measure traffic performance and assess the traffic impact of proposed developments. However, the development of Connected and Autonomous Vehicles (CAVs) may have profound implications for the current transport planning framework due to differing behaviour from human drivers. Many of the modelling parameters used in the strategic models were calibrated with human driving data. As CAVs are expected to improve traffic performance through shorter headways, faster reaction time and increased vehicle cooperation, these parameters may not reflect the characteristics of a network with autonomous agents.

This thesis aims to assess the adequacy of widely-used mathematical strategic models for use with CAVs, including Roundabout Capacity Models, Volume Delay Functions and Intersection Delay Functions. As there is no available CAV data, the microsimulator VISSIM is used to generate synthetic CAV data for analysis. Traffic networks are simulated at different CAV penetration rates to observe network performance in mixed fleet environments. The microsimulation data is compared with the mathematical models to evaluate the need for recalibration. Preliminary results for roundabouts suggest that the current roundabout capacity models begin to underestimate approach lane throughput at 50% CAV penetration rate, and predict less than 60% of the simulated lane capacity at 100% CAV penetration rate. A similar pattern is observed for volume delay functions, where the models begin to overestimate travel time at freeway weaving segments at 60% CAV penetration rate. The same study approach is applied to a signalised intersection. The remainder of the thesis attempts to recalibrate relevant modelling parameters and examine the predictive quality of the recalibrated strategic functions.

The impact of automated vehicles on human driver behaviour in transport networks

Jordan James Cashel

Prasannah Prabhakaran

Automated vehicle technology is rapidly being prepared for introduction to our road networks in the coming years. Many studies have investigated how these vehicles will navigate our existing network, but there has been little investigation into how human drivers will interact with automated vehicles in a mixed traffic network.

The aim of the research was to investigate how human driving behaviour might change when interacting with partially or fully automated vehicles in the traffic environment. Specifically, the study aimed to understand whether indicating whether a vehicle is manually driven or in fully automated mode, as opposed to being ambiguous, impacted human drivers' behaviour. Given that driving is considered a human social interaction, the study is deemed important as to determine what information should be communicated to other road users to allow for safer driving interactions in a mixed traffic environment.

32 participants in groups of 3, participated in a VR driving simulation study. All three participants were in their own vehicles interacting in the same virtual environment. The primary task was to make a right turn at a T-intersection through a safe gap in a stream of mixed vehicles (blue vehicles = human driven, red = fully automated vehicles and yellow = either human driven or fully automated). The dependent variables were gap acceptance and acceleration, with the independent variable being the vehicle colour.

It was hypothesised that drivers are more likely to accept smaller gaps when there is clear indication the vehicle is fully automated, as they are able to predict how it will behave with greater reliability than if it were a human driver. Preliminary analysis of the results suggest support for this hypothesis. If validated, the results have significant implications for vehicle design to ensure that the integration of automated vehicles increases safety for all road users.

Assessing the Validity of Hazard Perception Tests (Driving Simulator Study)

Jane Zifan Shen

Prasannah Prabhakaran

Hazard perception tests (HPTs) are used to assess a driver's ability to recognise potential dangers on the road and respond appropriately. HPTs have been incorporated into a number of licensing schemes around the globe and typically are computer-based tests that require drivers to respond via a button. However, whether this button press method is valid for measuring real-world hazard perception ability has not been evaluated in the literature.

This study aimed to assess the validity of a current HPT by comparing vehicle pedal pressing behaviour in a driving simulator. The research objective of this study was to determine whether there was a relationship between drivers' pedal press responses and button press responses and compare the effectiveness of these two HPT methodologies in assessing driver hazard perception ability. Measuring hazard perception through the use of a driving simulator with accelerator and brake pedals was considered a more ecologically valid way compared to the button press approach and as such was hypothesised to more accurately measure hazard perception of drivers.

32 participants were allocated to one of two groups button press group or pedal press group and were asked to respond to 26 HPT video clips. Two dependent variables were used to measure hazard perception the time participants anticipated a potential hazard (e.g. eased off the accelerator) and the time they acted in response to a hazard (e.g. broke). Preliminary results revealed that for 57% of HPT clips, response times to anticipate and act towards hazards were significantly different between the button and pedal groups. The results cast doubt on the validity of the button press method currently employed to measure driver hazard perception ability. If substantiated, the present study suggests that vehicle pedal presses may be a more suitable and more valid alternative for measuring hazard perception ability.

Optimization of Air Traffic

Stephanie Christianne Rahme

David Rey

The future of the aviation industry is expected to experience significant growth due to the increasing demand of air travel and the contributing impacts of globalisation. The regions most affected by congestion and face the greatest difficulties in coping with the demand surge include Europe and Asia. This global growth presents many challenges as current air traffic management systems are unable to keep up with the increasing demand. As a result, the aviation industry requires new systems to ensure safety between aircraft, improve efficiency and maximise air space capacity.

For this thesis, a framework model is presented which addresses the aircraft conflict resolution problem. This model is based on a time discretised approach which considers the parallel recovery of aircraft through a single manoeuvre. The model compares six overall approaches: a synchronous approach, an asynchronous approach and four different combinational approaches. The combinatorial approaches include three static methods which comprises of the speed deviation, angle deviation as well as a weighted function of both speed and angle deviations. The fourth approach is a dynamic method which considers time as a factor in determining the recovery combination. The combinations which result in a lower overall recovery time are favoured.

Through an analytical comparison of these different approaches, it was found the combinatorial approaches produced the best results overall, followed by the asynchronous and synchronous approaches respectively. The objective function of the model is able to consider a variety of different factors which include fuel expenditure and delay costs. The advantage of this model lies in its ability to solve instances with up to 20 aircraft in conflict which aims to simulate real air traffic scenarios.

Modelling and simulation of the stochastic aircraft boarding process

Rong Huang

Wei Liu; Fangni Zhang

Airplanes has been a convenient travelling method for both recreation and business. In order to save airline company cost in turnaround time and enhance passenger's boarding experience, an optimal boarding strategy that saves time need to be found.

In this thesis, firstly six popular boarding strategies are explained. Then, the boarding process is simulated by Matlab based on cellular automaton model and the cabin is modelled based on a real Australian domestic aircraft QANTAS 737-800.

The behavior under various situations of the boarding strategies are indicated by total boarding time, individual boarding time and the number of interferences. The situations consider different luggage loads and different durations dealing with interference.

The result shows that Steffen method which minimizes both seat interference and aisle interference, is always the best boarding strategy in different cases when considering the boarding time. However, since the group boarding (for example family) is not taken into account, Steffen method acting as a separated boarding method may not be fully accepted. In that way, boarding in several zones from back to front is an alternative feasible solution, which have the second least total boarding time and the smallest standard deviation for individual boarding time.

Modelling and optimizing an integrated network of autonomous vehicle lanes and non-autonomous local roads

Yuhui Chen

Wei Liu

There is no doubt that the development and introduction of autonomous vehicles (AVs) will bring significant changes to the current transportation systems. The AVs, relying on various sensors, can travel in the traffic network with little direct human input. The potential profits of the AVs concept include the increase of driving safety, reduction of travel time and fuel emission. Furthermore, the presence of AVs can decrease the shockwave and increase mobility as well in terms of the transportation system performance. Various studies have been done to research the AVs transport system. However, the penetration of AVs will take time to process, an inevitable scenario that mixed types of vehicles (AVs and CVs) will exist for a period. Therefore, some motorways and highways will be first converted or constructed into AV lane. Few pieces of research have focused on this area. There is a need for a comprehensive modelling and optimizing framework of the mixed network of autonomous vehicle lanes and non-autonomous local roads. This study presents a framework of modelling and optimizing the integrated network with a highway with AVs and two local roads with CVs connecting a single origin-destination pair. The model has taken the unity of AVs, value of driving time, manmade route choice decision and randomness of human behaviour into consideration. The model shows that the total system travel time and total travel time cost decreases to a constant level with the increase of the highway length. The value of time, tolling price and speed limit sensitivity test was performed as well. Moreover, an optimal tolling scheme has been developed under high traffic demand scenario. In conclusion, this study provides a comprehensive view of mixed traffic network and presents a basic framework of optimizing the network by applying a toll.

The Relationship between Pedestrian Characteristics, Individual Waiting Time, Maximum Waiting Time and Illegal Crossing Behaviour at Signalised Intersections in the Sydney CBD

Mark Yeung

Mike Regan; Prasannah Prabhakaran

Illegal crossings by pedestrians contribute significantly to pedestrian fatalities. Classification of pedestrians (e.g. by age) who cross illegally has been studied. However, nothing is known about the relationship between illegal crossing and how long pedestrians wait before crossing (Individual Waiting Time, IWT); and few studies have examined the relationship between Maximum Waiting Time (MWT) and illegal crossing. No Australian studies have examined the latter two issues.

The study was designed to answer three research questions:

1. What proportion of pedestrians cross during the Green phase (GP), Flashing Red phase (FRP) and Static Red phase (SRP) at signalised pedestrian crossings?
2. Is there a relationship, if any, between the IWT and MWT?
3. Is there a relationship, if any, between the number of pedestrians crossing illegally during the FRP and SRP, and MWT?

An observational study was conducted at nine signalised intersection crossings in the Sydney CBD. Signal phase durations and number of pedestrian crossings during each phase were recorded manually for 1.5-hrs by two observers, using a custom-made Ipad application. Video footage was collected to verify manual recordings, calculate IWTs and derive other measures (gender, age and pace). Chi-square, t-test, and ANOVA statistics were used to answer research questions 1, 2, and 3, respectively.

6,931 pedestrians crossed during the GP (86.5%), FRP (5.48%) and SRP (8.02%). Of the recorded 853 that crossed illegally, 64.2% were male, 92.8% were young adults and adults, and 86.9% were walking. At the time this abstract was written, analyses of data for Research Questions 2 and 3 could not be completed. Full results will be presented in the Thesis.

Illegal crossings in the Sydney CBD are alarmingly high (13.5%), with males (aged 18-59) most likely to offend. This study provides objective data that can be used to inform countermeasure development to improve pedestrian safety.

Analysing the impact of autonomous vehicles on the network traffic flow

Weihaio Zhang

Ziyuan Gu

Autonomous vehicles currently have been introduced to provide convenient and comfortable travel for human beings, improve traffic conditions, and ensure travelers' safety. Because AVs (Autonomous vehicles) have not been run on the real traffic roads, the benefits from AVs can not be approved. This study aims to analyze the effects of AVs on traffic flows under various penetration rates and different traffic conditions. The analysis uses a simulation tool named SUMO (Simulation of Urban Mobility) to create a two-loop and one-merge traffic environment (loop-merge system). The experiment runs dozens of times simulation under different numbers of vehicles and various penetration rates of AVs to analyse how the AVs affect traffic flows. The results of simulation show that the participation of AVs in this environment can increase traffic flows and improve traffic conditions under certain penetration rates. However, the simulation also shows that as the increase of the penetration rate of AVs, the standard deviations of traffic flows are becoming larger, which means the traffic stability getting deteriorated. The instability is mainly caused by turning and merging operations without AVs being connected to cooperate. Nevertheless, the results may be inaccurate due to the only condition of vehicles in the loop-merge system considered. It may also have different conclusions from various traffic conditions. Moreover, the human-driven vehicles have different performance because of different drivers' behaviors. In addition, there might be some errors in this experiment, and the results of observation from real traffic roads may also differ from simulations. Therefore, to entirely and preciously analyse the effects of AVs on traffic flows, more sophisticated experiments and real traffic practices are required.

Identifying User Concerns, Problems and Needs relating to the Design and Operation of Off-Street Parking Facilities

Joel Li

Mike Regan; Prasannah Prabhakaran

Off-street parking facilities are a common feature of many metropolitan cities. However, there is little literature around what user-centred aspects are critical for the design of these facilities. As such, the aim of the research was to identify user concerns, problems and needs relating to the design and operation of off-street parking facilities.

The study was designed to answer three research questions:

1. What negative aspects or concerns do users have about the design and operation of off-street parking facilities (multi-storey car parks and open-air car parks)?
2. In what ways do users think the design and operation of off-street parking facilities could be improved?
3. How much of a problem for users are these negative aspects or concerns?

Two online surveys were created. Survey 1 (S1): to answer Research Questions 1 and 2; Survey 2 (S2): to answer Research Question 3. The surveys were distributed to respondents through emails and social media. The negative aspects and concerns of parking facilities raised by respondents were assessed categorically in S1 and ratings were analysed using appropriate statistics in S2.

Results of S1 identified 9 broad categories of negative aspects and concerns: access points; availability and congestion; compliance; environmental and aesthetic issues; layout and design; payment; safety; technology and visibility. The most problematic issues identified in S2 were availability, congestion, and payment (for multi-storey car parks); and compliance with rules and aesthetics (for open-air car parks).

The findings of the study provide recommendations for improving the design and operation of off-street parking facilities, centered around the users' needs and expectations.