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**THNS 2021**  
**“Resilient City and Transport”**

**ABSTRACTS**  
**OF**  
**AWARD WINNERS**



**“Transports à Haut Niveau de Service”**  
**The International Symposium on Sustainable Development of**  
**Urban Transport Systems**

# Best Research Gold Award

# Impacts of Urban Rail Transit Lines on Car Ownership: Evidence from the Opening of the Circle Line in Singapore

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**Personal Profile:** Mi DIAO is a professor in the College of Architecture and Urban Planning at Tongji University. Mi DIAO received his Ph.D. in Urban and Regional Planning and Master in City Planning from Massachusetts Institute of Technology, USA, and Bachelor's and Master's degrees in Architecture from Tsinghua University, China. At the nexus of urban planning, urban economics, and urban technology, Dr. Diao applies urban economics theories, emerging big data, and new analytics in tackling urban challenges. His research has appeared in leading academic journals such as Nature Sustainability, Journal of Urban Economics, Regional Science and Urban Economics, Urban Studies, Journal of Planning Education and Research, Transportation Research Part A, C, D, and Environment and Planning A, B.

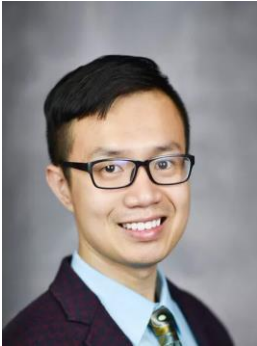
**Keywords:** Urban rail transit; Car ownership; Difference-in-differences; Two-dimensional propensity score matching; Singapore.

**Abstract:** Urban rail transit system has been considered an important component of the policy package of today's cities in addressing transport challenges and reducing car dependency. In this research, we use the opening of fourth Mass Rapid Transit (MRT) Line in Singapore, the circle line (CCL), as a quasi-natural experiment to assess the impact of new urban rail transit lines on car ownership. We perform a difference-in-differences analysis based on two national household travel surveys conducted before and after the operation, respectively. To control for the demographic heterogeneity, we adopt a two-dimensional propensity score matching approach to create matched samples so that we can compare car ownership levels of the same type of households in the treatment and control areas as well as before and after the opening of CCL to isolate the treatment effect of CCL. We find that the opening of CCL can reduce the car ownership level of households who located within 500 meters from CCL stations relative to those living farther away from the stations. With matched samples, the treatment effect of CCL becomes more profound than that estimated with the unmatched samples. The findings can withstand a set of robustness checks. We also find that CCL reduces car ownership of households with both home and work locations close to rail transit stations, while its impact on other households is insignificant. Furthermore, the opening of CCL shows significant impact on households' decisions on whether to purchase the first car, while its impact on the number of cars given car ownership is insignificant. The research findings provide new evidences that support the effectiveness of urban railtransit investment in reducing car ownership.

## Does Ridesourcing Provide Equitable Accessibility?

**Sicheng Wang**

Michigan State University



**Personal Profile:** Sicheng Wang earned a PhD from Edward J. Bloustein School of Planning and Public Policy at Rutgers University in 2021. He is now Research Associate in the Department of Geography, Environment, and Spatial Sciences at Michigan State University. With a background of urban and transportation planning, Wang’s research interests include travel behavior of using emerging transportation technologies (e.g., autonomous vehicles, Mobility-as-a-Service, and shared micro-mobility), the social and economic impact of information and communications technology and autonomous vehicles, and opportunity accessibility and social justice in transportation in the Automation Age. Wang received the 2020 Regional Science Association International (RSAI) Czamanski Dissertation Award, the 2020 International Association for China Planning (IACP) Karen Polenske Best Student Paper Award, and was selected as the finalist of 2021 World Society for Transport and Land Use Research (WSTLUR) Best Thesis Award. He also received 2018 and 2019 American Public Transportation Foundation Scholarships. Before joining WEAVE, Wang taught GIScience in the Department of Geography at the University of South Carolina. He had extensive research experience at the Alan M. Voorhees Transportation Center and the National Center for Smart Growth. He also worked as an urban planner and designer for years in Shanghai, China.

**Keywords:** ride sourcing, accessibility, equity, spatial model

**Abstract:** In this study, we conduct a comprehensive evaluation of the accessibility offered by ridesourcing services. We measure accessibility of ridesourcing and transit to three types of destinations: healthcare facilities, restaurants, and grocery stores in Chicago. Realized ridesourcing trip data are used to calculate the average travel times between origins and destinations. Both the employment volume by sector and points of interest locations are used to measure the opportunity attractiveness for estimating accessibility. We estimate spatial autoregressive models to examine the associations between realized ridesourcing accessibility and census tract-level demographic and socioeconomic indicators. Results suggest that ridesourcing has a less equitable distribution compared to transit, based on the median household income of census tracts and minority populations in those tracts. The analysis provides guidance for policymakers on the inequities associated with new mobility options and how best to offer improved accessibility for disadvantaged populations.

# Best Research Silver Award

# Energetic Optimization of Stirling Engines for the Valorization of Exhaust Gas Issue from Ice and Its Use in Transport and Sustainable Energy

**Fethi Aloui**

INSA Hauts-de-France



**Personal Profile:** Fethi ALOUI is a full Professor of Mechanical Engineering and Energy Systems since September 2011 at the Engineering School INSA Hauts-de-France of Valenciennes (UPHF), Laboratory LAMIH (UMR CNRS 8201), France. He has published more than 230 journal and conference papers so far.

**Keywords:** Transport, Stirling engine, Micro-cogeneration, Heat transfer, Optimization

**Abstract:** In the energy and environmental context, the interest in improving the thermal performance of piston machines, has known recently important developments. Indeed, piston machines have been used to develop several engineering applications: energy production, cogeneration and micro-cogeneration, automotive propulsion, and many another industrial systems. The improvement of these machines can be done only by understanding the flow transport / transfer phenomena and especially the heat transfer.

# The Impacts of Land Use on Urban Road Network Vulnerability: A Case Study in Wuhan

Zhao Liyuan

Huazhong University of Science and technology



**Personal Profile:** Liyuan Zhao Ph.D Professor, Supervisor of Doctorate Candidates Dr. Zhao received her jointed Ph.D in urban and regional planning from University of Florida, U.S. and in transportation planning and management from Southwest Jiaotong University (SWJT), China. She has hosted two grants sponsored by National Natural (Social) Science Foundation of China, four grants sponsored by provincial and ministerial foundation, and over twenty practical projects in the area of urban planning and design. She has authored many publications in top journals in urban planning and transportation, including Transport Geography, Transport Policy, Journal of Urban Planning and Development, and Journal of Transport Geography. Research Fields: Urban transportation planning and design, Application of intelligent technologies in urban planning, Urban sustainable development.

**Keywords:** transportation planning, land use, mobile phone signaling data, vulnerability

**Abstract:** Growth in travel demand exacerbates the road network vulnerability. This study aims to explore how the source of travel demand, that is, the land use spatial layout, impacts road network vulnerability. Based on the interaction between land use and transportation, this study develops a new raster-based road network vulnerability assessment model and employs a logistic model to quantify the correlation between land use and vulnerability. To assess the raster-based vulnerability, this study uses the change in the total travel time for all O-D pairs before and after the disruption of all intersecting links and nodes within the geographical extent of a grid. The central city in Wuhan, China, was selected as the case study which was divided into 2096 grids of uniformly shaped and sized cells. Highly vulnerable areas showed a centripetal distribution trend and were mainly concentrated in the areas around the bridges, expressways, and arterial roads. The logistic model revealed the statistical results that the closer to residential land, public service land, and water area, the higher the vulnerability. Intensive density and land use mix increase the vulnerability of road networks. High risk road links were identified for adapting strategies by overlapping the congested road maps with the vulnerability results. Police implications were summarized to mitigate road vulnerability. This method provided technical support for prioritizing the improvement of road network resilience.

## Innovative Forms of Housing and Mobility for Paris 2024

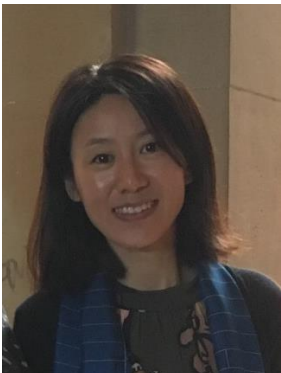
Mazzoni Cristiana <sup>1,\*</sup>, FAN Lang <sup>4</sup>, Magliacani Flavia <sup>2,3</sup>

1. ENSA Paris Belleville ; 2. University Roma La sapienza ; 3. ENSA Paris Belleville ; 4. ORIA Paris

### Personal Profile:



Cristiana Mazzoni is an architect, urban designer and Professor of Architecture and Urban design in the National Architectural school of Paris-Belleville (ENSA PB). During her academic career she has been teaching as visiting professor in Italy, Germany, France, Spain, USA and China. She is the Director of the Research Center UMR AUSser, in the framework of the French Scientific Research Center (CNRS). She is in the scientific committee of the Chinese and French “Innovative metropolitan mobility” Chair (IMM Chair) and scientific director of the “Metropolitan Architecture and Great Events” Chair (MAGE Chair). She directs several research projects funded by the French Ministry of Environment (MEDDE) and the French Ministry of Culture (MC) on the topics of: 1. Metropolitan development, regional planning and urban design, innovative and integrated mobility, railway infrastructures and railway stations; 2. Historical courtyards blocks in European heritage cities; 3. Architectural and urban European theories (20th Century). She edited more than 80 scientific publications (books, thematic magazines and articles).



Fan Lang is an architect and urban designer (China and France). In 2018, she defended his doctoral thesis (PhD) in the Strasbourg university about « Neighbourhood relations in today's Asian metropolis. Types of housing and forms of cohabitation analysed through the prism of the notion of Harmony », under the supervision of prof. Cristiana Mazzoni.

She is actually lecturer in the field of urban design in the Architectural School of Strasbourg and researcher in the AMUP Laboratory (since 2011). She is part of the research team of the Shanghai Academy of Social Sciences (SASS). Since 2016, she is in the teaching staff of the Sino-French Chair on Metropolitan Innovative Mobility (IMM Chair - ENSA Strasbourg, CAUP



Tongji/Shanghai, SYSTRA). She is the co-coordinator of the Double Master Degree Program, France-China, « Architecture, urban planning and design », ENSAS-CAUP Tongji/Shanghai (since 2015).



Flavia Magliacani is architect graduated in the University of Rome La Sapienza. She is a doctoral candidate of cycle XXXIV, Rome La Sapienza in co-tutorship with ENSA Paris Belleville - Université Paris Est, IPRAUS-AUSser laboratory. She is currently working on housing and urban density in the contemporary European metropolis, as part of a thesis work entitled “Urban Density in the Contemporary Metropolis. Urban forms and housing in Greater Paris”.

**Keywords:** innovative mobility , housing, JO Paris 2024

**Abstract:** The aim of the conference is to present the research work we are currently carrying out on the evolution of housing and mobility in Greater Paris by questioning the notion of sharing, density and urban intensity. A focus will be made on the work in progress for the Paris 2024 Olympic Games.

# Best Research Bronze Award

## What Motivates Drivers to Comply With Guidance Information at Signalized Intersections?

Chen Xumei

Beijing Jiaotong University



**Personal Profile:** Dr. Xumei Chen is a professor at Beijing Jiaotong University. She was a visiting scholar at UC Berkeley, Texas Southern University, and University of Waterloo. Dr. Chen has extensive experience on urban transportation planning, managed lane capacity analysis, emission modeling, and transit operation evaluation. She has been a primary investigator or co-investigator in more than 40 projects, which were sponsored by a variety of national and municipality level agencies such as National Natural Science Foundation of China (NSFC), Ministry of Education of China, Beijing Environmental Protection Bureau, Beijing Transportation Research Institute, and Beijing Public Transport Holdings Co., Ltd. Dr. Chen has authored and co-authored over 80 peer-reviewed journal papers and conference papers. Dr. Chen is the international peer reviewer for national fund sponsored by Singapore and Chile. She also currently serves as a reviewer for journals and conferences such as Transportation Research (TR) - Part A, C, D, E, and TRB annual meeting etc. Dr. Chen has rich experience on organizing international workshops, including a workshop held at Newcastle University in UK, which was jointly funded by the British Council Newton Fund Scheme and National Natural Science Foundation of China. Dr. Chen is a member of the Transportation Research Board (TRB) committee on Managed Lanes, Institute of Transportation Engineers (ITE), and a number of other professional organizations.

**Keywords:** Driving Behaviour, Latent Class Analysis, Intrinsic Motivation

**Abstract:** This presentation focuses on a study in which the intrinsic motivation of drivers most likely to accept guidance information at signalized intersections has been explored by using a mixed model approach. The proposed approach contains a Multiple-Indicator Multiple-Cause model with a Latent Class Analysis. The MIMIC model was used to quantify intrinsic motivations according to individual heterogeneity. From a group similarity perspective, the LCA was employed for the latent classification of drivers. The features and possibility of accepting guidance information of each class were also analyzed according to the intrinsic motivation of drivers. Data were collected from the Stated Preference online surveys, in which the questionnaire was designed according to the Diffusion of Innovation, in 2015 and 2019 in China. Four subjective perceptions of drivers were identified: the perception of innovating guidance information, the perception of convenience regarding guidance information transmission, the perception of surrounding complexity, and individual innovation. The estimation results show that age, driving experience, education levels, and the familiarity with road network are significant factors of compliance behavior. The proportion of conservatives gradually decreased from 2015 to 2019, while the proportion of early followers and late followers increased through market penetration, familiarity with the internet of vehicles, and social networks in the same period. This prevalence demonstrates that guidance information at signalized intersections is gradually becoming acceptable in China.

## Spatio-Temporal Variation Induced Group Disparity of Intra-Urban No<sub>2</sub> Exposure In Shanghai

Luo Xiao , Wang Huizi , Liu Chao  
Tongji university



**Personal Profile:** Dr.Xiao LUO is now currently an associate professor of Transportation Environment in the college of Transport Engineering, Tongji university, China. Xiao LUO firstly worked in industry as deputy director planner in Shanghai Tongji Urban Planning and Design Institute after he get Phd degree from Nagoya university in 2015, and then started work as associate professor in Tongji university in 2018 because of his excellent performance in research and teaching, he had led more than 10 important projects on urban planning and transport environment with big data technology. He is now gest editor of “Technological Forecasting and Social Change”, he serves as chairman of Special interest Group F3 (Smart transport, Smart city and Quality of Life) in World transport Research Society, technical committee member of WTC (World transport Convention). His current research areas focus on smart transport, transport environment, quality of life, and related IOT techniques.

**Keywords:** Land Use Regression (LUR), Mobile Phone Signal Data, NO<sub>2</sub>, Population Exposure, Group Disparity

**Abstract:** Previous studies on exposure disparity focused more on spatial variation but ignored the temporal variation of air pollution, and, thus, it is necessary to explore group disparity in terms of spatio-temporal variation to assist policymaking regarding public health. This study employed the dynamic Land Use Regression (LUR) model and mobile phone signal data to illustrate the variation features of group disparity in Shanghai. The results showed that NO<sub>2</sub> exposure follows a bimodal, diurnal variation pattern and remains at a high level on weekdays but decreases on weekends. The most critical at-risk areas lie within the central city in areas with a high population density. Moreover, women and the elderly proved to be more exposed to NO<sub>2</sub> pollution in Shanghai. Furthermore, the results of this study showed that it is vital to focus on land-use planning, transportation improvement programs, and population agglomeration to attenuate exposure inequality.

## Unlocking the Long-Term Potential of Land Value Uplift in New Subsidiary Centres: How Does Planning Matter?

**Tianren Yang**

University of Hong Kong



**Personal Profile:** Tianren Yang is an Assistant Professor in the Department of Urban Planning and Design at the University of Hong Kong. He is interested in developing advanced urban analytics and modelling to provide an all-round understanding of how cities evolve, particularly in relation to technology, policy and human behaviour. His current research explores integrated policy perspectives to measure and predict how to maximise economic, environmental and social benefits through the spatial coordination of various urban developments (e.g. housing, jobs and transport).

**Keywords:** Land value capture, Urban spatial structure

**Abstract:** New subsidiary centres tend to be planned in currently low demand areas, where the potential of radical urban transformation is high, but the prima facie prospects of land value capture are poor. This research develops a spatial equilibrium framework to predict how sub-centre planning can lead to higher economic prospects of land value gains and improved lives for residents. Applying the model to Shanghai reveals that the annual land price increment will range from 0.5% for a purely residential development to 14.2% for an employment-oriented growth. Furthermore, economic and social trade-offs matter in where to locate these large-scale developments.

# Development and Future Prospects of Roadside Detection Technology for Intelligent Transportation

BI Xin

Tongji University



**Personal Profile:** BI Xin is a Researcher / Ph.D. supervisor of Tongji University. Former researcher of Shenyang Institute of automation, Chinese Academy of Sciences. The visiting scholar of Massachusetts Institute of Technology (MIT) in 2014. Expert member of ISO / TC204-WG14, member of SAC / TC268, member of SAE International Technical Committee and member of Shanghai Artificial Intelligence Technology Association. He has published more than 60 SCI \ EI articles, authorized more than 40 patents and 3 monographs. Scientific and technological achievements are widely used in the fields of automobile driverless and active safety, vehicle road collaborative perception and planning, rail transit active safety system, UAV autonomous obstacle avoidance and industrial intelligent measurement and control.

**Keywords:** Roadside detection, intelligent transportation

**Abstract:** Autonomous driving and intelligent transportation system based on vehicle infrastructure cooperation have gained increasing attention and importance in the industry. Roadside detection as the core technology of intelligent transportation system, has been well developed relying on advanced technologies such as AI, the commercial use of 5G, and big data. Roadside detection is a comprehensive technology that involves target recognition, trajectory prediction and tracking, low-latency data transmission in different environments. Depending on the circumstances, different technical solutions apply to different scenarios. Considering cost and economic benefits, the roadside detection system can be constructed in a hierarchical manner to provide early warning, collaborative sensing, remote control and other services for autonomous vehicles at different stages. This core technology provides effective support for the optimization of intelligent traffic efficiency and the final resolution of traffic accidents and congestion.

# Prediction of Metro Ridership During The Covid-19 Pandemic: A Deep Learning Approach Based on Heterogeneous Graph

**Fang Xiao-Rui**<sup>1,\*</sup>, Yang Jin-Ming<sup>1</sup>, Wang Hong-Wei<sup>1</sup>, Peng Zhong-Ren<sup>2</sup>

1. Shanghai Jiao Tong University ; 2. University of Florida



**Personal Profile:** Xiao-Rui Fang Postgraduate Student Center for Intelligent Transportation Systems and Unmanned Aerial Systems Applications Research, State Key Laboratory of Ocean Engineering, School of Naval Architecture, Ocean & Civil Engineering, Shanghai Jiao Tong University.

**Keywords:** Metro Ridership Prediction, Deep Learning, COVID-19, Heterogeneous Graph Network, Attention Mechanism

**Abstract:** The COVID-19 pandemic has changed people's lives and travel patterns. During the pandemic, travelers prefer more to travel by private cars, which runs counter to the current sustainable development policies advocated by governments. Although current researches have studied the changes in people's travel behavior during the pandemic from different aspects, how to build a model predict metro ridership during the pandemic remains understudied. In this study, we innovatively propose a deep learning model called Heterogeneous graph attention network (HetGAN) for the prediction of metro ridership during the COVID-19 pandemic. Metro stations and geographical city blocks are formulated as heterogeneous nodes in a complex network which contains both metro ridership and infection information. Attention mechanism is then implemented to capture and aggregate information of the two types of nodes in the heterogeneous graph. Numerical experiments in New York show that, during the pandemic, the proposed heterogeneous graph network is able to capture the correlation between metro ridership and infection number and then make accurate metro ridership prediction. Comparing to baseline models which do not consider the pandemic infection number, the proposed HetGAN model acquired a performance gain of 11% on average. This study contributes technically to help researchers and policy makers to predict the possible change of metro ridership under the influence of the pandemic, and make corresponding countermeasures in advance.

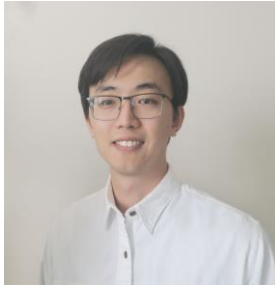
# Best Student Research



# Origin-Destination Matrix Estimation: A Bayesian View on Traffic Assignment Using Probe Trajectory Data and Link Counts

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1.Ecole des Ponts ParisTech ; 2.CY Cergy Paris Université



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**Keywords:** Origin Destination Matrix Estimation, Bayesian Assignment, Heterogenous Sampling Rates, Probe Vehicle Trajectories, Link Flow Counts, Cross Entropy Minimization

**Abstract:** Being a fundamental metric of the transportation network, the origin-destination flow matrix is a critical input for various transportation models and studies. This paper deals with the estimation of an OD matrix of trip flows based on two kinds of data: probe trajectory data and local traffic counts. A Bayesian assignment framework is developed for demonstrating the relationship between the link probe sampling rates and the fractional contributions from the sampling rates on different OD pairs. The unknown OD matrix is estimated by applying cross entropy minimization using a prior matrix from the probe trajectories, along with the Bayesian assignment rules on link sample rates as the constraints. The methodology was applied using Floating Car Data and camera link flow counts for a numerical experiment. The results show that the method can achieve in a robust estimation of OD matrices, even using different prior matrices. The issue of the heterogenous sampling rates can be well addressed with link count constraints, effectively correcting the unknown bias in the probe sampling. The case study using real data also proves the feasibility of mining observed trajectory data to obtain the assignment fractions and estimate the OD matrix inversely, avoiding conventional sophisticated process of traffic assignment modeling.