Conference Program

2026 10th International Conference on Intelligent Traffic and Transportation (ICITT 2026)

September 2-4, 2026

Oslo, Norway

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Welcome Message

On behalf of the ICITT organising committee, first and foremost we would like to take this opportunity to thank all of the contributing authors for their high-quality papers submitted, the reviewers for their time and constructive comments, the plenary and keynote speakers for sharing their research with the delegates and the local organizing committee for their careful preparation of the conference. Our thanks go to the Programme Committee members who helped to review papers and ensure the high quality of the conference.

We would like to acknowledge ICITT consortium members and industrial partners for their support at this conference. The conference theme of ICITT2026 is 'Impact of Generative AI Technology and 3D Machine Vision Streaming on Autonomous Vehicles Operational Safety Essentials'. Within the context ICITT2026 will bring researchers, academics, and industrialists together to share their vision, knowledge, and experience, and discuss emerging trends and new challenges in the field. The conference main plenary keynote speech will be presented by Professor Dr. Mahmoud Shafik, CTO of GIES Innovation Ltd and Senior Lead Academic of University of Greater Manchester, UK. The keynote speeches will be offered by Professor Dr. Agus Budiyono, Indonesia Center for Technology Empowerment, Indonesia & Professor Dr. Xiaojun Zhai, University of Essex, UK and Professor Dr. Chun Sing Lai, Tianjin University, China. The conference also includes a number of session keynote lecturers provided by Prof. Sara Moridpour, RMIT University, Australia & Prof. Fabian Diaz, Universidad Tecnica Particular de Loja, Ecuador & Mr. Christian Wille, German Aerospace Center, Germany & Prof. Joewono Prasetijo, Universiti Tun Hussein Onn Malaysia, Malaysia & Prof. Emre Kuskapan, Erzurum Technical University, Turkey & Prof. Marko Durasevic, University of Zagreb, Croatia and Prof. Amur S Ai Yahmedi, Sultan Qaboos University, Oman.

This conference eBook is SCOPUS indexed and the fifth iteration of the conference wider publications to ensure that international scholar able to make the best out of the conference. This year the selection of the peer reviewed paper included are focused on: Intelligent Traffic and Transportation, Autonomous Technology, Industrial Automation, Artificial Intelligence, Machine Deep and Cognitive Learning, Distributed Networking, Transportation in Future Smart Cities, Hybrid Vehicles Technology, Mobility, Cyber-Physical Systems, Design and Cost Engineering, Enterprise Information Management, Product Design, Intelligent Automation, ICT-enabled Collaborative Global Manufacturing, Knowledge Management, Product-service systems, Optimisation, Product Lifecycle Management, Sustainable Systems, Machine Vision, Industrial 4.0 and beyond, and Navigation Systems.

We look forward to welcoming you to ICITT2026 and hope that every delegate enjoys the conference.

Mahmoud Shafik

Editor & ICITT Conference Chairman

Conference Venue

Quality Hotel Hasle Linie
Add.: Bøkkerveien 15, 0579 Oslo, Norway
Tel.: +47 21 95 78 00
Web: https://www.strawberry.no/

Time Zone

UTC/GMT+2

Important Notes

- ✧ Please take care of your belongings during the conference. The conference organizer does not assume any possibility for the loss of personal belongings of the participants.
- ✧ Please wear delegate badge during the conference. There will be NO access for people without a badge. Never discard your badge at will.
- ✧ Accommodation is not provided. Early reservation is suggested to be made for delegates.
- ✧ Please show the badge and meal coupons during lunch and dinner.
- ✧ Don't stay too late in the city and don't be alone in the remote area. Be aware of the strangers who offer you service, signature of charity, etc., at scenic spots. More Tourist Information and Security tips are available online.
- ✧ Delegates are advised to carry sufficient cash with them when travelling around.

Important Phone Numbers

In case of emergency in the Norway, please call **112** for **Police Assistance; 110** for **Fire Alarms & Rescue; 113** for **Medical Emergencies**

September Climate & Weather Averages in Oslo

High Temp: 15.2 °C Low Temp: 9.1 °C Mean Temp: 12.1°C

Online APP

ZOOM Download Link: https://zoom.us/download
ZOOM Using & Presentation Instruction:
www.icitt.org/kits.zip

Please rename your screen name before entering the room

Rename Screen Name Before Entering the Room	Examples
Authors: Paper ID-Name	OL901-San Zhang
Delegate: Delegate- Name	Delegate-San Zhang
Keynote Speaker: Keynote-Name	Keynote-San Zhang
Session Keynote Lecturer: Session Keynote-Name	Session Keynote-San Zhang
Committee Member: Committee-Name	Committee-San Zhang

Materials Prepared by the Presenters

✧ **Oral Presentation:**

PowerPoint or PDF files

PowerPoint Background Template: www.icitt.org/kits.zip

Duration of Each Presentation

✧ Plenary Speech: 40 Minutes of Presentation including Q&A.

✧ Keynote Speech: 40 Minutes of Presentation including Q&A.

✧ Session Keynote Lecture Speech: 25 Minutes of Presentation including Q&A.

✧ Regular Oral Presentation: 15 Minutes of Presentation including Q&A.

Note

✧ The regular oral presentation time arrangement is for reference only. In case any absence or some presentations are less than 15 minutes, please join your session before it starts.

An excellent presentation will be selected from each session which will be announced and awarded an excellent presentation certificate.

Plenary Speaker

September 03, Thursday, 09:05-09:45, GMT+2, Oslo Time

Meeting Room: Ekvator - 1st Floor

Prof. Mahmoud Shafik

CTO of GIES Innovation Ltd and Senior Lead Academic, University of Greater Manchester, UK

Speech Title: Intelligent Traffic and Transportation Challenges and Opportunities: Impact of Generative AI Technology and 3D Machine Vision Streaming on Autonomous Vehicles Operational Safety!

Abstract: Generative Artificial Intelligence (AI) Technology, 2D/3D Machine Vision, and Industrial Automation are developing rapidly. As they are one of the greatest approaches to enhance and strengthen autonomous machine potentials, increase navigation precision and are moving from simple reasoning towards human-like cognitive learning abilities. This confirms the urgent need to adopt such technology to enrich intelligent traffic, and transportation systems and its infrastructure. As, this could strengthen transportation network potentials, enhance mobility, and increase productivity. There are significant technical challenges with intelligent traffic, and transportation technology, gaps between what the current industrial systems are offering and industrialist expectations. Industrial applied research programmes are certainly playing major rules in this fascinating area and there are several ongoing research initiatives these include, self-learning autonomous vehicles using AI and Imitation Learning (IL), 2D/3D Machine Vision, Bigdata Handling and Security, Mass Information, Internet of Everything (IoE), Real-time Interconnection Devices and Deep Integration, Battery, and Battery Management System (BMS) technologies …etc. This talk will explore some of the outcomes of these initiatives including 2D and 3D machine vision of the future self-learning vehicles solution platform using AI and IL, and adaptation of generative AI and green technology to meet the world zero carbon agenda in 2050. The talk will be concluded with some of the ongoing industrial applied research programmes, which present few original areas of industrial applied research for future autonomous connected vehicles industrial applications.

Bio: Professor Mahmoud Shafik is a well-known expert in Digital Innovation in Engineering with over 20 years of industrial applied research experience. His expertise spans various fields, including, Intelligent Systems and Digital Technology, Innovation for Sustainable Engineering, Industry 4.0, Artificial Intelligence (AI) and Industrial Automation, Robotic Systems, Autonomous Systems, Internet of Everything (IoE), Intelligent Traffic and Transportation Systems, Fly, Drive and Steer-by-wire, 3D Smart Sensors and Actuators, Machine Vision, Cancer Treatment using CVD Diamond Radio Therapy Technology, Information Technology for Blind and Visually Impaired people, Electro-Rheological Fluid Micro Actuators Technology, AD-HOC Wireless Technology, Assisted Living

Technology, Chronic Diseases ICT Technological Solutions, Telehealth, Telecare, Climate Change, and Software Tools. Shafik has also a number of patents in these areas of industrial applied research and sustainable technology.

Shafik has been leading several industrial applied research projects from European Commission, Innovate UK and UK Research Councils, of a budget of several millions of euros and have made an international technical, economic and social impact in his area of expertise. His research work has brought many groundbreaking outcomes that have been commercially explored by several Small to Medium (SME's) and large enterprise (LE's) organisations. This includes and not limited to: Intersurgical Ltd – UK, Veslatec Oy – Finland, Semelab plc. – UK, PTW Freiburg – Germany, Neotek – France, Kirchmayer Handel & Consulting GmbH – Austria, Spectrum Telecom Installations Ltd – Ireland, Diamond Materials GmbH – Germany, Fireworks International Ltd – UK, Pirotecnia Oscense SA – Spain, Total Motion Systems Ltd –UK, Micromech Limited – UK, Smart Technology Ltd – UK, Audi -Germany, Ford – UK, Schlumberger – France, Nissan – Japan and Rolls Royce - UK.

Shafik is the co-founder of Institute of Innovation in Sustainable Engineering (IISE) - https://www.derby.ac.uk/colleges/science-engineering/iise/, founder of International Journal of Robotics and Mechatronics - http://ojs.unsysdigital.com/index.php/ijrm, Editor-In-Chief of both Journal of Traffic and Logistics - http://www.jtle.net/ and International Journal of Mechatronics Engineering - https://www.svedbergopen.com/journals/ijme/about-the-journal/. He is serving as a chairman and plenary speaker of: International Conference on Intelligent Traffic and Transportation (ICITT) - http://www.icitt.org/, International Conference in Automation and Mechatronics Engineering - https://www.icame.org/, International Conference in Communication and Network Technology - http://www.iccnt.org/index.html, and Co-general Chair of International Conference Mechanical Engineering and Robotics Research - http://www.icmerr.com/index.html.

Shafik has joined the University of Hertfordshire in September 2025. He is CEO of GIES Innovation Ltd and formal senior lead academic and MSc course director of MSc in Mechatronics University of Derby - http://www.derby.ac.uk/. He has been supervising and external examiners for several PhD, and MSc research programmes across worldwide. He is a visiting professor, industrial and curriculum consultant for a few organisations in EU, Japan, China, and Middle East. He is also a committee member of The Consortium of UK University Manufacturing and Engineering (COMEH) for the Engineering Professorial Council - https://epc.ac.uk/network/communities/comeh/ and is serving as an Assessor and Knowledge Transfer Expert for the UK Knowledge Transfer Network, UKRC, Innovate-UK and EC Research Programmes.

For more information of Professor Shafik profile, career, achievements and selected publications please visit: https://www.linkedin.com/pub/mahmoud-shafik-ph-d/7/237/60 & ORCID: Mahmoud Shafik (PhD) BEng MSc PhD FHEA MIET MASME, Intelligent Systems and Digital Technology (0000-0001-8296-5698) - ORCID & https://www.researchgate.net/profile/Mahmoud_Shafik.

Keynote Speaker I

September 03, Thursday, 09:45-10:25, GMT+2, Oslo Time

Meeting Room: Ekvator - 1st Floor

Prof. Agus Budiyono

Indonesia Center for Technology Empowerment, Indonesia

Speech Title: Intelligent Mobility Beyond Roads: Unmanned Marine Vehicles in the Era of Autonomous Systems

Abstract: Transportation intelligence is no longer confined to roads, railways, and urban networks; it increasingly extends across coastal, underwater, and maritime environments where autonomous systems must operate in uncertain, dynamic, and communications-limited conditions. This keynote presents a research and engineering journey in the development of diverse unmanned marine vehicles, including remotely operated vehicles, autonomous underwater vehicles, unmanned surface vehicles, diver propulsion vehicles, hybrid surface–underwater platforms, self-righting vessels, and recoverable acoustic-training targets. Drawing on field-oriented projects for inspection, hydrographic survey, environmental monitoring, surveillance, diver support, rough-sea operation, and maritime training, the presentation traces the progression from mission analysis and hull design to propulsion, materials, energy systems, sensing, navigation, guidance and control, communications, autonomy, testing, and operational readiness. Particular attention is given to the practical integration of theory with real-world implementation, where sensor limitations, hydrodynamic uncertainty, underwater positioning challenges, human–machine interaction, endurance constraints, and recovery reliability strongly influence system performance. The keynote argues that intelligent mobility should be understood as a multimodal transportation ecosystem spanning land, air, surface water, and the underwater domain. It concludes by discussing how digital engineering, data-driven asset readiness, resilient autonomy, edge intelligence, and cooperative multi-vehicle operations can transform experimental marine robots into dependable transportation and service systems for future maritime applications.

Bio: Professor Dr Agus Budiyono is a graduate of the Massachusetts Institute of Technology, having received his qualifications in 1998 and 2000. His academic accomplishments extend to acquiring four degrees in Aeronautics and Astronautics from the reputable institutions of Institut Teknologi Bandung and MIT. His rich professional journey spans over three decades, which includes a productive 15-year tenure in academia.

Throughout his academic career, Agus has established a scholarly footprint by publishing more than 300 research papers (with about 6000 citations and an H-index of 24). His expertise was further honed through his service as a

professor at different institutions around the globe. From 2008 to 2015, he held the position of Foreign Professor at KKU-Seoul and later, between 2015 and 2017, served as an Associate Professor of Aerospace at RMIT Melbourne.

Beyond academia, Agus has been an active participant in various industry-related pursuits. These experiences catalyzed his involvement in startup activities across the United States, South Korea, and Indonesia. As a leading figure in these entrepreneurial endeavors, Agus co-founded and provides advisory services to over 10 small and medium-sized technology enterprises. His knowledge and skills are often sought after, enabling him to offer consulting services to various companies both in the country and abroad, including some Fortune 500 firms.

In addition to his academic and professional undertakings, Agus has made contributions to the field of robotics and unmanned systems through his published works. His authored books include “Autonomous Control System and Vehicles. Intelligent Unmanned System,” published by Springer Verlag in April 2013, co-edited with Kenzo Nonami, Muljowidodo Kartidjo, and Kwang-Joon Yoon. His other notable work, “Intelligent Unmanned Systems: Theory and Applications,” co-edited with B. Riyanto and E. Joelianto, was published under the Studies in Computational Intelligence (SCI) series by Springer Verlag in April 2009.

Agus's influence extends to the world of academic journals, where he has served in prominent editorial roles. Since 2013, he has been the Editor-in-chief of the Journal of Unmanned System Technology (JUST), published by UNSYSdigital, Korea. He was also the founding Editor-in-chief of the International Journal of Intelligent Unmanned System (IJIUS), produced by Emerald Publishing, UK, between 2012 and 2016. He is presently the President of International Society of Intelligent Unmanned Systems (ISIUS), the society has organized its flagship international conference (ICIUS) for the last 21 years.

Keynote Speaker II

September 03, Thursday, 10:55-11:35, GMT+2, Oslo Time

Meeting Room: Ekvator - 1st Floor

Reader Xiaojun Zhai

University of Essex, UK

Speech Title: Embedded and Intelligent Systems Research: From Embedded SoCs to Nuclear Robotics

Abstract: Embedded and intelligent systems are increasingly shaping the future of autonomous systems, with applications spanning from consumer electronics to industrial and safety-critical environments. This talk will provide an overview of both past and ongoing projects related to embedded intelligent system design, with a particular focus on the design of efficient neural network accelerators on Field-programmable Gate Arrays (FPGAs).

We will also explore the evolution of embedded Systems-on-Chips (SoCs), emphasizing their critical roles in enhancing power efficiency, computational performance, reliability, and real-time processing capabilities. These advancements have paved the way for next-generation applications in robotics, artificial intelligence, and autonomous systems.

Finally, the talk will highlight current research initiatives in the fields, including collaborative efforts with industry and academia, and the successful translation of cutting-edge technology into commercial applications.

Bio: Dr Xiaojun Zhai is a Reader in the Embedded Intelligent Systems (EIS) Laboratory and co-leader of the Robotics and Embedded Systems Research Group within the National Centre for Nuclear Robotics (NCNR). He has led the technical development of resilient cyber-physical systems designed for operation in extreme radiation environments.

Since 2020, Dr Zhai has secured a portfolio of prestigious research grants totalling approximately £8.5 million as PI or Co-I. These include the EPSRC New Investigator Award (EP/V034111/1), EU CELTIC-NEXT, Royal Society funding, EPSRC awards in the areas of digitally enabled circular economy and sustainable digital technologies (EP/Z533749/1), EPSRC Digital Security by Design (DSbD) programme awards (EP/V000462/1 and EP/X52590X/1), the EPSRC New Horizons Award (EP/X015955/1), and multiple Innovate UK projects (FORENSIC, FollowPV, SensiChain, UltraNetAI).

Supported by these grants, Dr Zhai has been building a research team focused on high-performance and energy-efficient AI solutions for emerging intelligent devices and autonomous systems deployed in homes, workplaces, and extreme environments. His research emphasises intelligence, performance, security, power efficiency, and reliability.

Dr Zhai has published more than 160 peer-reviewed papers across reconfigurable computing, connected health, the Internet of Things, image and signal processing, and acceleration techniques using multicore, FPGA, and GPU-based systems.

He is a Senior Member of the IEEE, a Fellow of the Higher Education Academy, and a member of both the British Computer Society and ACM. His research interests include embedded systems, high-performance reconfigurable computing, hardware–software co-design, connected health applications, and image and video processing.

Keynote Speaker III

September 03, Thursday, 11:35-12:15, GMT+2, Oslo Time

Meeting Room: Ekvator -1st Floor

Prof. Chun Sing Lai

Tianjin University, China

Speech Title: Electrification of Urban Air Mobility in Smart Cities

Abstract: Urban air mobility (UAM), powered by electric vertical take-off and landing (eVTOL) aircraft, promises to decongest cities and revolutionize transport. However, its success depends on solving a critical "energy-mobility" challenge that extends far beyond aircraft design. Vertiports must be reimagined as high-demand energy nodes within the urban grid. With current batteries limiting range and requiring megawatt-scale fast charging, projected daily electricity consumption for intercity routes could force major upgrades to power infrastructure. Beyond the grid, success hinges on integrating UAM with multimodal networks, designing low-altitude corridors, and addressing public concerns over noise and safety through AI-driven traffic management and digital twin simulations. Ultimately, realizing UAM's potential requires unprecedented coordination between city planners, grid operators, and regulators to build a sustainable, trusted, and seamless urban air transport system.

Bio: Prof Chun Sing Lai received the B.Eng. (First Class Hons.) in electronic and electrical engineering from Brunel University of London, UK, in 2013, and the D.Phil. degree in engineering science from the University of Oxford, UK, in 2019.

He is currently a Yingcai Professor with the School of Electrical and Information Engineering at Tianjin University. His interests are in smart grid, energy system modeling, computational intelligence, and electric vehicle systems. He organized the workshop on Smart Grid and Smart City, IEEE SMC 2017 in Canada and a workshop on Blockchain for Smart Grid, IEEE SMC 2018 in Japan. He was a Publications Co-Chair for IEEE International Smart Cities Conference ISC2 (2020 and 2021). Prof Lai was also a Technical Program Co-Chair for 2022 IEEE International Smart Cities Conference. He was Conference Chair for the 2024 5th International Conference on Intelligent Computing and Human-Computer Interaction, technically sponsored by the IEEE. He is a member of the International Advisory Committee of the 4th International Conference on Smart City and Green Energy, Sydney, Australia. He is the Vice-Chair of the IEEE Smart Cities Publications Committee. He is a Senior Editor for IEEE Transactions on Consumer Electronics and an Associate Editor for IEEE Transactions on Systems, Man, and Cybernetics (IEEE/SMCS): Systems and IET Energy Conversion and Economics. He is the Working Group Chair for IEEE P2814 and P3166 Standards, an Associate Vice President, Systems Science and Engineering of the IEEE/SMCS and Chair of the IEEE/SMCS Intelligent Power and Energy Systems Technical Committee. Prof Lai was a recipient of the best paper award in the 2020 IEEE International Smart Cities Conference. He was a recipient of the 2022 Meritorious Service Award from the

IEEE SMC Society for "meritorious and significant service to IEEE SMC Society technical activities and standards development". Prof Lai received the IEEE Most Active SMC Technical Committee Award: Systems Science and Engineering in 2024. He was awarded first place in the Chester W. Sall Memorial Awards by the IEEE Consumer Technology Society in 2025. He was awarded a Best Associate Editor Award for IEEE Transactions on Consumer Electronics, and Excellent Reviewer Award for IET Energy Conversion and Economics in 2024. Prof Lai is recipient of IEEE SMC Early Career Award in 2025. He has co-authored "Smart Energy for Transportation and Health in a Smart City", IEEE Press/Wiley, 2023. He has contributed to six journal papers that appear on Web of Science as Highly Cited Papers with three as the lead author. Since 2021, he is recognized as the top 2% of world active scientists by survey conducted by Stanford University. He is a Senior Member of the IEEE, UK Chartered Engineer, and Fellow of the Higher Education Academy, UK.

Session Keynote Lecturer I

September 03, Thursday, 16:10-16:35, GMT+2, Oslo Time

Meeting Room: Tapperiet A -1st Floor

Prof. Sara Moridpour

RMIT University, Australia

Speech Title: Bridging Data and Physics: A Physics-Informed Deep Learning Framework for Pedestrian Velocity Estimation

Abstract: Accurate estimation of pedestrian velocity is crucial for understanding movement dynamics in complex traffic environments. This study proposes a hybrid framework integrating Deep Learning (DL) and Physics-Informed Deep Learning (PIDL) for pedestrian velocity estimation at signalised intersections. While the DL model learns motion patterns from trajectory data, the PIDL model incorporates governing motion equations to enforce physical consistency. Results demonstrate that PIDL significantly outperforms DL, reducing prediction errors from MSE = 0.064 and RMSE = 0.253 to MSE = 0.002 and RMSE = 0.045. In addition, PIDL improves temporal stability, achieving a lower Velocity Smoothness Index (0.06) compared to DL (0.25), indicating smoother and more realistic motion profiles. These findings highlight that integrating physics-based constraints enhances accuracy, robustness, and interpretability, making PIDL a reliable approach for pedestrian velocity estimation and traffic analysis.

Bio: Prof. Sara Moridpour, holds a Bachelor's degree in Civil Engineering and earned both her Master's and Ph.D. degrees in Traffic and Transportation Engineering. With over 23 years of professional and research experience in the field, she has been a member of the academic staff at RMIT University since 2010 and is currently a Professor of Transport Engineering.

Sara is actively involved in a wide range of research and professional activities both within RMIT and in the broader transport engineering community. She has led and contributed to numerous projects, published extensively in peer-reviewed journals, and presented her work at leading national and international conferences. Her areas of expertise include transport modelling, traffic simulation, road safety, and sustainable transport.

In addition to her research contributions, Sara has served on the technical and organising committees of various conferences and holds editorial board positions with several engineering journals.

Session Keynote Lecturer II

September 04, Friday, 13:00-13:25, GMT+2, Oslo Time

ZOOM Link: https://us02web.zoom.us/j/81842112234

ZOOM ID: 818 4211 2234

Password: 090204

Prof. Fabián Díaz

Universidad Técnica Particular de Loja, Ecuador

Speech Title: Operational Demand and Loading-Bay Capacity for Urban Freight Distribution in a Medium-Sized City: Evidence from Commercial Establishments in Loja, Ecuador

Abstract: Urban freight distribution is essential for urban supply, but it also intensifies curbside competition and operational conflicts, particularly in medium-sized cities with limited road space. Although previous studies have emphasized the importance of loading and unloading zones, empirical evidence for estimating the required number of bays in emerging urban contexts remains limited. This study aimed to estimate operational loading and unloading demand and determine the number of required bays for urban freight distribution in a commercial setting in Loja, Ecuador. A structured digital questionnaire was applied to 100 commercial establishments through ArcGIS Survey123, and the resulting database was cleaned, recoded, and transformed into derived variables related to daily-equivalent operations, unloading time, and schedule-specific demand. A capacity-based approach was then implemented under base, operational, and conservative scenarios. The results showed an expected daily demand of 40.333 operations, with a critical concentration between 06:00 and 07:00, when 14.490 operations were estimated. The weighted mean unloading time was 13.056 minutes, and the scenario analysis indicated requirements ranging from 3 bays under daily base conditions to 6 bays under conservative peak conditions. Overall, the study demonstrates that combining establishment-based survey data with operational capacity modelling provides a consistent basis for loading-bay planning in medium-sized cities.

Bio: Fabián Patricio Díaz Muñoz is a Civil Engineer from the Universidad Técnica Particular de Loja (UTPL), Ecuador, with advanced academic training in infrastructure planning, transportation, mobility, road safety, and logistics. He holds a Master's degree in Planning and Management of Infrastructures from the Universidad Politécnica de Madrid, Escuela Técnica Superior de Ingenieros de Caminos, Canales y Puertos; a Master's degree in Transport Management, with a specialization in Traffic, Mobility, and Road Safety, from the Universidad Internacional del Ecuador and EIG, Spain; and a University Master's degree in Logistics Management and Supply Chain Management from the Universidad Europea, School of Sustainability. His academic background has enabled him to develop an interdisciplinary perspective linking civil engineering, transport systems, mobility analysis, and logistics management.

He is a university lecturer at UTPL and has undertaken academic leadership responsibilities in both undergraduate and postgraduate education. His professional and academic work focuses on the development of civil engineering projects and on the analysis, planning, and management of transportation, mobility, and logistics systems. He has led and participated in institutional projects related to university mobility, accessible transport, urban freight distribution, and sustainable supply chains, and he is the author of academic books and indexed publications in the fields of transportation, traffic engineering, logistics, and engineering education. His work combines teaching, applied research, and project development aimed at addressing current challenges in mobility, infrastructure, and logistics.

Session Keynote Lecturer III

September 03, Thursday, 16:10-16:35, GMT+2, Oslo Time

Meeting Room: Tapperiet B -1st Floor

Christian Wille

German Aerospace Center, Germany

Speech Title: Emergency Vehicle Priorisation at Digital Test Bed Berlin

Abstract: The paper deals with the prioritisation of emergency vehicles, which is achieved with the help of a rule-based V2I-based traffic control system was developed, implemented and tested in the test field for the cooperative prioritisation of emergency and public transport vehicles. The aim was to demonstrate an intelligently networked traffic light control system using V2X communication in order to make emergency journeys safer, faster and more efficient. The system structure comprised V2I-capable traffic light systems, roadside units, backendsupported data processing, secure mobile radio connections and emergency vehicles equipped with on-board units. The technical implementation was based on a modular architecture with communication and localisation units in the vehicle, a central backend for data fusion and routing as well as gateways for secure connection of the infrastructure. Standardised V2X message formats such as CAM, DENM, SPAT/MAP, SRM and SSM enabled interoperable communication between vehicles and traffic light systems. The signal request and feedback messages in particular formed the basis for emergency vehicle pre-emption. The technical functionality of the overall system was successfully demonstrated in test operation. Prioritisation worked in all tested directions, allowing emergency vehicles to pass the junction without stopping. The project demonstrates the potential of cooperative, hybrid transport architectures for the gradual integration of V2X technologies into existing infrastructures. The digital urban traffic test field offers a scalable platform for this and opens up prospects for further applications such as green waves for emergency vehicles, digital rescue lanes, prioritisation concepts, support for automated vehicles as well as evacuation and special situations. In this way, the system contributes to improving road safety, reducing response times and the future-oriented digitalisation of urban traffic infrastructure.

Bio: Christian Wille holds a bachelor's degree in telematics (the combination of telecommunications and computer science) and obtained his master's degree in information and communication technology in 2018. Christian has been working at the German Aerospace Center (DLR) since 2012 and therefore has more than 13 years of professional and research experience. He currently works as a group leader in the Cooperative Road Vehicles and Systems department. Christian is an expert in the field of connected mobility and intelligent transport systems, with a particular focus on V2X communication across multiple transport domains, including road, rail, and maritime systems. He works closely with leading players from industry and the public sector on various research and development projects.

His key work includes several V2X-based projects for traffic prioritization and control. These range from prioritizing public transport shuttles and buses (projects with BVG and Fraunhofer), to applications in rail transport such as on-demand train stops and intelligent level crossings (in cooperation with Deutsche Bahn and Siemens), as well as

maritime communication between ships and infrastructure (Ship2X), and the prioritization of emergency vehicles in urban traffic together with the Berlin Fire Department. The results of these projects have also been published at various national and international conferences. Through this work, Christian makes a significant contribution to the advancement of cooperative, connected transport systems and the digitalization of transport infrastructure.

His areas of expertise include V2X communication, traffic engineering, traffic simulation, road safety, and sustainable transport. In addition, he is active in ETSI and the C2C Communication Consortium, where he contributes to the development of standards and specifications in the field of V2X communication and automated driving.

Session Keynote Lecturer IV

September 03, Thursday, 14:00-14:25, GMT+2, Oslo Time

Meeting Room: Tapperiet A -1st Floor

Assoc. Prof. Emre Kuşkapan

Erzurum Technical University, Turkey

Speech Title: Predicting the Risk of Future Traffic Accidents Using a New Hybrid Approach

Abstract: Traffic accidents result in both financial and emotional losses for societies. Many countries are taking significant policy steps to reduce the number of traffic accidents. Various analyses and studies are being conducted to prevent traffic accidents. In this study, future projections were made using statistical data on the number of fatalities in traffic accidents occurring in Turkey. In the analyses conducted at the provincial level, seven distinct risk classes were established based on the number of traffic accident fatalities per million vehicles. A hybrid model combining the Markov chain method and a regression model was developed as the forecasting model. When the results from both models were evaluated together, a common finding emerged indicating that the “very high-risk” category will disappear by 2030. The study’s results demonstrate that traffic safety risks are not static and can be reduced to lower risk levels over time through appropriate policies. The findings provide important insights for developing targeted traffic safety strategies at the provincial and regional levels.

Bio: Associate Professor Emre Kuşkapan holds a bachelor’s degree in Civil Engineering and completed both his master’s and doctoral studies in Transportation Engineering. Since 2018, he has been a faculty member at Erzurum Technical University, where he continues his academic and research activities. His work primarily focuses on key areas of transportation, including traffic safety, sustainable transportation systems, intelligent transportation systems, and micromobility. He has authored numerous academic publications in these fields, contributing to both theoretical advancements and practical applications in transportation engineering.

In addition to his research, Dr. Kuşkapan serves as a member of the editorial boards of various engineering journals, actively contributing to the dissemination of scientific knowledge. He has led and participated in multiple research and development projects and has provided academic consultancy to various public and private institutions. Through these efforts, he has played an active role in bridging academia and practice in the field of transportation. Furthermore, he is a full member of Sigma Xi, one of the oldest and most prestigious scientific research societies in the international scientific community.

Session Keynote Lecturer V

September 03, Thursday, 16:35-17:00, GMT+2, Oslo Time

Meeting Room: Tapperiet A -1st Floor

Assoc. Prof. Marko Đurasević

University of Zagreb, Croatia

Speech Title: Application of Hyper-Heuristics for the Vehicle Routing Problem

Abstract: The Vehicle Routing Problem (VRP) is a well-known combinatorial optimisation problem that seeks to determine efficient routes for a fleet of vehicles while ensuring that all customers are served and one or more objectives are optimised. Due to the large number of VRP variants and the diverse constraints and optimisation criteria that must be considered, designing effective solution methods remains a challenging task. In dynamic and large-scale environments, where complete information is often unavailable in advance, simple constructive heuristics are frequently employed because they can rapidly adapt to changing problem conditions using the latest available information.

Traditionally, the design of such heuristics has relied heavily on human expertise, making the development process time-consuming and problem-specific. Hyper-heuristics offer an alternative approach by automating the generation or selection of heuristics, aiming to produce more general and adaptable solution methods. In particular, genetic programming can be used as a high-level search mechanism to automatically design heuristic rules that rank available decisions during solution construction. Based on these rankings, the hyper-heuristic selects and executes the most promising decision at each step.

The ability to automatically generate decision-making rules enables hyper-heuristics to be applied across a wide range of VRP variants and optimisation objectives, reducing the need for manually crafted problem specific heuristics. Initial results indicate that such approaches can achieve competitive and often superior performance compared to manually designed heuristics, demonstrating the potential of hyper-heuristics as an effective methodology for solving vehicle routing problems.

Bio: Marko Đurasević is an Associate Professor at the Faculty of Electrical Engineering and Computing (FER), University of Zagreb. His research is centered on evolutionary computation, particularly genetic programming and hyper-heuristics for solving complex scheduling and optimization problems. He earned his Ph.D. in Computer Science from FER in 2018, with a dissertation focused on the automated design of dispatching rules in unrelated machines environments. Dr. Đurasević has published over 100 scientific papers in international journals and conferences, contributing extensively to the fields of combinatorial optimization, machine learning, and soft computing. He is the principal investigator of two nationally funded projects dealing with optimization of containers in ports and routing of electric vehicles. Furthermore, he also leads a project in collaboration with the company AVL-AST. His scientific excellence has been recognized with the Annual Award for Young Researchers by the Croatian Parliament in 2023 and several other national institutions. Dr. Đurasević is an active member of IEEE, IEEE CIS, ACM, and ACM SIGEVO, and regularly serves as a reviewer for leading journals in artificial intelligence and operations research.

Session Keynote Lecturer VI

September 03, Thursday, 14:00-14:25, GMT+2, Oslo Time

Meeting Room: Tapperiet B -1st Floor

Assoc. Prof. Amur Salim Al Yahmedi

Sultan Qaboos University, Oman

Speech Title: Towards Human-Centred and Explainable Autonomous Vehicle Navigation

Abstract: Autonomous vehicles should not only move efficiently; they should move in ways that are safe, comfortable, transparent, and aligned with human expectations. This talk presents a human-centred and explainable approach to autonomous vehicle navigation, spanning Adaptive Cruise Control (ACC) as the foundational longitudinal function and lane-change decision-making as its lateral counterpart in intelligent transportation systems.

Conventional designs emphasise tracking accuracy, stability, and constraint satisfaction. While essential, these do not capture how passengers and surrounding road users experience automated motion. The work reframes ACC as a behaviour-synthesis problem, embedding safety, ride comfort, natural following behaviour, and interpretability directly into the controller.

The framework couples a Sugeno-type fuzzy controller with multi-objective optimization. Its rule base captures human-like reasoning through linguistic concepts such as *safe distance* and *moderate closing speed*, mapping spacing error, relative velocity, and speed-limit deviation to acceleration commands, with Time-to-Collision, jerk, and time-headway as explicit goals. A multi-objectives optimization formulation tunes the membership functions and reveals trade-offs between conservative safety, smoother motion, and closer headway. The same interpretable philosophy governs lane-change decisions, where a dual-channel fuzzy framework weighs safety against progress, changing lanes only when both clearly favour it — yielding behaviour that is predictable, auditable, and traceable to intuitive driving heuristics.

Bio: Dr. Amur Salim Al Yahmedi is an Associate Professor in the Department of Mechanical and Industrial Engineering, College of Engineering, Sultan Qaboos University, Oman. He received his B.Eng. in Mechanical Engineering from Sultan Qaboos University, his M.Sc. in Control Systems from UMIST, Manchester, UK, and his Ph.D. in Mechanical Engineering from the University of California, Davis, USA.

His research and teaching are centred on modelling, simulation, dynamics, control, robotics, and autonomous systems. His earlier work includes biped robotics, biomechanics, mobile robot navigation, fuzzy-logic-based control, and motion prediction. More recently, his research has expanded toward human-centred robotics and autonomous vehicle behaviour, with emphasis on scenario-based simulation, explainable fuzzy decision-making, and the design of autonomous systems that behave safely, transparently, and appropriately in environments shared with people.

Dr. Al Yahmedi has supervised and co-supervised graduate research projects in human gait prediction, biomechanical

modelling, in-pipe inspection robots, mobile robotics, and autonomous systems. His scholarly work spans robotics, mechatronics, biomechanics, fuzzy logic, modelling and simulation, and engineering education. He has also contributed to curriculum development, quality assurance, accreditation, and the development of mechanical and mechatronics engineering programmes and laboratories at Sultan Qaboos University.

He has held visiting or research appointments at several international institutions, including KAIST in Korea, the European Centre for Mechatronics in Aachen, the University of California, Davis, Cornell University, and the University of Portsmouth. His current work seeks to connect rigorous engineering design with the human qualities of motion: comfort, trust, interpretability, and responsible autonomy.

Day 1- September 02, 2026
Wednesday, GMT+2, Oslo Time

Onsite Sign-in		
Time	**Event**	**Venue**
13:00-17:00	Onsite Sign-in	Quality Hotel Hasle Linie lobby-G Floor

Time	Presenters	ZOOM Information
09:00-12:00	Session Chairs (Online), Committee Members (Online), Session Keynote Lecturers (Online)	ZOOM Link: https://us02web.zoom.us/j/81842112234 ZOOM ID: 818 4211 2234 Password: 090204
	Online Session 1: Urban Road Network Situational Awareness and Safety Risk Assessment Driven by Multi-Source Traffic Data OL928, OL933, OL905, OL935, OL943, OL944, OL918	
	Online Session 2: Road Geometry Design Parameter Optimization and Speed Coordination Control for Active Safety OL956, OL917, OL925, OL938, OL957, OL964	
	Online Session 3: Intelligent Logistics Network Optimization and Multimodal Transport Collaborative Scheduling for Green and Low-Carbon Development OL920(SKL), OL909, OL904, OL958, OL955, OL963-A, OL965	

Online Test Tips:

- ✧ Please get your presentation file ready for the pretest.
- ✧ Please unmute audio and start video while your presentation.
- ✧ It's suggested to use headset with microphone or earphone with microphone.

Day 2- September 03, 2026
Thursday, GMT+2, Oslo Time

Opening Ceremony, Plenary Speech and Keynote Speeches

1. **Meeting Room:** Ekvator -1st Floor
2. **ZOOM Link:** https://us02web.zoom.us/j/81842112234
   ZOOM ID: 818 4211 2234
   Password: 090204

09:00-09:05	**Welcome Message** Prof. Mahmoud Shafik, CTO of GIES Innovation Ltd and Senior Lead Academic, University of Greater Manchester, UK
09:05-09:45	**Plenary Speech** Prof. Mahmoud Shafik, CTO of GIES Innovation Ltd and Senior Lead Academic, University of Greater Manchester, UK **Speech Title:** Intelligent Traffic and Transportation Challenges and Opportunities: Impact of Generative AI Technology and 3D Machine Vision Streaming on Autonomous Vehicles Operational Safety!
09:45-10:25	**Keynote Speech I** Prof. Agus Budiyono Indonesia Center for Technology Empowerment, Indonesia **Speech Title:** Intelligent Mobility Beyond Roads: Unmanned Marine Vehicles in the Era of Autonomous Systems
10:25-10:55	Group Photo & Coffee Break
10:55-11:35	**Keynote Speech II** Reader Xiaojun Zhai University of Essex, UK **Speech Title:** Embedded and Intelligent Systems Research: From Embedded SoCs to Nuclear Robotics
11:35-12:15	**Keynote Speech III** Prof. Chun Sing Lai Tianjin University, China **Speech Title:** Electrification of Urban Air Mobility in Smart Cities
12:15-14:00	**Break&Lunch (Restaurant Location: 1st Floor, Quality Hotel Hasle Linie)**

14:00-15:55	Tapperiet A 1st Floor	**Onsite Session 1 - Traffic Safety Analysis and Risk Prediction: Data-Driven Accident Modeling and Emergency Management** **Session Chair:** Prof. MAURICI RUIZ-PÉREZ, UNIVERSITY OF THE BALEARIC ISLANDS, SPAIN **Session Keynote Lecturer:** Assoc. Prof. Emre Kuşkapan, Erzurum Technical University, Türkiye OL948-A, OL934, OL914, OL930-A, OL959, OL952
14:00-15:55	Tapperiet B 1st Floor	**Onsite Session 2 – Multimodal Perception Fusion and Intelligent Decision Control for Autonomous Driving in Complex Environments** **Session Chair:** Assoc. Prof. Amur Salim Al Yahmedi, Sultan Qaboos University, Oman **Session Keynote Lecturer:** Assoc. Prof. Amur Salim Al Yahmedi, Sultan Qaboos University, Oman OL951, OL937, OL931, OL947, OL968, OL946
15:55-16:10	**Coffee Break**	
16:10-18:00	Tapperiet A 1st Floor	**Onsite Session 3 – Intelligent Transportation Systems and Logistics Optimization for Urban Delivery: Route Planning and Resource Scheduling** **Session Chair:** Prof. Sara Moridpour, RMIT University, Australia **Session Keynote Lecturers:** Prof. Sara Moridpour, RMIT University, Australia Assoc. Prof. Marko Đurasević, University of Zagreb, Croatia OL942, OL949, OL945, OL940
16:10-17:50	Tapperiet B 1st Floor	**Onsite Session 4** –Digital Twin-Driven Urban Traffic Planning and Multimodal Travel Behavior Simulation Modeling **Session Chair:** Prof. Mahmoud Shafik, CTO of GIES Innovation Ltd and Senior Lead Academic, University of Greater Manchester, UK **Session Keynote Lecturer:** Christian Wille, German Aerospace Center, Germany OL932, OL960, OL902, OL908, OL939
18:00-20:00	**Dinner (Restaurant Location: 1st Floor, Quality Hotel Hasle Linie)**	

Day 3 – September 4, 2026
Friday, GMT+2, Oslo Time

Online Sessions **ZOOM Link: https://us02web.zoom.us/j/81842112234** **ZOOM ID: 818 4211 2234** **Password: 090204**	
09:00-10:45	**Online Session 1 –Urban Road Network Situational Awareness and Safety Risk Assessment Driven by Multi-Source Traffic Data** **Session Chair:** Xavier Merino-Vivanco, Department of Civil Engineering, Architecture and Geosciences, Universidad Técnica Particular de Loja, Marcelino Champagnat Street, Loja, Ecuador OL928, OL933, OL905, OL935, OL943, OL944, OL918
10:45-11:00	**Break Time**
11:00-12:30	**Online Session 2 –Road Geometry Design Parameter Optimization and Speed** Coordination **Control for Active Safety** **Session Chair:** Vinicio Roblez-Torres, Universidad Técnica Particular de Loja, Ecuador OL956, OL917, OL925, OL938, OL957, OL964
12:30-13:00	**Break Time**
13:00-14:55	**Online Session 3 –Intelligent Logistics Network Optimization and Multimodal Transport Collaborative Scheduling for Green and Low-Carbon Development** **Session Chair:** TBA **Session Keynote Lecturer:** Prof. Fabián Patricio Díaz-Muñoz, Universidad Técnica Particular de Loja, Ecuador OL909, OL904, OL958, OL955, OL963-A, OL965

Onsite Session 1

Time: 14:00-15:55 (GMT+2, Oslo Time)
Date: Thursday, September 03
Venue: Tapperiet A -1st Floor
Topic: Traffic Safety Analysis and Risk Prediction: Data-Driven Accident Modeling and Emergency Management
Chaired by: Prof. MAURICI RUIZ-PÉREZ, UNIVERSITY OF THE BALEARIC ISLANDS, SPAIN

Session Keynote Lecturer (OL910) **14:00-14:25**	**Title:** Predicting the Risk of Future Traffic Accidents Using a New Hybrid Approach **Author:** Emre Kuşkapan **Speaker:** Emre Kuşkapan, Erzurum Technical University, Engineering and Architecture Faculty, Erzurum, Türkiye **Abstract:** Traffic accidents result in both financial and emotional losses for societies. Many countries are taking significant policy steps to reduce the number of traffic accidents. Various analyses and studies are being conducted to prevent traffic accidents. In this study, future projections were made using statistical data on the number of fatalities in traffic accidents occurring in Turkey. In the analyses conducted at the provincial level, seven distinct risk classes were established based on the number of traffic accident fatalities per million vehicles. A hybrid model combining the Markov chain method and a regression model was developed as the forecasting model. When the results from both models were evaluated together, a common finding emerged indicating that the "very high-risk" category will disappear by 2030. The study's results demonstrate that traffic safety risks are not static and can be reduced to lower risk levels over time through appropriate policies. The findings provide important insights for developing targeted traffic safety strategies at the provincial and regional levels.
OL948-A **14:25-14:40**	**Title:** The Importance of Real-Time Traffic Information in the Context of ITT - Generation and Distribution: A Case Study of the Bavarian Traffic Information Center **Author:** Andreas Müller **Presenter:** Andreas Müller, Okari GmbH, Germany **Abstract:** In Intelligent Traffic and Transportation (ITT), roadworks and closure information is a key input for routing, traffic operations, and data-driven decision support. Its value materializes only when delivered as machine actionable data with measurable performance—most notably in terms of timeliness, plausibility, and completeness. Timeliness requires operational governance across the event lifecycle (create, update, terminate), with explicit targets for publication latency and correction times. Technically, delivery should rely on APIs/feeds with clear versioning and incremental updates so navigation services can ingest changes near real time. Plausibility depends on standardized, semantically consistent models (persistent event IDs, defined states/ transitions, consistent temporal models). Equally critical is routing-grade spatial referencing—ideally linear events with start/end and direction—since vague location descriptions increase map-matching errors and degrade routing decisions. Automated validation (topology, consistency, conflict checks) is essential to prevent systematic errors. Completeness means fully specified, decision-relevant attributes: validity intervals, affected directions/lanes, restrictions, and impacted user groups. A particularly important aspect is reliable event termination; stale closure records are highly detrimental in ITT because they continuously trigger wrong decisions and erode trust. A measurably high level of compliance with the above criteria is therefore key to being perceived as a reliable partner providing high-quality data for navigation services. As a concrete example of an approach to this subject area that is widely regarded as excellent, the work of the Bavarian Traffic Information Center of the State Building Authority of Bavaria is presented, focusing

	on its key components. Of particular interest here is the structure of the system, as well as the continuous refinement, adaptation, and automation of workflows using AI, all while adhering to strict data protection guidelines.
OL934 **14:40-14:55**	**Title:** Compensation for the Absence of a Delivery Driver: A Systematic Transformation Methodology **Authors:** Henrik Lampe, Tobias Schräder, Christian Raulf, Jürgen Pannek **Presenter:** Henrik Lampe, MOIA GmbH, Germany **Abstract:** Current autonomous vehicle development focuses on driving automation while delivery drivers spend only 60% of their time driving. Autonomous last-mile delivery must compensate for all driver activities beyond vehicle operation. We present a SysML-based methodology that maps delivery tasks to functional requirements and assigns these to automation, elimination, or delegation via multi-criteria decision analysis. Our model captures 19 non-driving activities, cross-checked through industry interviews, and consolidates them into 12 compensation requirements with traceable links from activities to requirements. Autonomous driving is included as foundational requirement. We demonstrate the approach on three representative requirements and test robustness of the strategy assignments under varying criterion weights. The method offers a pragmatic template for task substitution in logistics and service domains requiring complete human operator removal.
OL914 **14:55-15:10**	**Title:** A large Language Model Driven Adaptive Large Neighborhood Search for Emergency Snow Removal Resource Allocation on Highway Networks **Authors:** Xin SHI, Ce TIAN, Juan LI, Taisheng DU **Presenter:** Xin Shi, Center for Standards and Metrology, China Academy of Transportation Sciences, China **Abstract:** This study addresses emergency snow removal resource allocation on highway networks under severe winter weather. A mathematical model is developed to optimize node activation, vehicle prepositioning, and postdisaster dispatch under multiple scenarios. Based on this model, a large language model (LLM) driven adaptive large neighborhood search (ALNS) algorithm is proposed to improve search efficiency and constraint awareness. A case study on the Zhu Yong and Dong Yong expressway network verifies the feasibility and effectiveness of the proposed framework for emergency decision support.
OL930-A **15:10-15:25**	**Title:** SHAP-Based Identification of Risk Phenotypes for Severe Vehicle-Pedestrian Crashes **Authors:** Xi Lin, Claudio Feliciani, Daichi Yanagisawa, Katsuhiro Nishinari **Presenter:** Xi Lin, The University of Tokyo, Japan **Abstract:** Vehicle-pedestrian crashes are a critical safety concern because severe outcomes arise from the interaction of vehicle impact conditions, pedestrian vulnerability, road environment, and traffic regulation. This study develops an interpretable machine-learning framework to identify severe vehicle-pedestrian crash risk phenotypes using 74,080 nationwide police-reported crashes in Japan from 2023 to 2024. Severe crashes were defined as crashes involving at least one fatality or two or more injured persons. CatBoost, LightGBM, and XGBoost were compared using 2023 data for model development and 2024 data for external-year testing. CatBoost achieved the best discrimination and was selected for SHAP (SHapley Additive exPlanations) analysis. Global SHAP results showed that severe-crash prediction was mainly driven by vehicle collision point, pedestrian age, hour, speed restriction, vehicle type, area type, and stop regulation control. Signed SHAP values were then used for k-means clustering to identify risk-contribution phenotypes. The principal two-

	cluster solution revealed a high-burden phenotype with a severe-crash rate of 11.7%, compared with 2.53% in the lower-burden phenotype. Logistic regression confirmed a substantially higher severe-crash burden in this phenotype. Mapping the cluster back to original features showed enrichment in nighttime crashes, pedestrians aged 75 years or older, freight vehicle involvement, frontal impacts, mid-width roads, non-urban areas, and near-intersection settings. The proposed framework provides an interpretable AI-based decision-support approach for severity-oriented pedestrian safety management, enabling smart-city and ITS agencies to identify high-risk crash phenotypes and prioritize targeted interventions.
OL959 **15:25-15:40**	**Title:** Multi-Modal Synthetic Data Fusion and Cross-Modal Attention Feature Extraction for Data-Driven Risk Propagation Simulation and Airport Traffic Resilience Optimization **Authors:** Ge Meng, Chenyang Wang, Hui Zhang **Presenter:** Ge Meng, Tsinghua University, China **Abstract:** Modern hub airports are vulnerable to localized risk propagation under external shocks, and dense pedestrian flows can accelerate system disruptions. Based on the Preparation-Absorption-Recovery-Adaptation (PARA) theory, this study develops a full-lifecycle closed-loop digital twin control framework. First, a multi-modal traffic data fusion method integrates pedestrian trajectories, infrared thermography, and flight wave schedules into a unified spatiotemporal grid to enable privacy-independent risk perception. Second, a Cross-Modal Spatiotemporal Attention Network (CMSAN) with a dual-stream encoder is proposed to capture latent exposure risks and reduce the impact of camera occlusions. A multi-agent simulation model is then developed to reproduce microscopic pedestrian dynamics under severe spatial disruptions. Finally, a bi-objective robust optimization model for emergency resource allocation is established and solved using the reference-point-based Non-dominated Sorting Genetic Algorithm III (NSGA-III) to improve recovery and adaptation capabilities. Experiments with real airport failure data show that CMSAN achieves 80.90% latent risk capture accuracy under 80% extreme occlusion, while the evolution engine maintains an Structure Similarity Index Measure (SSIM) above 99.85% throughout the lifecycle. The optimal defense strategy reduces the critical-area spatiotemporal nonlinear divergence score from 3.8904 to 1.1699, restores traffic performance retention to 85.30%, and improves topological steady-state reconstruction by 60.8%. Ultimately, the resilience reconstruction of the complex spatiotemporal system is achieved at a minimal operational cost.
OL952 **15:40-15:55**	**Title:** Functional Architecture and Technical Path of the Intelligent-driven Traffic Safety Management System for Highway Reconstruction and Expansion **Authors:** Bencheng ZHU, Dianliang XIAO, Ran LI, Kailun LI, Bin ZHANG **Presenter:** Kailun Li, China Academy of Transportation Sciences, Beijing, China **Abstract:** Digital and intelligent transformation is the key direction for transportation sector during the 15th Five-Year Plan of China. To address the challenges of insufficient digital technology application, unclear system functional positioning, and unclear technical path in traffic safety management and control for highway reconstruction and expansion projects, this paper focused on small-scale, micro-scenarios, examining the functional architecture, technical path, and typical case studies of a digitally driven highway reconstruction and expansion traffic safety management and control system. Based on risk management and systems engineering theory, this paper analyzed five key characteristics of traffic safety in highway reconstruction and expansion projects. Based on the needs of typical business scenarios, a process-oriented structured analysis approach was employed to propose a functional architecture for a digital highway reconstruction and expansion traffic safety

	management and control system, and a technical path for digital highway reconstruction and expansion traffic safety management and control adapted to these scenarios and functions was constructed. Using a case study approach, this paper explored the current application of digital technology in highway reconstruction and expansion traffic safety management and control, as well as areas for optimization and improvement. The results indicate that a digitally driven highway reconstruction and expansion traffic safety management and control system should possess five key functions: data acquisition and processing, real-time traffic safety status diagnosis, traffic safety risk status prediction, decision-making and control, and data description and refined display. Currently, the functional completeness of digital highway reconstruction and expansion systems in China is approximately 80%. Traffic safety status diagnosis and traffic safety risk prediction are key areas for future optimization and improvement of highway reconstruction and expansion traffic safety management and control systems. The research results can provide theoretical guidance and technical support for the application of digital technology in traffic safety assurance in highway reconstruction and expansion, and help the digital transformation and upgrading of highway transportation infrastructure.

Onsite Session 2

Time: 14:00-15:55 (GMT+2, Oslo Time)
Date: Thursday, September 03
Venue: Tapperiet B -1st Floor
Topic: Multimodal Perception Fusion and Intelligent Decision Control for Autonomous Driving in Complex Environments
Chaired by: Assoc. Prof. Amur Salim Al Yahmedi, Sultan Qaboos University, Oman

Session Keynote Lecturer (OL916&OL919) **14:00-14:25**	**Title:** Towards Human-Centred and Explainable Autonomous Vehicle Navigation **Speaker:** Amur Salim Al Yahmedi, Sultan Qaboos University, Oman **Abstract:** Electric vehicle drivetrain development has expanded significantly beyond conventional single-motor layouts, with increasing attention to dual-motor, distributed-drive, modular, and reconfigurable propulsion systems. At the same time, traction motor choice remains a major design factor because machine characteristics influence efficiency, packaging, controllability, reliability and overall drivetrain integration. This paper presents a comparative analysis of electric vehicle drivetrain architectures together with the principal traction motor technologies reported in the literature. The paper examines single-motor e-axles (electric axles), dual e-axle systems, distributed-drive arrangements and mechanically coupled or modular configurations, and compares them in terms of layout simplicity, torque delivery, scalability, control implications, redundancy potential and implementation challenges. In parallel, the paper discusses major traction motor options, including permanent-magnet synchronous motors, induction motors, axial-flux motors, electrically excited synchronous motors and switched-reluctance motors, with emphasis on their suitability for modern battery-electric vehicle applications. The analysis shows that motor selection and drivetrain topology are strongly coupled, and identifies the main factors influencing future EV architecture and traction-motor selection.
OL951 **14:25-14:40**	**Title:** A Road-Tire Collaborative Perception System for Vehicle Safety Risk Warning **Authors:** Jiahan Yang, Zongchen Ying, Jiye Huang, Yujie Yuan and Chun Sing Lai **Presenter:** Prof. Chun Sing Lai, Tianjin University, China **Abstract:** Vehicle operational risk is jointly affected by road conditions and tire states, making single-source road recognition or tire abnormality detection insufficient for safety warning. This paper proposes a road-tire collaborative perception system for vehicle operational risk warning, named TR-CPS. It integrates road images, tire radial acceleration, and IMU features for road recognition, and combines road risk, tire abnormality risk, and their compound effect through a continuous decision-level fusion score. The final output is mapped into Healthy, Caution, and Warning states. Experiments on the collected real-vehicle dataset show that TR-CPS achieves 98.00% Accuracy and 91.70% Macro-F1, exceeding the project-level 80% target and supporting the effectiveness of road–tire collaborative fusion under the evaluated conditions.
OL937 **14:40-14:55**	**Title:** Comparative Analysis of Electric Vehicle Drivetrain Architectures and Traction Motor Technologies **Authors:** Shihab Shah, Mark Ovinis, Mario De Oliveira, Fawaz Yahya Annaz **Presenter:** Fawaz Yahya Annaz, Birmingham City University, United Kingdom **Abstract:** Electric vehicle drivetrain development has expanded significantly beyond conventional single-motor layouts, with increasing attention to dual-motor, distributed-drive,

	modular, and reconfigurable propulsion systems. At the same time, traction motor choice remains a major design factor because machine characteristics influence efficiency, packaging, controllability, reliability and overall drivetrain integration. This paper presents a comparative analysis of electric vehicle drivetrain architectures together with the principal traction motor technologies reported in the literature. The paper examines single-motor e-axles (electric axles), dual e-axle systems, distributed-drive arrangements and mechanically coupled or modular configurations, and compares them in terms of layout simplicity, torque delivery, scalability, control implications, redundancy potential and implementation challenges. In parallel, the paper discusses major traction motor options, including permanent-magnet synchronous motors, induction motors, axial-flux motors, electrically excited synchronous motors and switched-reluctance motors, with emphasis on their suitability for modern battery-electric vehicle applications. The analysis shows that motor selection and drivetrain topology are strongly coupled, and identifies the main factors influencing future EV architecture and traction-motor selection.
OL931 **14:55-15:10**	**Title:** Defining Skills and Training Requirements for Remote Operators of Highly Automated Vehicles: A Delphi Study **Authors:** Nikoo Razavi and Heikki Liimatainen **Presenter:** Nikoo Razavi, Doctoral researcher, Tampere University, Finland **Abstract:** The emergence of highly automated vehicles introduces new operational roles, among which remote operators have become critical intermediaries between manual and fully automated systems. However, limited research has examined the competencies and training needs of human remote operators. This study aims to identify the essential multi-dimensional skills and qualifications and training requirements and responsibilities of them in highly automated public transport. Building on a literature review, the study uses a two-round Delphi process to identify key skills and establish technical and cognitive benchmarks. Findings reveal that while a traditional driver's license serves as a legal baseline, the role demands a rigorous interdisciplinary blend of technical expertise, cognitive ability, and task- specific knowledge. Also, study presents criteria for eligibility of a remote operator and training requirements. The study concludes that remote operation demands interdisciplinary competencies rather than a single professional background or a certificate, emphasizing the importance of multi-faceted training, clear role and tasks.
OL947 **15:10-15:25**	**Title:** Corroboration-Aware Evidential Object Existence Fusion for CPM-Compliant Cooperative Perception **Authors:** Redge Melroy Castelino, Elias Modrakowski, Shrijal Pradhan, Axel Hahn **Presenter:** Redge Melroy Castelino, German Aerospace Center, Germany **Abstract:** Vehicle-to-everything (V2X) collective perception enables connected vehicles to share detected object information via standard Collective Perception Messages (CPMs), which include Object Perception Quality (OPQ) values indicating the likelihood that a detected object exists. This paper presents a Dempster-Shafer Theory-based framework for fusing CPM-reported OPQ values as basic belief assignments over a binary existence frame of discernment. Four contextual discount factors: detectability, sensor competence, trust, and temporal decay are derived directly from metadata available in the standard CPM format, requiring no message extensions. A corroboration-dependent OPQ ceiling, rising monotonically with the number of confirming CAVs, prevents overconfident fused estimates when corroborative evidence is limited. The proposed framework is evaluated in a CAV platooning scenario within an Autoware-CARLA simulation against other combination rules,

	demonstrating stable and temporally smooth fused OPQ estimates under dynamically changing sensor coverage conditions.
OL968 **15:25-15:40**	**Title:** EKF-Based IMU/GPS Sensor Fusion for Robust Urban Vehicle Localization with MPC Path Following **Authors:** Uchenna Onyemaa, Mahmoud Shafik, Thankgod A. Njoku **Presenter:** Mahmoud Shafik, CTO of GIES Innovation Ltd and Senior Lead Academic, University of Greater Manchester, UK **Abstract:** This paper presents a comprehensive simulation-based study of an Extended Kalman Filter (EKF) framework for fusing Inertial Measurement Unit (IMU) and Global Positioning System (GPS) data to achieve robust vehicle localization in urban driving scenarios. A sixteen-dimensional state vector captures vehicle orientation via quaternions, position, velocity, and sensor biases in a navigation-frame representation. The EKF incorporates nonholonomic motion constraints appropriate for wheeled ground vehicles to improve lateral and vertical velocity estimation. The localization system is evaluated within a closed-loop simulation comprising a high-fidelity 14-Degree-of-Freedom (DOF) Simscape vehicle model, a Model Predictive Control (MPC) path-following controller, virtual IMU and GPS sensor models, and an Unreal Engine visualization interface. Two scenarios are assessed: nominal sensor fusion and GPS signal degradation. Under nominal conditions, the EKF achieves position Root Mean Square Errors (RMSE) of 0.17 m and 0.05 m in the longitudinal and lateral axes, respectively, and attitude RMSEs of 0.17°, 0.2°, and 0.1° in roll, pitch, and yaw. Under GPS degradation, the filter demonstrates graceful performance decay with bounded inertial drift and rapid covariance recovery upon GPS re-acquisition. Throughout all scenarios, the MPC controller remains stable, confirming the suitability of EKF-derived estimates for closed-loop vehicle control.
OL946 **15:40-15:55**	**Title:** Balancing Hybrid Synthetic-Real Datasets: The Limits of Scaling Under Real-World Data Scarcity **Authors:** Niklas RAHENBROCK, Shrijal PRADHAN **Presenter:** Niklas Rahenbrock, German Aerospace Center (DLR), Germany **Abstract:** Robust perception systems for automated driving require massive amounts of labeled training data. While synthetic data generated via simulation offers a scalable and cost-effective alternative to expensive real-world data collection, its utility is inherently constrained by the domain gap between virtual environments and physical reality. To bridge this gap, detection models are trained with combined datasets containing synthetic and real-world data. However, a critical open question remains: What is the optimal balance between synthetic and real-world data, given a fixed amount of real-world samples? In this paper, we systematically investigate the impact of synthetic dataset scaling on 2D object detection performance under a strict, fixed amount of real-world data. Using synthetic data from the CARLA simulator and real-world data from the nuImages dataset, we evaluate multiple training approaches across synthetic dataset volumes ranging from 1,500 to 100,000 samples. Our experiments reveal that while joint training with a carefully limited injection of synthetic data yields the highest overall mean Average Precision (mAP), massively over-scaling the synthetic dataset induces an overfitting domain dominance effect and severely degrading real-world accuracy.

Onsite Session 3

Time: 16:10-18:00 (GMT+2, Oslo Time)
Date: Thursday, September 03
Venu: Tapperiet A -1st Floor
Topic: Intelligent Transportation Systems and Logistics Optimization for Urban Delivery: Route Planning and Resource Scheduling
Chaired by: Prof. Sara Moridpour, RMIT University, Australia

Session Keynote Lecturer (OL924) **16:10-16:35**	**Title:** Bridging Data and Physics: A Physics-Informed Deep Learning Framework for Pedestrian Velocity Estimation **Authors:** Md Shohel PARVEZ, Sara MORIDPOUR, Richard TAY, Amir SHTAYAT **Speaker:** Sara Moridpour, RMIT University, Australia **Abstract:** Accurate estimation of pedestrian velocity is crucial for understanding movement dynamics in complex traffic environments. This study proposes a hybrid framework integrating Deep Learning (DL) and Physics-Informed Deep Learning (PIDL) for pedestrian velocity estimation at signalised intersections. While the DL model learns motion patterns from trajectory data, the PIDL model incorporates governing motion equations to enforce physical consistency. Results demonstrate that PIDL significantly outperforms DL, reducing prediction errors from MSE = 0.064 and RMSE = 0.253 to MSE = 0.002 and RMSE = 0.045. In addition, PIDL improves temporal stability, achieving a lower Velocity Smoothness Index (0.06) compared to DL (0.25), indicating smoother and more realistic motion profiles. These findings highlight that integrating physics-based constraints enhances accuracy, robustness, and interpretability, making PIDL a reliable approach for pedestrian velocity estimation and traffic analysis.
Session Keynote Lecturer **16:35-17:00**	**Title:** Application of Hyper-Heuristics for the Vehicle Routing Problem **Author:** Marko Đurasević **Speaker:** Assoc. Prof. Marko Đurasević, University of Zagreb, Croatia **Abstract:** The Vehicle Routing Problem (VRP) is a well-known combinatorial optimisation problem that seeks to determine efficient routes for a fleet of vehicles while ensuring that all customers are served and one or more objectives are optimised. Due to the large number of VRP variants and the diverse constraints and optimisation criteria that must be considered, designing effective solution methods remains a challenging task. In dynamic and large-scale environments, where complete information is often unavailable in advance, simple constructive heuristics are frequently employed because they can rapidly adapt to changing problem conditions using the latest available information. Traditionally, the design of such heuristics has relied heavily on human expertise, making the development process time-consuming and problem-specific. Hyper-heuristics offer an alternative approach by automating the generation or selection of heuristics, aiming to produce more general and adaptable solution methods. In particular, genetic programming can be used as a high-level search mechanism to automatically design heuristic rules that rank available decisions during solution construction. Based on these rankings, the hyper-heuristic selects and executes the most promising decision at each step. The ability to automatically generate decision-making rules enables hyper-heuristics to be applied across a wide range of VRP variants and optimisation objectives, reducing the need for manually crafted problem specific heuristics. Initial results indicate that such approaches can achieve competitive and often superior performance compared to manually designed heuristics, demonstrating the potential of hyper-heuristics as an effective methodology for solving vehicle routing problems.

OL942 **17:00-17:15**	**Title:** Traffic Flow Simulation and Fleet Scheduling for Autonomous On-Demand Monorail Vehicles **Authors:** Martin Griese, Jan Zabel, Thomas Schulte **Presenter:** Martin Griese, Ostwestfalen-Lippe University of Applied Sciences and Arts, Germany **Abstract:** Numerous single-track railway lines in rural areas remain disused due to economic factors, yet represent a substantial untapped infrastructure resource. The MONOCAB, a gyro-stabilised monorail vehicle, addresses this gap by enabling bidirectional, on-demand Personal Rapid Transit on a single conventional rail. Effective fleet operation requires scheduling and control mechanisms that account for the unique topological constraints of single-track infrastructure, where vehicles cannot overtake and must coordinate longitudinally. This paper presents a traffic flow simulation environment for MONOCAB fleet operations. The simulation is built on the open-source tool SUMO (Simulation of Urban Mobility), extended via a Python-based control layer that manages fleet dispatch, convoy formation, and distance regulation. Two scheduling strategies are evaluated: a Nearest Vehicle heuristic and an Adaptive Large Neighbourhood Search algorithm, assessed against seven key performance indicators across 40 simulation scenarios including balanced and commuter demand profiles with Rush Hour conditions. The simulation framework provides a reusable tool for operational planning which is adaptable to further on-demand vehicles.
OL949 **17:15-17:30**	**Title:** Automated Design of Heuristics for the Container Relocation Problem: Specialisation versus Generalisation **Authors:** Tena Škalec, Marko Đurasević **Presenter:** Tena Škalec, University of Zagreb Faculty of Electrical Engineering and Computing, Croatia **Abstract:** In today's world, the container relocation problem (CRP) plays an important role in global logistic processes, since a great deal of global trade is carried out by sea. One common way of solving the CRP is by using relocation rules (RRs), simple heuristics that determine how containers should be moved within the yard to achieve the best performance. Recently, a lot of research has been dedicated towards automatically designing RRs, in order to relieve domain experts of this tedious task, but also to generate better rules. However, an important design choice is whether RRs should be trained on a large selection of specific problems to better capture their intricacies and be specialised for solving particular problem types and dealing with their unique complexities, or to be trained on such problems that will allow GP to learn a more general strategy that, while perhaps of limited use in certain scenarios, does works well across a wide variety of problems. Therefore, this study compares the two training approaches by evaluating the performance difference between generalised and specialised rules. The obtained results demonstrate that specialised rules obtain only a marginal aggregate improvement, with the two approaches being practically equivalent under a $\pm1\%$ margin, demonstrating that it is possible to design rules that include a good general strategy that works well across a wide range of problems, thus eliminating the need for designing several specialised RRs.
OL945 **17:30-17:45**	**Title:** A Unified Metaheuristic Framework for Autonomous Multi-Drone Mission Planning **Authors:** Antimo Di Bernardo, Vittorio Ugo Castrillo, Domenico Pascarella, Angela Vozella **Presenter:** Antimo Di Bernardo, Italian Aerospace Research Centre (CIRA), Capua, Italy **Abstract:** Mission planning is a central challenge in autonomous multi-drone systems, where multiple agents must coordinate to execute distributed tasks under operational constraints.

	The combinatorial nature of these problems makes exact optimization methods impractical at realistic scales, motivating the adoption of scalable heuristic and metaheuristic approaches. This work presents a unified framework for multi-drone mission planning that jointly integrates spatial clustering and route optimization to address large-scale task allocation scenarios. The framework incorporates multiple metaheuristic strategies, including Reduced and Basic Variable Neighborhood Search, and Wolf Pack Search, within a reproducible architecture. To enhance scalability, hybrid initialization strategies based on K-means clustering and a centroid-based abstraction method are introduced to decompose large problem instances. The proposed framework is evaluated through an extensive comparative analysis across different mission scales.
OL940 **17:45-18:00**	**Title:** Machine-Learning Nowcasting of Aviation Flight Category of Hub Airports: A METAR-Based Early-Warning Aid for Air-Traffic Management **Authors:** Saif Obaid AlDarmaki, Khaula Alkaabi **Presenter:** Saif Obaid AlDarmaki, University of Illinois at Urbana–Champaign, United Arab Emirates **Abstract:** Low-visibility conditions caused by radiation fog, advection fog, and blowing dust periodically trigger Low-Visibility Procedures (LVP) at the United Arab Emirates' busiest airports, including Dubai International (OMDB), the world's busiest international hub. These events reduce runway capacity and disrupt regional air-traffic flow. This study nowcasts the aviation flight category—VFR, MVFR, IFR, or LIFR, which jointly reflects visibility and cloud ceiling—at six UAE hub airports at lead times of +1, +3, and +6 hours using only routine METAR observations from the Iowa Environmental Mesonet archive. A calibrated gradient-boosting (XGBoost) classifier, together with a LightGBM counterpart and compact deep-learning models (LSTM/TCN and TabNet), was trained using a chronological data split with leakage controls and recency weighting to address concept drift. Forecast skill was evaluated using per-category POD, FAR, CSI, Heidke Skill Score, Brier Score, and reliability metrics, and compared against decoded Terminal Aerodrome Forecasts (TAFs), persistence, and climatology. At OMDB, the model achieved an IFR-or-worse CSI of 0.41 at +3 hours, compared with 0.25 for persistence. While TAF PROB/TEMPO fog groups anticipated onset events approximately 22 hours in advance, they exhibited substantial over-warning (frequency bias 5.9; false-alarm ratio 0.88). At the same +3-hour detection rate as the TAF, the model reduced the false-alarm ratio from 0.88 to 0.64 at OMDB. SHAP analysis identified physically meaningful predictors, demonstrating the potential of the approach as a low-cost decision-support tool for air-traffic management at Gulf hub airports.

Onsite Session 4

Time: 16:10-17:50 (GMT+2, Oslo Time)
Date: Thursday, September 03
Venue: Tapperiet B -1st Floor
Topic: Digital Twin-Driven Urban Traffic Planning and Multimodal Travel Behavior Simulation Modeling
Chaired by: Prof. Mahmoud Shafik, CTO of GIES Innovation Ltd and Senior Lead Academic, University of Greater Manchester, UK

Session Keynote Lecturer (OL913) **16:10-16:35**	**Title:** Emergency Vehicle Priorisation at Digital Test Bed Berlin **Authors:** Christian Wille, Jan Trumpold, Robert Oertel, Willi Schmidt, Maximillian Stein, Lucas Geilich **Speaker:** Christian Wille, German Aerospace Center, Germany **Abstract:** The paper deals with the prioritisation of emergency vehicles, which is achieved with the help of a rule-based V2I-based traffic control system was developed, implemented and tested in the test field for the cooperative prioritisation of emergency and public transport vehicles. The aim was to demonstrate an intelligently networked traffic light control system using V2X communication in order to make emergency journeys safer, faster and more efficient. The system structure comprised V2I-capable traffic light systems, roadside units, backendsupported data processing, secure mobile radio connections and emergency vehicles equipped with on-board units. The technical implementation was based on a modular architecture with communication and localisation units in the vehicle, a central backend for data fusion and routing as well as gateways for secure connection of the infrastructure. Standardised V2X message formats such as CAM, DENM, SPAT/MAP, SRM and SSM enabled interoperable communication between vehicles and traffic light systems. The signal request and feedback messages in particular formed the basis for emergency vehicle pre-emption. The technical functionality of the overall system was successfully demonstrated in test operation. Prioritisation worked in all tested directions, allowing emergency vehicles to pass the junction without stopping. The project demonstrates the potential of cooperative, hybrid transport architectures for the gradual integration of V2X technologies into existing infrastructures. The digital urban traffic test field offers a scalable platform for this and opens up prospects for further applications such as green waves for emergency vehicles, digital rescue lanes, prioritisation concepts, support for automated vehicles as well as evacuation and special situations. In this way, the system contributes to improving road safety, reducing response times and the future-oriented digitalisation of urban traffic infrastructure.
OL932 **16:35-16:50**	**Title:** Developing pedestrian-sensitive traffic signal control in SUMO **Authors:** Maik Halbach, Kim Jannik Eggers **Presenter:** Maik Halbach, German Aerospace Center, Germany **Abstract:** Urban signalised junctions continuously face the challenge of balancing traffic efficiency and safety. The increasing deployment of high-resolution sensors at signalised junctions enables precise tracking of vulnerable road users (VRUs), particularly pedestrians. However, a practical and easily integrable solution for incorporating such detailed sensor data into signal control is still absent. The LTSA (Local Traffic Safety Analyzer) project addresses this gap by developing specialised software modules that process pedestrian object data and convert it into usable inputs for signal control. The primary objective is to enhance pedestrian comfort, safety and efficiency at signalised junctions without significantly compromising the traffic flow for other road users. The project modules were developed and validated in a safe, microscopic traffic simulation environment using Simulation of Urban Mobility (SUMO). This paper presents the framework, testing and implementation of the project modules, which form the basis for the LTSA-system that will be deployed at a real-

	world signalised junction in Potsdam, Germany, in a later project phase. The proposed approach represents a step towards multimodal signal controls with the potential to improve both safety and efficiency at urban junctions for all road users.
OL960 **16:50-17:05**	**Title:** Short Trips, Small Savings: A Reality Check on the Fifteen-Minute City in Palma (Illes Balears) **Author:** MAURICI RUIZ-PÉREZ **Presenter:** MAURICI RUIZ-PÉREZ, UNIVERSITY OF THE BALEARIC ISLANDS, SPAIN **Abstract:** The fifteen-minute city assumes that many short car trips can be walked or cycled, but trip counts do not reveal how much driving or pollution would fall because short trips account for few kilometres. We test this distinction in Palma (422,587 people, 88 neighbourhoods and 1.10 million daily trips) with a traffic model using mode-specific pedestrian and cycle networks. We calculate the maximum removable car-kilometres directly and use the model only for network effects. If 40% of eligible drivers switched, walking would reduce car-kilometres by 0.28% (0.43% after estimating omitted within-neighbourhood trips), cycling by 4.70%, and an optimistic public-transport scenario by at most 23.72%. Walking is barely distinguishable from model noise, cycling has a modest effect, and public transport dominates because it targets long trips. The policies are approximately additive; benefits concentrate in dense central areas, while scattered outskirts gain little and also have poorer bus access. None materially eases congestion in the local-trip network modelled. A fifteen-minute policy therefore has no determinate scale until the mode is specified, and trip reductions should not be confused with vehicle-kilometre reductions.
OL902 **17:05-17:20**	**Title:** When Service Runs Out: Late-Night Accessibility and Demand-Driven Last-Train Service Optimization at Hong Kong International Airport **Authors:** Wenxuan Wang, Jacqueline Lo **Presenter:** Wenxuan Wang, The Hong Kong Polytechnic University, Hong Kong SAR **Abstract:** Late-night airport flight arrivals often occur when urban rail and bus services approach end-of-service, making public transport access highly sensitive to timetable feasibility. This study develops a time-dependent, multimodal night network of Hong Kong International Airport to support accessibility analysis and optimization. For each departure time, an earliest-arrival search identifies reachable population zones, and sweeping the night window produces an accessibility collapse curve that reveals stepwise losses and their dominant first-violation mechanisms. Flight arrivals are converted into a minute-level demand profile to evaluate public transport supply. Building on this, an intelligent multi-objective optimization framework, using an evolutionary meta-heuristic algorithm, treats line-specific service extensions as decision variables to trade off demand-weighted accessibility gains against operational costs. Results show late-night accessibility loss is driven by discrete service cutoffs. The optimized strategies delay key collapse events and reduce unmet demand efficiently. Overall, targeted protection of high-leverage services delivers outsized benefits, and this data-driven framework supports robust operational planning.
OL908 **17:20-17:35**	**Title:** Automated Baggage System for the Next Generation Train Station: Development and Simulation of an Efficient Sorting Facility for Seamless Baggage Transport **Authors:** Andrei Popa, Olaf Milbredt, Mathias Böhm and Stephan Kintzel **Presenter:** Andrei Popa, German Aerospace Center (DLR), Germany

	Abstract: The carriage of large pieces of baggage in passenger rail service often leads to prolonged boarding and dwell times, complicates stowage, and causes obstructions by blocking seats and aisles, all of which substantially diminish travel comfort. This paper presents the concept development of an innovative baggage handling system for the Next Generation Station, followed by a simulation-based evaluation of its performance. The system's goal is to make rail travel significantly more attractive by reintroducing an automated, passenger-decoupled baggage transport solution.
OL939 **17:35-17:50**	**Title:** Tourism-Driven Urban Air Mobility Planning **Authors:** Khaula Alkaabi; Saif Obaid AlDarmaki **Presenter:** Khaula Alkaabi, United Arab Emirates University, UAE **Abstract:** Urban Air Mobility (UAM) offers a potential mobility solution for tourism-intensive cities. This study develops a tourism-oriented UAM planning framework for Dubai integrating GIS-based suitability, multimodal accessibility, multinomial logit mode choice, O-D demand, vertiport ranking, capacity assessment, and travel-time analysis. Demand was evaluated under 1%, 3%, and 5% modal-share scenarios. Results identify Dubai Marina/DMCC as the strongest candidate hub, supported by Downtown Dubai, DIFC, Deira, and the Healthcare–Dubai Creek corridor. High-value tourism corridors provide modeled travel-time savings of approximately 30 min/trip compared with surface travel. The framework supports phased UAM deployment by integrating tourism demand, multimodal accessibility, and vertiport performance, offering a transferable approach for tourism-intensive cities.

Online Session 1

Time: 9:00-10:45 (GMT+2, Oslo Time)
Date: Friday, September 04
ZOOM Link: https://us02web.zoom.us/j/81842112234 **ZOOM ID:** 818 4211 2234
Password: 090204
Topic: Urban Road Network Situational Awareness and Safety Risk Assessment Driven by Multi-Source Traffic Data
Chaired by: Xavier Merino-Vivanco, Universidad Técnica Particular de Loja, Marcelino Champagnat Street, Loja, Ecuador

OL928 **09:00-09:15**	**Title:** Data-Driven Identification of Urban Traffic Accident Hotspots Using Kernel Density Estimation for Road Safety Planning in Smart Cities: Evidence from Loja, Ecuador **Authors:** Xavier Merino-Vivanco and Germán Roblez-Torres **Presenter:** Xavier Merino-Vivanco, Universidad Técnica Particular de Loja, Marcelino Champagnat Street, Loja, Ecuador **Abstract:** Urban traffic accidents remain a critical challenge for road safety planning, particularly in intermediate cities where advanced spatial analysis is less frequently used in operational decision-making. This study identifies urban traffic accident hotspots in Loja, Ecuador, using Kernel Density Estimation (KDE) and complementary descriptive analysis to support road safety planning within a smart city framework. A descriptive and exploratory spatial design was applied to a secondary anonymized database provided by the Unidad de Control Operativa de Tránsito (UCOT) of Loja. After filtering rural records and spatial outliers, 472 traffic accidents registered in the urban area during 2025 were analyzed. Coordinates were processed in QGIS 3.44.2, using EPSG:4326 as the original coordinate reference system and EPSG:32717 for distance-based spatial analysis. KDE was applied using an approximate search radius of 300 m and a raster cell size between 10 and 20 m; the resulting density surface was reclassified and polygonized to delimit critical zones. Results reveal a non-random spatial pattern dominated by a central north-south corridor, with secondary clusters in northern and southern sectors. Descriptively, nighttime accidents represented 28.60% of cases, while crashes against fixed objects, angular side collisions, and perpendicular side collisions accounted for 66.95% of recorded accidents. The study demonstrates the usefulness of combining KDE and descriptive traffic accident profiling for evidence-based safety planning in intermediate smart city contexts.
OL933 **09:15-09:30**	**Title:** A Real-World LiDAR Benchmark for Fine-Grained Vehicle Classification **Authors:** Georgios Mitrakas, Tom Dinkelacker and Selina Moritz **Presenter:** Selina Moritz, Esslingen University of Applied Sciences, Germany **Abstract:** This study investigates deep learning-based vehicle type classification from LiDAR point clouds in motorway traffic scenes. Using stationary, roadside LiDAR sensors, the work aims to distinguish vehicle categories such as motorcycles, passenger cars, vans, trucks, buses, and trailer combinations in a non-invasive, privacy-preserving, and weather-independent manner. In addition to model comparison, a major contribution of the work is the creation and validation of a projectspecific LiDAR dataset, derived from an initial dimension-based CoMark preclassification and subsequently verified through manual labeling. To assess the suitability of contemporary point cloud architectures, DGCNN with PAConv, PointNeXt, and Point Transformer V3 (PTv3) were trained on the manually validated dataset. The experimental results indicate that PointNeXt achieved the strongest overall performance, reaching 96.74% accuracy and an F1 score of 0.942, while also exhibiting the lowest model complexity among the bestperforming methods. PTv3 attained

	similarly high classification accuracy but required substantially more parameters, whereas DGCNN with PAConv showed robust performance at the cost of significantly higher training effort. Class-wise analysis and confusion matrices reveal that the remaining errors occur primarily among structurally similar commercial vehicle classes, highlighting the geometric ambiguity inherent in the dataset. Overall, the findings demonstrate that deep learning on LiDAR point clouds offers a scalable and effective solution for vehicle classification in traffic monitoring applications, while careful dataset preparation, validation, and class-specific analysis remain crucial for robust realworld deployment. To support reproducibility, the dataset, data loader, and training instructions will be released in a public GitHub repository: https://github. com/xGeorg315/tls81-roadside-lidar-vehicle-classification. Keywords. LiDAR, Vehicle classification, Dataset, Point cloud, Deep learning, Traffic monitoring, Model comparison, Real-world data.
OL905 **09:30-09:45**	**Title:** Road Traffic Accident Patterns in Southern Ecuador: A Descriptive–Correlational Analysis Based on Official Data from Loja Province **Authors:** Vinicio Roblez-Torres and Xavier Merino-Vivanco **Presenter:** Vinicio Roblez-Torres, Universidad Técnica Particular de Loja, Ecuador **Abstract:** Road safety represents a critical challenge in regional and subnational contexts in Latin America due to the significant social and economic impacts generated by traffic accidents. In this context, the present study analyzes the occurrence and characteristics of traffic accidents recorded in the province of Loja using a quantitative descriptive–correlational approach. The research was based on the official traffic accident database from the Instituto Nacional de Estadísticas y Censos (INEC) corresponding to the year 2025. This dataset includes information on temporal, territorial, and accident severity variables such as number of injured people, fatalities, and total victims. In the first stage, descriptive statistics were applied to characterize the distribution of accidents according to month, day, canton, zone, and type of accident. Subsequently, a frequency analysis of the main reported causes of accidents was conducted. Finally, Spearman's correlation coefficient was used to evaluate the relationship between variables associated with accident severity, allowing the identification of relevant patterns that contribute to a better understanding of road accident dynamics.
OL935 **09:45-10:00**	**Title:** Spatial Association between Road Traffic Accidents and Road Surface Type in Peripheral Areas of an Intermediate City: Evidence from Loja, Ecuador **Authors:** Galina SEGARRA-MORALES, Xavier MERINO-VIVANCO, Vinicio ROBLEZ-TORRES **Presenter:** Xavier Rafael Merino-Vivanco, Universidad Técnica Particular de Loja, Ecuador **Abstract:** Road traffic accidents in urban peripheral areas represent a relevant challenge for territorial planning and road infrastructure management, particularly in intermediate cities where different road surface types coexist. This study analyzes the spatial association between traffic accidents and road surface type in peripheral sectors of Loja, Ecuador. A total of 439 georeferenced traffic accident records and a vector layer of peripheral roads classified as asphalt, gravel, and dirt roads were used. The spatial analysis was conducted using Geographic Information Systems in QGIS through a spatial proximity join with a maximum threshold of 30 meters between each accident and the nearest road segment. As a result, 37 accidents were spatially associated with the peripheral road network. Asphalt roads concentrated 34 accidents (91.89%), while dirt roads registered 3 accidents (8.11%) and gravel roads showed no associated accidents. After normalization by road length,

	asphalt roads reached a rate of 0.58 accidents/km, higher than the rate observed on dirt roads (0.07 accidents/km). The findings demonstrate the usefulness of GIS-based spatial analysis for identifying traffic accident patterns and generating comparable indicators to support urban road safety management and infrastructure planning in peripheral urban areas.
OL943 **10:00-10:15**	**Title:** Spatio-Temporal Analysis of Urban Mobility and Public-Space Incidents in Intermediate Cities: the Case of Loja, Ecuador **Authors:** Jamil Erasmo Quituizaca-Jaramillo, Juan Carlos Palacios-Ortega **Presenter:** Juan Palacios-Ortega, Universidad Técnica Particular de Loja, Ecuador **Abstract:** Intermediate cities face increasing challenges in managing urban mobility, road safety, and the use of public space under limited technical and institutional capacities. Although the literature highlights the value of urban data for decision-making, municipal records generated by surveillance cameras and control agents are often used mainly for administrative purposes, without being consolidated as analytical inputs for operational prioritization. This study aimed to analyze the spatial, temporal, and typological patterns of urban mobility and public-space incidents recorded by the municipal control system in Loja, Ecuador, in order to identify critical areas in an intermediate city. An exploratory, descriptive, and correlational design was applied to 463 valid records, considering date, time, zone, and incident type as the main variables. The analysis included frequency distributions, cross-tabulations, Chi-square tests, and Cramer's V. The results showed a concentration of incidents related to mobility and traffic operation, particularly improper use of the roadway and illegal parking, with higher recurrence in central areas and urban corridors. The study concludes that municipal records can be transformed into a simple, replicable, and low-cost tool to support evidence-based urban management.
OL944 **10:15-10:30**	**Title:** Multi-dimensional Protection of Child "Ghost-Probe" Traffic Accidents in Shenzhen: Technology Embedding and Policy Integration **Authors:** Yanbo WANG, Shi YIN, Jie ZHANG **Presenter:** Jie ZHANG, BYD Auto Industry Company Limited, China **Abstract:** Child pedestrian "ghost-probe" accidents—sudden blind-spot intrusions—are a critical safety issue in Chinese megacities. Taking Shenzhen as a high-density, innovation-driven case, this study examines how technology embedding and policy coordination can reduce such injuries. Based on field observations, surveys (N=926), interviews, and crash simulations, we identify gaps in current passive protections and propose child-specific optimizations: a progressive emergency braking strategy, a low-profile external airbag (0.5-1.2 m deployment height), and differentiated electronic fence zones. Simulations with idealized conditions and a simplified model show that the optimized airbag reduces head injury criteria (HIC) by over 80% at 40 km/h compared to no airbag. We further integrate regulatory, economic, and information policy instruments—mandatory installation standards, subsidies, data-driven supervision, and multi-stakeholder governance—to transform child road safety from reactive, fragmented measures to active, systemic prevention. This study offers referable experience for other densely populated cities.

OL918 **10:30-10:45**	**Title:** S4DG-Net: Frequency-Gated State-Space Diffusion Graph Network for Multi-Horizon Traffic Forecasting **Authors:** Alpana Akhi Prova, Dr. Md. Moniruzzaman **Presenter:** Alpana Akhi Prova, Islamic University of Technology (IUT), Bangladesh **Abstract:** Child pedestrian “ghost-probe” accidents—sudden blind-spot intrusions—are a critical safety issue in Chinese megacities. Taking Shenzhen as a high-density, innovation-driven case, this study examines how technology embedding and policy coordination can reduce such injuries. Based on field observations, surveys (N=926), interviews, and crash simulations, we identify gaps in current passive protections and propose child-specific optimizations: a progressive emergency braking strategy, a low-profile external airbag (0.5-1.2 m deployment height), and differentiated electronic fence zones. Simulations with idealized conditions and a simplified model show that the optimized airbag reduces head injury criteria (HIC) by over 80% at 40 km/h compared to no airbag. We further integrate regulatory, economic, and information policy instruments—mandatory installation standards, subsidies, data-driven supervision, and multi-stakeholder governance—to transform child road safety from reactive, fragmented measures to active, systemic prevention. This study offers referable experience for other densely populated cities.

Online Session 2

Time: 11:00-12:30 (GMT+2, Oslo Time)
Date: Friday, September 04
ZOOM Link: https://us02web.zoom.us/j/81842112234 **ZOOM ID:** 818 4211 2234
Password: 090204
Topic: Road Geometry Design Parameter Optimization and Speed Coordination Control for Active Safety
Chaired by: Vinicio Roblez-Torres, Universidad Técnica Particular de Loja, Ecuador

OL956 **11:00-11:15**	**Title:** Effects of Longitudinal Grade, Curve Radius, and Pavement Roughness (IRI) on the Operating Speed of Buses and Heavy Vehicles: Case Study of the Loja–Catamayo Mountain Road **Authors:** Ariana Belén Noriega Veraa, Darío Javier Carrillo Acaro, María Soledad Segarra-Morales **Presenter:** María Soledad Segarra-Morales, Universidad Técnica Particular de Loja, Ecuador **Abstract:** This article analyzes the influence of longitudinal grade, curve radius, and pavement surface condition on the operating speed of public transport and heavy vehicles along the Loja–Catamayo road, located in a mountainous area of southern Ecuador. The analysis incorporated 100 speed profiles, consisting of 50 records for each vehicle category, and considered the International Roughness Index (IRI) as an indicator of the pavement's functional condition. The data were subjected to normality tests and an analysis of variance (ANOVA) at a 95% confidence level. The results showed that grade, curve radius, and IRI significantly affect the speed of both vehicle categories. For public transport vehicles, grade had the greatest statistical influence, whereas for heavy vehicles, the effect of curve radius was predominant. Likewise, increased pavement roughness was associated with a reduction in operating speed. It is concluded that vehicle behavior on rural mountain roads is influenced by road geometry, pavement surface condition, and the specific operational characteristics of each vehicle category.
OL917 **11:15-11:30**	**Title:** Operational Safety Control in Maintenance Work Zones for Mountainous Freight Corridor **Authors:** Xin Shi, Wei Feng, Qiong Wu, Zhiyu Wang, Wu Cai, Xiaomin Li **Presenter:** Qiong Wu, Hebei Jiaotong Vocational and Technical College, China **Abstract:** By conducting field data collection on traffic characteristics (e.g., traffic volume, density, vehicle speed) in mountainous freight corridor maintenance work zones, this study analyzes speed parameters across control zones on experimental sections. Results indicate elevated risk levels in warning zones and upstream transition zones of these freight-intensive corridors. Through on-site collection of drivers' physiological-psychological data, a corridor-specific model was established to determine minimum length limits for these zones. The model integrates speed gradients, heart rate growth rates, and zone lengths under mountainous freight conditions, identifying minimum control lengths and proposing freight-oriented warning strategies to reduce queuing time and delays. Mountainous freight corridor simulations in VISSIM validate the strategies, demonstrating that queue length and delay-to-travel-time ratios decrease as closed-zone length increases in heavy-vehicle-dominated environments.

OL925 **11:30-11:45**	**Title:** Speed Hump Geometry and Operating Speed on Urban Streets in Ecuadorian Cities **Author:** Juan Palacios-Ortega **Presenter:** Juan Palacios-Ortega, Universidad Técnica Particular de Loja, Ecuador **Abstract:** Vehicle speed control in urban environments is a key element of road safety, with speed humps being one of the most widely used measures within traffic calming strategies. The literature has demonstrated their effectiveness; however, gaps remain in Latin American contexts regarding how their geometric characteristics influence operating speed under real traffic conditions. In the Ecuadorian context, limited standardization in the design of these devices is also evident, generating uncertainty about their performance. This study aimed to analyze the relationship between speed hump geometry and the operating speed of light vehicles on urban streets. A quantitative, non-experimental study with a descriptive–correlational scope was conducted, based on 408 field records obtained through travel time measurements along defined approach segments to the speed hump. Statistical analysis was performed in R, including descriptive statistics, grouped analysis, correlation analysis, and a linear regression model to explain total speed reduction as a function of geometric variables. The results show a progressive reduction in speed along the approach segments, as well as a more consistent association between hump height and the magnitude of deceleration, compared to hump width. It is concluded that speed hump geometry—particularly height—significantly influences vehicle behavior, highlighting the need to strengthen technical design criteria in the Ecuadorian urban context.
OL938 **11:45-12:00**	**Title:** Platoon Formation on a Two-Lane Mountain Highway: A Microscopic Analysis Using Automatic Traffic Count Data **Author:** Juan Palacios-Ortega **Presenter:** Juan Palacios-Ortega, Universidad Técnica Particular de Loja, Ecuador **Abstract:** Two-lane mountain highways present complex operational conditions due to grades, curves, visibility restrictions, and limited passing opportunities, all of which increase vehicle interaction and favor platoon formation. Previous studies have recognized the importance of vehicle-following behavior and traffic composition in the performance of this type of roadway; however, continuous microscopic evidence obtained from automatic traffic counters remains limited in Latin American mountain contexts. This study aimed to analyze vehicle platoon formation on a two-lane mountain highway using microscopic traffic data, characterizing vehicle-following patterns, platoon structure, and the operational factors associated with their occurrence. A quantitative exploratory, descriptive, and correlational approach was applied to individual vehicle records collected with a MetroCount automatic traffic counter, considering speed, travel direction, gap, headway, vehicle type, and platoon leadership. The results showed that platoons were mostly small, with operational differences between travel directions, a strong association between traffic volume and platooning, and lower mean speeds for heavy vehicles. The study concludes that microscopic traffic data provide a robust basis for accurately characterizing platoon dynamics on two-lane mountain highways.
OL957 **12:00-12:15**	**Title:** Roadway Geometry and IRI as Determinants of Light Vehicle Operating Speed: A Case Study of the Loja–Catamayo Rural Mountain Road **Authors:** Karen Yeleny López Garrido, María Soledad Segarra-Morales **Presenter:** María Soledad Segarra-Morales, Universidad Técnica Particular de Loja, Ecuador **Abstract**: This study analyzed the influence of roadway geometric characteristics and the International Roughness Index (IRI) on the operating speed of light vehicles on rural

	mountainous roads, using the Loja–Catamayo section of the E35 highway as a case study. The research was motivated by the high crash rates recorded on rural roads in Ecuador, where roadway geometry, pavement condition, and operating speed directly influence traffic risk. Roadway geometry was evaluated, the IRI was measured, and operating speed was determined from 50 speed profiles collected in the field using a mobile application with Global Positioning System (GPS) georeferencing. The data were analyzed using normality tests and analysis of variance (ANOVA) to evaluate the influence of geometric variables and the IRI on operating speed. The results showed that grade, curve radius, and IRI had a significant effect on mean operating speed ($p < 0.05$), indicating that roadway geometric characteristics and pavement surface condition influenced operating speed.
OL964 **12:15-12:30**	**Title:** Applied Research on A Triple-Loop Simulation Pre-Evaluation Methodology for Passenger Experience Enhancement in High-Speed Railway Hubs **Authors:** Xiaoqian LIU, Jian SUN, Haoyang LIANG, Yingyao QIAO, Ruoxi KONG and Junyu ZHU **Presenter:** Xiaoqian LIU, Tongji Architectural Design (Group) CO., Ltd, China **Abstract:** The planning and design of large-scale high-speed railway passenger hubs are shifting from "efficiency-first" toward "equal emphasis on experience and efficiency." However, the design stage currently lacks effective pre-evaluation methods for passenger experience. This paper proposes a Triple-Loop Simulation framework for experience pre-evaluation, which integrates three closed-loop mechanisms—Environment-in-the-Loop (BIM-driven scene construction), Crowd-in-the-Loop (macro-micro integrated pedestrian simulation), and Human-in-the-Loop (VR-based human-in-the-loop experiments)—to enable quantitative diagnosis and optimization feedback of design schemes from a human-centered perspective. A large-scale high-speed railway hub under construction is adopted as a case study to validate the engineering applicability of the framework under the condition of no operational data. The results demonstrate that the Triple-Loop Simulation Pre-Evaluation (TLSPE) can effectively identify potential experience deficiencies during the design stage, providing quantitative feedback for design optimization grounded in human-centered evaluation.

Online Session 3

Time: 13:00-14:55 (GMT+2, Oslo Time)
Date: Friday, September 04
ZOOM Link: https://us02web.zoom.us/j/81842112234 **ZOOM ID:** 818 4211 2234
Password: 090204
Topic: Intelligent Logistics Network Optimization and Multimodal Transport Collaborative Scheduling for Green and Low-Carbon Development
Chaired by: TBA.

Session Keynote Lecturer **13:00-13:25**	**Title:** Operational Demand and Loading-Bay Capacity for Urban Freight Distribution in a Medium-Sized City: Evidence from Commercial Establishments in Loja, Ecuador **Author:** Díaz-Muñoz Fabián, and Second Merino-Vivanco Xavier **Speaker:** Fabián Patricio Díaz-Muñoz, Universidad Técnica Particular de Loja, Ecuador **Abstract:** Urban freight distribution is essential for urban supply, but it also intensifies curbside competition and operational conflicts, particularly in medium-sized cities with limited road space. Although previous studies have emphasized the importance of loading and unloading zones, empirical evidence for estimating the required number of bays in emerging urban contexts remains limited. This study aimed to estimate operational loading and unloading demand and determine the number of required bays for urban freight distribution in a commercial setting in Loja, Ecuador. A structured digital questionnaire was applied to 100 commercial establishments through ArcGIS Survey123, and the resulting database was cleaned, recoded, and transformed into derived variables related to daily-equivalent operations, unloading time, and schedule-specific demand. A capacity-based approach was then implemented under base, operational, and conservative scenarios. The results showed an expected daily demand of 40.333 operations, with a critical concentration between 06:00 and 07:00, when 14.490 operations were estimated. The weighted mean unloading time was 13.056 minutes, and the scenario analysis indicated requirements ranging from 3 bays under daily base conditions to 6 bays under conservative peak conditions. Overall, the study demonstrates that combining establishment-based survey data with operational capacity modelling provides a consistent basis for loading-bay planning in medium-sized cities.
OL909 **13:25-13:40**	**Title:** High-Speed Rail and Sustainable Urban Development: Evidence from Pollution–Carbon Synergy in China **Authors:** Ding Wang, Yilin Chen, Jae-hoon Chung **Presenter:** Ding Wang, Pusan National University, Republic of Korea **Abstract:** This study takes into account the coordinated reduction of air pollutants and carbon emissions based on a longitudinal dataset of 267 Chinese prefectures from 2007 to 2022. We use an intensity-based difference-in-differences(DID) framework to build a complete synergy index and assess the impact of high-speed rail on urban environmental governance. Our empirical evidence shows that HSR expansion significantly enhances pollution-carbon synergistic reduction, and a 1% increase in HSR intensity is associated with an increase of 0.0102 units in the pollution–carbon synergy index. The results further indicate that the PM2.5 suppression effect is higher than the CO2 suppression effect. The findings remain robust after applying PSM-DID and Double Machine Learning methods; thus, transportation infrastructure contributes to promoting sustainable urban development.

OL904 **13:40-13:55**	**Title:** Location Optimization of Highway Emergency Resource Depots Based on Bertsimas-Sim Robust Optimization Method **Authors:** Jianguang LI, Fanqiang KONG, Jinyou LIU, Jun DENG, Dandan DONG, Aoping WU, Tiesen ZENG **Presenter:** Tiesen ZENG, China Railway Chengdu Research Institute, Science and Technology Co., Ltd., China **Abstract:** To address the challenges of traditional highway emergency resource depot location models in handling demand uncertainty and single-dimensional cost considerations, this paper conducts research based on the Bertsimas-Sim robust optimization method. First, we integrate four cost dimensions—construction costs, inventory costs, transportation costs, and unmet demand penalty costs—and consider multiple constraints including minimum demand satisfaction rate, service radius, resource capacity, and emergency response time to construct a nominal optimization model. Second, we characterize demand fluctuation features by constructing an uncertainty set and introduce a robust budget parameter to balance robustness and economic efficiency, establishing a robust optimization model for highway emergency resource depot location. Finally, we select typical highway section data to design numerical experiments. Results show that as the robust parameter value increases from 0 to 5, the total cost of the model increases by approximately 17.7%, while the average demand satisfaction rate improves from 98.5% to 100%, verifying the robustness and economic efficiency of the proposed model.
OL958 **13:55-14:10**	**Title:** Enhancing Urban Mobility: A Mobility as a Service (MaaS) Bundle Recommend Framework Integrating the Impact of Historical Travel Behavior **Authors:** Yiran YU, Baoming HAN, Dewei LI, Qi ZHANG, Zhicheng DAI and Ruonan ZHANG **Presenter:** Yiran YU, School of Traffic and Transportation Beijing Jiaotong University, China **Abstract:** To enhance the competitiveness of public transportation, it is necessary to deeply integrate metro, bus, bike-sharing, and taxi systems to create Mobility as a Service (MaaS) bundles and recommend them to travelers. Based on this, a MaaS bundle recommendation system must possess 3 core capabilities: medium- to long-term preference extraction, deep-level bundle strategy extraction, and dynamic adaptive candidate bundle selection. This study proposes MaaS-BundleGT, an MaaS bundle recommendation system that incorporates the influence of historical travel behavior. First, we construct a MaaS Bundle Historical Choice Behavior Graph (MB-HCBG), characterizing the "traveler-bundle-atomized benefit" ternary relationship and infusing it with domain-specific information; we also introduce the Hawkes process to explicitly describe the time-decay characteristics of travel preferences; Second, we propose an improved bundle recommendation model that uses a GAT and a Hawkes GAT layer to extract static and dynamic domain information, respectively, and aggregate them into the ternary relationship. Through the improved BundleGT model, we accurately extract bundle strategies, differentiated decision-making logic, and benefit associations and substitution relationships; Finally, we employ a two-tower model as a ranker to address the dynamic variations of candidate bundles, achieving moderate decoupling and precise matching between travelers and bundles. Numerical experiments validate the effectiveness of MaaS-BundleGT. Further analysis indicates that the Hawkes process effectively captures the temporal decay patterns of preferences, and the introduction of atomized benefit entities and relationships significantly alleviates the sparsity issue in interaction data. These findings can support the construction of MaaS

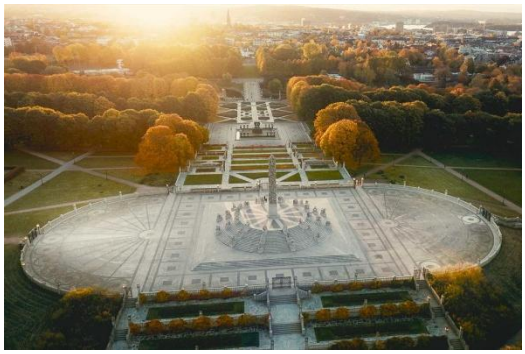
	platforms, improve the green travel service experience, and advance the implementation of sustainable transportation development goals.
OL955 **14:10-14:25**	**Title:** Modeling and Analysis of Heterogeneous Traffic Flow in a Connected and Automated Vehicle Environment **Authors:** Feng Guo, Huayu Xia, Zhongbin Xiao and Chaoyun Wen **Presenter:** Huayu Xia, Planning and Research Institute, Jsti Group, China **Abstract:** While cellular automata (CA) models are widely used for simulating mixed traffic of connected and automated vehicles (CAVs) and human-driven vehicles (HDVs), many existing approaches merely differentiate CAVs by shorter reaction times, neglecting their distinct, feedback-based control architecture. To better capture these operational differences, this study applies and extends the continuous cellular automata (CCA) framework by integrating three established car-following logics: the Gipps model for HDVs, and the PATH laboratory models for Adaptive Cruise Control (ACC) and Cooperative Adaptive Cruise Control (CACC). This integrated model enables a more faithful representation of CAV driving behavior within a computationally efficient simulation environment. Systematic numerical simulations assess the macroscopic performance of heterogeneous traffic flow across a range of CAV penetration rates. Key metrics including speed distribution, flow–density relationships, and congestion rate are analyzed, along with a sensitivity analysis of the CAVs' desired time headway. Results indicate that CAVs significantly improve road capacity: a penetration of 40%–60% yields an 18%–30% increase over a pure HDV scenario, while full penetration achieves approximately 2.07 times the baseline capacity. Furthermore, capacity rises as the desired time headway decreases for a given penetration rate. These findings underscore the importance of structurally integrating CAV-specific control models in traffic simulation and provide theoretical insights for the planning and management of future mixed traffic systems.
OL963-A **14:25-14:40**	**Title:** Does Artificial Intelligence really Decarbonize Urban Transport? Evidence from Chinese Cities **Author:** Xiong Wu **Presenter:** Xiong Wu, School of Management Science and Real Estate, Chongqing University, Chongqing, China **Abstract:** Artificial intelligence (AI) is a pivotal technology driving green transportation. Most existing studies focus on factors influencing traffic carbon emissions or isolated applications of intelligent transportation systems, while the exploration of AI's impact on urban transportation carbon emission efficiency (UTCEE) remains relatively underexplored. This study utilizes panel data from 34 core cities in China, covering the period from 2013 to 2023, and employs the global super efficiency epsilon-based measure (GSE-EBM) model, which accounts for both direct fuel emissions and indirect emissions from transportation-related electricity consumption, to assess UTCEE. Furthermore, by applying the double fixed-effects and spatial Durbin model, the study analyzes the spatial spillover effects and heterogeneity characteristics. The results indicate that the expansion of AI enterprises has suppressed local UTCEE, with this effect being particularly pronounced in eastern regions and megacities, thus exhibiting significant regional heterogeneity. Conversely, this expansion has improved UTCEE in adjacent cities, demonstrating an overall positive spatial spillover effect. These findings provide innovative strategies for establishing cross-regional collaborative emission reduction and lay a foundation for advancing the low-carbon transformation of transportation through AI.

OL965 **14:40-14:55**	**Title:** Intelligent Route Assignment System for Delivery Services Using AI **Authors:** Brayan Hernan Martínez Chuco, Luis Gabriel Prosopio Landeo, Thalia Soledad Guzman Bernar, Jorge Martín Vega Rosales **Presenter:** Brayan Hernan Martínez Chuco, Universidad Continental, Huancayo, Peru **Abstract:** Last-mile logistics is affected by traffic variability, road restrictions, and high temporal uncertainty. This study aimed to determine the impact of an artificial-intelligence-based intelligent route assignment system on average delivery time and on-time delivery performance in six locations in the Junín region of Peru. A quantitative, applied, repeated-measures quasi-experimental study was conducted with 140 PedidosYa motorcycle couriers and 2,700 delivery trips, equally distributed between conventional and system-assisted planning. The proposed solution integrated an optimized A* algorithm with a direction factor, temporal pruning, and node recovery, together with an LSTM network for travel-time prediction. Average delivery time decreased from 45.3 to 30.2 min, a 33.3% reduction ($p<0.001$; $d=2.90$), while the on-time delivery rate increased from 70.6% to 88.1%, a relative improvement of 24.8% ($p<0.001$; $d=1.94$). The findings indicate that combining temporal prediction with dynamic optimization significantly improves the efficiency and punctuality of urban delivery operations.

Oslo Attractions

Oslo, the soul of Norway, is a modern Viking city embraced by fjords. It is steeped in the seafaring spirit of the Vikings and renowned for its humanism. Vigeland Sculpture Park contemplates the entirety of life through stone carvings, leaving a profound impact; the Munch Museum houses *The Scream*, confronting the depths of human emotion. The entire city resembles a showcase of Nordic design, with the opera house's white sloping rooftop embodying an open and democratic ethos, reflecting a "built for people" philosophy. It is a place of calm and warmth, perfectly balancing self-exploration with immersion in nature.

Vigeland Sculpture Park



Sculpture park in the Frogner Park with more than 200 sculptures by Gustav Vigeland (1869–1943) in bronze, granite and cast iron, including *The Angry Boy* (*Sinnataggen* in Norwegian), *The Monolith* (*Monolitten*) and *The Wheel of Life* (*Livshjulet*). Vigeland was also responsible for the design and architectural outline of the park, which is one of Norway's top tourist attractions, with more than one million annual visitors. The park is free to enter and open all year round, 24 hours a day.

The Munch Museum

The Munch Museum is an art museum located in Oslo, the capital of Norway, dedicated to exhibiting the works of painter Edvard Munch and materials related to his life. Founded in 1963, the museum was originally situated in Tøyen. On 22 October 2021, it relocated to its new museum building in Bjørvika.

National Theatre

Step onto the stage of Norwegian theatre history. Nestled in central Oslo, the National Theatre opened in 1899 as a neo-Renaissance architectural gem. Guarded by statues of Ibsen and Bjørnson, this iconic landmark breathes the spirit of Nordic drama. Wander its elegant halls, trace the legacy of world-famous plays, and feel where Norway's greatest theatrical stories came to life. Catch a live performance or simply admire its timeless facade — a must-see destination for art lovers visiting Oslo.

Memo