

TRANSFORMATIVE TRANSPORTATION '22

5th CATTS Symposium

June 7, 2022



AGENDA

9:00-9:10 Welcome and Opening Remarks, Amer Shalaby

9:10-10:50 **Session I-** moderated by Toka S. Mostafa

- Transportation Planning:
 - *Mobility as a Service (MaaS)*, Eric Miller
 - *A Framework for Modelling Mobility Services with an Application to Ridehailing-* Eric J. Miller & Francisco Calderon
 - *MaaS Platforms and Travel Demand-* Shuoyan Xu & Eric J. Miller,
 - *Overview of AV and related MaaS Research by the Travel Demand Modelling Group (TDMG)*, Khandker Nurul Habib
 - *A Dynamic Agent-Based Multi Modal Travel Demand Modelling with Routing of AVs -* Sk. Mashrur, Kaili Wang, and Brenden Lavoie
 - *Substitutions of Travel Time in AV in the context of Daily Travel Demands -* Brenden Lavoie
- *Transportation and Air Quality* by Marianne Hatzopoulou
 - *Prediction of short-term ultrafine particle exposures using real-time street-level images paired with air quality measurements-* Junshi Xu
 - *Energy and greenhouse gas implications of shared automated electric vehicles-* Marc Saleh
- *Freight Modelling and Logistics*, Matthew Roorda
 - *Performance of Person-following Delivery Robots in Crowded Pedestrian Environments -* Ruowei Li
 - *Freight Modeling and Impacts of Freight AV in the Greater Toronto and Hamilton Area -* Tufayel Chowdhury
- *Computer Vision*
 - *Long range traffic detection with AI-based computer vision –* Steven Waslander
 - *Visual 3D Understanding of Mixed Traffic in Busy Intersections-* James Elder

10:50-11:00 Break

11:00-12:30 Session II- moderated by Toka S. Mostafa

- *Traffic Management and Control by Baher Abdulhai*
 - *Traffic Management with TRiP reservation system- Ahmed Aqra*
 - *Freeway management with AV headway control- Lina Elmorshedy*
 - *The challenge of controlling the QEW: long congested and dense on-ramps -Omar Elsamadisy*
 - *State of the art AI-based adaptive traffic signal control: Yonge and Steeles – Xiaoyu Wang and Illia Smirnov*
- *Public Transportation by Amer Shalaby*
 - *Coordinated and Bi-Objective Transit Signal Priority (TSP): Optimization Using a Deep Reinforcement Learning Approach - Wenxun Hu*
 - *Advanced Real-Time Transit Management Strategies in Mixed-Traffic Arterial- Kareem Othman*
 - *Transfer Synchronization in Transit Networks; a Stochastic Programming Approach - Zahra Ansarilari*
 - *Public Perceptions of Autonomous Shuttle Service: A Case Study in Toronto's West Rouge Neighbourhood - Chelsea DeGuzman*
 - *Planning Integrated On-Demand and Scheduled Bus Transit Services: Guiding Principles -Alaa Itani*

12:30-1:30 Break

1:30-2:30 Guest Speakers' Session moderated by Toka S. Mostafa

1:30-2:00 *The Importance of Living Labs for Emerging Transport Technologies*-Oliver Howes, Smart Mobility London Living Lab: London

2:00-2:30 *Toronto's AV Tactical Plan: Three Years Later* – Ryan Lanyon, the City of Toronto

2:30-2:45 Break

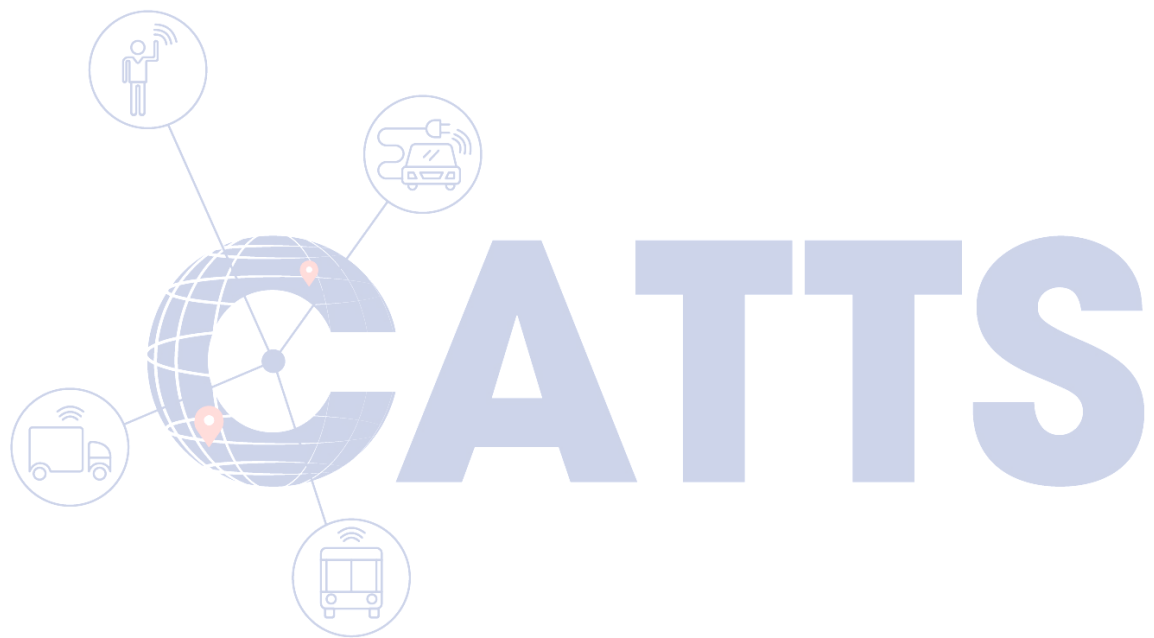
2:45-3:15 Session III- moderated by Toka S. Mostafa

- *Creating Digital Twins: Initial Insights from the Ecopia / City of Toronto Initiative - Jason Neudorf, the City of Toronto, and Kelly Liang, Ecopia*
- *Update on Advanced Transportation Technologies Implemented in York Region- Lauren Crawford, York Region*

3:15-3:40 CATTs Next: Toronto Smart Mobility Living Lab, Baher Abdulhai

3:40-4:00 Break

4:00-5:00 Partner's Planning Workshop (Closed session with partners only), moderated by Baher Abdulhai and Amer Shalaby.



Speakers' Bios:

ERIC J. MILLER, BAsC (1973, UofT); MAsC (1975, UofT); PhD (1978, MIT), has been a faculty member in the Department of Civil & Mineral Engineering, University of Toronto since 1983, where he is currently Director of the UofT Mobility Network. His research interests include agent-based microsimulation, travel demand modelling, integrated urban system modelling and sustainable transportation planning. Recent awards include the 2018 International Association for Travel Behaviour Research Lifetime Achievement Award, and the 2020 UofT Faculty of Applied Science and Engineering Safwat Zaky Research Leader Award. He is currently chair of the Bay Area Rapid Transit Travel Demand Modelling Peer Review Panel.

Shuoyan Xu, M.Sc. is currently working toward his Ph.D. degree under the supervision of Professor Eric. J. Miller at the University of Toronto. His research interests are mobility as a service (MaaS) system, travel behavior, and operations research. He received M.Sc. in transportation engineering in 2021 on "Optimizing Snowplow Routes using All-New Perspectives: Road Users and Winter Road Maintenance Operators" at the University of Alberta, Alberta.

Sk. Md. Mashrur is a PhD student in Civil Engineering at the University of Toronto. He earned his master's and bachelor's degrees from the Bangladesh University of Engineering and Technology. His research interest is transit demand modelling, and he is currently working on integrated activity-based demand and dynamic transit assignment framework for his PhD under the supervision of Professor Khandker Nurul Habib.

Brenden Lavoie is a MAsC candidate at the University of Toronto under the supervision of Professor Khandker Nurul Habib, Brenden is exploring the future of Autonomous Vehicles and how they will impact the GTHA's transportation system. During his undergraduate degree at the University of Toronto, Brenden worked with the Region of Peel where he led Peel's successful effort to establish itself as a United Nations Regional Centre of Expertise, tackling complicated issues such as sustainability and equity through a variety of transportation initiatives. Outside of Engineering, Brenden is also an avid golfer, traveler, and photographer.

Khandker Nurul Habib is the Percy Edward Hart Professor in Civil & Mineral Engineering at the University of Toronto. His overall research focus is sustainable transportation planning and policy development. For this, he recognizes that we need a clear understanding of peoples' transportation behaviour and appropriate methodology for capturing such behaviour while forecasting demand for transportation infrastructure or results of any transportation and land-use policies. So, his research involves developing activity-based travel demand forecasting models, integrated land-use and transportation models, and advanced travel survey methods. For his pioneering contribution in these areas, he received numerous national and international awards. He is the recipient of the 2020 "Sandford Fleming Award" from the Canadian Society of Civil Engineering (CSCE), and he is the chair of TRB's Standing Committee on 'Travel Behaviour and Values'.

Junshi Xu is a post-doc fellow with Prof. Marianne Hatzopoulou in the Transportation and Air Quality Research group. He is also the program director for the Positive Zero Transport Futures initiative. His research mainly focuses on local traffic emissions and near-road air quality. He has led studies in mobile monitoring campaigns and empirical modelling of traffic-related air pollution. He also has expertise in using computer vision techniques to derive local traffic information from images and applying machine learning algorithms to investigate the impacts of meteorology, land use, and traffic on near-road air pollution.

Marc Saleh is a PhD candidate at the Department of Civil and Mineral Engineering of the University of Toronto. His research explores the role of emerging technologies in mitigating transport sector emissions. His recent projects vary from investigating the traffic emissions of freight demand management strategies; to understanding the potential impact of electric automated vehicles on vehicle ownership and their respective emissions. Prior to pursuing his PhD, Marc received a Bachelor of Science in Civil Engineering from the University of Toronto. He also holds a federal NSERC Postgraduate Scholarship – Doctoral (PGS D) award.

Marianne Hatzopoulou is Professor and Associate Chair of Graduate Studies in the Department of Civil and Mineral Engineering at the University of Toronto. She holds a Canada Research Chair in Transportation and Air Quality. Dr. Hatzopoulou leads an active research group studying the interactions between transportation, air quality, climate change, and public health. She supported municipal governments and community groups in the appraisal of transportation policies in terms of climate and air impacts. She also served on national and international expert panels, providing advice on the development of strategies to reduce transportation-related emissions. Dr. Hatzopoulou works closely with epidemiologists in the development of improved measures for air pollution exposure and has received funding from provincial, federal, and international health agencies to conduct integrative research in transportation engineering, air pollution, and public health. She serves on the Transportation Research Board of the National Academies of Sciences, Engineering, and Medicine as the committee research coordinator for the standing committee on “Air Quality and Greenhouse Gas Mitigation”. She is also an associate editor of the journal Transportation Research Part D: Transport and Environment.

Matthew Roorda is a Professor of Civil Engineering and has been a faculty member at the University of Toronto since 2005. He is the Canada Research Chair in Freight Transportation and Logistics. His research focuses on modelling, data analytics and pilot projects promoting efficient and sustainable urban freight systems.

Ruowei Li is an M.Sc candidate under the supervision of Professor Matthew Roorda at the University of Toronto. Her research interests include last-mile logistics, pedestrian simulation, and transportation planning. Ruowei’s current project involves evaluating the performance of a person-following delivery robot in crowded environments.

Tufayel Chowdhury is a PhD candidate at the Department of Civil & Mineral Engineering, University of Toronto. His PhD research involves developing freight demand models for policy analysis at the national and urban scales using agent-based and traditional trip-based methods. Prior to the PhD program, he worked in management consulting, specializing in transportation, infrastructure, and energy. His previous research focused on econometric modeling of built environment and travel behavior, and benchmarking commuting efficiency.

Steven Waslander is a leading authority on autonomous aerial and ground vehicles, including multirotor drones and autonomous driving vehicles, Simultaneous Localization and Mapping (SLAM) and multi-vehicle systems. He received his M.S. in 2002 and his Ph.D. in 2007, both from Stanford University in Aeronautics and Astronautics, and is currently an associate professor at the University of Toronto Institute for Aerospace Studies (UTIAS), where he founded the Toronto Robotics and Artificial Intelligence Laboratory (TRAILab). His work on autonomous vehicles has resulted in the Autonomoose, the first autonomous vehicle created at a Canadian University to drive on public roads.

James Elder is Professor and York Research Chair in Human and Computer Vision at York University. He is jointly appointed to the Department of Psychology and the Department of Electrical Engineering & Computer Science at York and is a member of York’s Centre for Vision Research (CVR) and Vision: Science to Applications (VISTA) program. His research employs psychophysical and computational methods to understand the principles that underly both biological and machine vision systems. Dr. Elder’s current research is focused on natural scene statistics, perceptual organization, contour processing, shape perception, single-view 3D reconstruction, attentive vision systems and machine vision systems for dynamic 3D urban awareness. Dr. Elder has led numerous large-scale multi-sector collaborative research projects and currently directs the multi-institution ORF-RE project Intelligent Systems for Sustainable Urban Mobility. He holds three patents on attentive vision technologies and is the co-founder of the AI start-up AttentiveVision.

Ahmed Aqra is a Ph.D. Candidate in Intelligent Transportation Systems at the University of Toronto under the supervision of Prof. Baher Abdulhai. His research focuses on Trip Reservation and Intelligent Planning for Hyper-Congestion-Free Transportation Systems. Ahmed received his B.Sc. in Computer Engineering from Ajman University in 2006, he obtained his Master of Engineering Management from the University of Wollongong. In 2016, he received his second MASc in Software Systems Engineering from the University of Regina. Ahmed has worked in the transportation industry for a decade as a Software Engineer, Chief Analyst, Product Manager, and ITS Subject matter expert. Ahmed led the “Big” Data Team for Traffic Applications in the ITS lab at the University of Toronto. Ahmed’s research interests include networkwide transportation management systems, machine learning, big data analytics, transportation modelling, sharing economy business models, and on-demand services. Ahmed is passionate about incubating new ideas and solving real-life problems using information and communication technologies.

Lina Elmorshedy is a PhD candidate who has received her BSc. in Electrical Engineering from Alexandria University, Egypt, and her MASc. degree in Electrical and Computer Engineering from the University of British Columbia, Vancouver, Canada. During her Master’s studies, Lina has gained experience in the fields of mathematical optimization, data analysis and machine learning to tackle various wireless communication problems. Lina’s current PhD research focuses on the implementation and evaluation of traffic management and control strategies in the context of emerging vehicular automation technologies.

Omar Elsamadisy is a PhD candidate in the Civil and Mineral Engineering Department at the University of Toronto (UofT), under the supervision of Prof. Baher Abdulhai. His PhD research is in the field of Intelligent Transportation Systems (ITS). His PhD research is in the field of Intelligent Transportation Systems (ITS). His main goal is to develop a control strategy for both manually driven and autonomous vehicles on freeways to reduce congestion and preserve safe and efficient flows at bottlenecks using the latest Artificial Intelligence (AI) methods and techniques.

Xiaoyu Wang is a Ph.D. candidate at the Department of Civil Engineering, University of Toronto. He has an education in control theory and got his M.Sc. degree in control science and technology at Shanghai Jiao Tong University. His research covers a wide range from robotics to intelligent transportation systems. More recently, Xiaoyu shifts his interest toward controlling and coordinating regional traffic signal lights. Together with Professor Abdulhai’s team, he is dedicated to improving both the effectiveness and reliability of the modern reinforcement learning driven traffic signal control systems.

Wenxun (Ariel) Hu received her M.Sc. degree in 2015 and is pursuing a PhD in transportation engineering at the University of Toronto, Ontario, Canada. Her research interests include transit planning and operations, traffic signal control, and intelligent transportation systems.

Kareem Othman is PhD candidate at the Civil & Mineral Engineering Department, University of Toronto. His research interests include transit management, adaptive arterial control, connected vehicles, and autonomous vehicles.

Zahra Ansarilari is a PhD candidate in transportation engineering at the University of Toronto, Department of Civil & Mineral Engineering. Her research focuses on improving public transit services. There are so many aspects regarding public transit that need to be enhanced; Zahra is working on minimizing transfer times through optimization model.

Chelsea DeGuzman is a fourth year PhD student in the Department of Mechanical and Industrial Engineering at U of T. She works in the Human Factors and Applied Statistics lab, under the supervision of Prof. Birsen Donmez. Her research interests focus on human-automation interaction, specifically drivers’ understanding of driving automation and how to develop better training to support them in using these systems safely.

Alaa Itani is a PhD candidate in the Department of Civil and Mineral Engineering. Her research interest is in the field of bus-hailing and flexible transit services. Her research focuses on developing guidelines and analytical framework for planning integrated transit networks that operate scheduled and on-demand bus services. Alaa holds MASc degree from the University of Toronto where her research focused on managing unplanned subway disruptions.

Oliver Howes is the Acting Head of Automation at TRL, focusing on preparing automated transport technologies for deployment. TRL's mission is to create clean, efficient transport that is safe, reliable, and accessible for everyone. Automation in transport will play a key role in achieving this mission and Oliver ensures TRL is well placed to support this mission. Previously Oliver was a Principal Consultant for the Smart Mobility Living Lab: London (SMLL) which is a TRL company. SMLL is the world's most advanced urban testbed for accelerating the creation of new mobility solutions. Within this role Oliver developed expertise in the trialling and testing of new and innovative transport technologies in a living lab environment. Oliver played a key role in the design and build of the SMLL test facility which launched in 2020. He has also technically authored guidance documentation for safety case development of connected and automated vehicles (CAVs) and developed a systems safety case framework for CAVs.

Ryan Lanyon is the Manager of Strategic Policy and Innovation for Transportation Services at the City of Toronto. Ryan is also chair of the City's Interdivisional AV Working Group, which consists of 30 divisions and agencies. He and his team lead automated vehicle research, policy, and pilot projects for the City.

Jason Neudorf is a Project Manager at the City of Toronto and leads the City of Toronto's Automated Vehicle file. He is responsible for implementing the City's Automated Vehicle Tactical Plan and overseeing the City's Transportation Innovation Zone program. Jason has a decade of experience working in complete street design, transit operations and innovative transportation policy development. He holds a Masters degree in Planning from the University of Waterloo.

Kelly Liang is a Product Manager at Ecopia AI and has been with the company for 4 years. She leads product strategy and oversees products throughout the product life cycle. Prior to this, she was a data scientist at the company responsible for developing algorithms to extract insight from geospatial data at a country-scale.

Lauren Crawford is a professional engineer with over 20 years of experience managing major transit/transportation infrastructure in the public and private sectors. She is currently the Manager of Transportation Long-Term Planning at York Region with responsibility for transportation planning studies, capital plan prioritizing and programming, data forecasting and modelling and researching and planning for transportation technology initiatives. Prior to joining the Region, Lauren spent 10 years in the private sector as a transportation consultant working on traveller information system projects for clients in Ontario and the US. Lauren enjoys spending time with her family, cheering on her kids in sports, travelling, skiing, reading, and running marathons!