

INTRODUCTION TO THE CTRF 2026 CONFERENCE

Sarah Harlley, Adrian Lightstone, Joseph Monteiro, and Barry E. Prentice

The theme of the 2026 conference is “Mobilizing our Future: Transport Innovations for a Stronger Canada”. The world we have lived in is changing. Canada is beginning to adjust, in the words of Prime Minister of Canada “We have removed all federal barriers to interprovincial trade. We are fast-tracking a trillion dollars in energy, AI, critical minerals, new trade corridors and beyond by the end of this decade and we’re doing so in ways that builds our domestic industries. We are rapidly diversifying abroad. We have agreed to a comprehensive strategic partnership with the EU [European Union], including joining SAFE, the European defence procurement arrangements. We have signed twelve other trade and security deals in four continents in six months. In the past few days, we’ve concluded new strategic partnerships with China and Qatar. We are negotiating free-trade pacts with India, ASEAN [Association of Southeast Asian Nations], Thailand, the Philippines and Mercour.” In addition to changes on the world scene which have created uncertainty as a result of the threat of tariffs from the government in the US, the domestic scene has witnessed labour strikes in air transportation, rail and postal services.

At the 61st conference, CTRF will examine developments that are occurring in transportation that are calling for changes in our global supply chains arising from new trade agreement. Innovations in transportation - electric vehicles, e-bikes, drones, flying taxis, driverless automobiles, automation and the use of artificial intelligence - are becoming more visible and affecting our past habits and calling for new laws. All these developments are having an effect on transportation and the economy. More specifically, how will it affect transportation productivity? How will it affect mobility patterns and supply chains? Are policy and regulations keeping up with these developments? To add to this, the threat of inflation, the possibility of new tariffs in a revised CUSMA, together with increasing demands to deal with climate change due to global warming are now concerns. The conference proceedings contain a rich collection of papers on these issues with particular emphasis on the recent developments and their impacts on transportation systems, mobility of people, and transit. These proceedings demonstrate the range and depth of topics that make the Canadian Transportation Research Forum the foremost annual venue of its kind in Canada.

Organization of the Proceedings and an Overview of Individual Papers

The papers in this Proceedings are organized under twenty sessions. 1. Net-Zero, Emissions & Climate Policy; 2. Northern & Remote Infrastructure Development; 3. Air Transportation & Aviation Policy; 4. Emergency Response, Resilience & Safety; 5. Ride-Hailing, TNCs & Shared Mobility; 6. Autonomous & AI-Based Modeling; 7. Intercity & High-Speed Rail in Canada; 8. Maritime & Marine Transportation issues; 9. Travel Demand Modeling & Transferability; 10. Housing, Land Use & Mobility; 11. Transit Operations & Bus Systems; 12. Freight, Supply Chain & Logistics; 13. Urban Form, Street Space & Curb Management; 14. Transportation Planning Practice & Tools; 15. Multimodal & National Transportation Capacity; 16. Survey Methods & Behavioral Modeling; 17. Urban Mobility & Travel Behavior Modelling Tools; 18. Transportation Funding & Economic Policy; 19. E Bikes, Active Travel & Well-Being; and 20. Accessibility & Equity.

1. Net-Zero, Emissions & Climate Policy

Clearing the Skies: Pathways to Net-Zero Air Cargo Emissions in Canada by 2050 – Hao Thi Lam, Chris Bachmann, Clarence Woudsma

This study develops a Well-to-Wake emissions projection framework that integrates traffic growth modeling based on revenue tonne-kilometres with life-cycle emission factor analysis (g CO₂e per RTK) to estimate baseline and future greenhouse gas emissions for Canada’s domestic air cargo sector from 2023 to 2050. Initial analyses suggest that while Sustainable Aviation Fuels adoption yields near-term

reductions, achieving deep decarbonization will depend on coordinated policy support and accelerated innovation in low-carbon propulsion technologies.

A Flexible Framework for High-Resolution Vehicle Emission Inventories in Data-Rich and Data-Limited Canadian Cities – Mina Jamshidi Kalajahi, Bijoy Saha, Madhawa Premasiri, Mahmudur Fatmi, Naomi Zimmerman

The authors present a flexible framework that integrates agent-based activity-based model (ABM) with the MOVES emissions model to generate spatiotemporally-resolved EIs in both data-rich and data-limited contexts. In this paper, the study highlights the framework's potential as a transferable tool for Canadian municipalities seeking to develop detailed EIs despite inconsistent data availability.

Modeling Pedestrian Exposure to Traffic Related PM_{2.5} Along an Urban Freight Corridor – Azam Khan

This study examines the determinants of pedestrian exposure to vehicular PM_{2.5} emissions along a designated urban freight corridor in Halifax, Nova Scotia. Ambient PM_{2.5} concentrations were monitored at six roadside locations during morning and afternoon freight peak periods. Concurrent measurements of traffic volume and meteorological conditions including temperature, relative humidity, and wind speed were collected. Employment density within a 500 m buffer was incorporated as a categorical land use indicator representing corridor activity intensity. Generalized Linear Models (GLM) and Generalized Additive Models (GAM) were employed to quantify the effects of traffic, meteorological, and land use variables on PM_{2.5} concentrations. Model comparison indicates that the GAM provides a superior fit, achieving an adjusted R² of 0.964 and effectively captures nonlinear relationships. The results identify relative humidity, ambient temperature, and surrounding employment density as the dominant predictors of pedestrian PM_{2.5} exposure. These findings support targeted mitigation strategies for freight intensive urban corridors.

Enforcing IMO GHG Regulations: Implications Of Goal-Based Regulatory Strategies – Sylvia Xinyue Zhang

The author focuses on how to enhance regulatory accountability at the enforcement stage and advocates efforts at three fronts: First, it is critical to improve the law enforcement capacity of maritime administrations. Second, a more transparent institutional compliance mechanism should also be established at the level of the IMO. Third, public authorities, as well as capable non-government entities, such as academics and environmental organizations, should invest more resources to develop effective technological tools and methodologies for performance monitoring, violation detection and compliance verification.

2. Northern & Remote Infrastructure Development

The Ring of Fire in Northern Ontario Future Prospects and Developments – Malcolm Cairns

This paper surveys the development of critical minerals in the far north of Ontario, known as the Ring of Fire. It has the potential for a significant development value, once a number of obstacles are overcome – including transportation access. A number of critical minerals may be extracted, but only traces of rare earth elements (REEs), as they are not typically found in the same geological formations as the minerals concentrated in the Ring of Fire.

Transmettre pour s'adapter : la force de la gestion des Connaissances dans la sécurité de la navigation arctique - Camille Audet, Anne Fauré

Cette recherche examine comment la culture de sécurité, le leadership et le transfert de connaissances contribuent à la résilience du transport maritime dans l'Arctique canadien. À partir d'une approche qualitative alliant analyse documentaire, observation non participante et entrevues, elle explore comment les équipages et les organisations anticipent, partagent et adaptent leur expertise face à un environnement changeant. Les résultats préliminaires suggèrent que le partage des savoirs expérientiels constitue un levier

essentiel de préparation et d'adaptation. En intégrant ces savoirs au cœur des pratiques organisationnelles, cette recherche met en lumière des avenues concrètes pour renforcer la sécurité, la capacité d'apprentissage et la résilience du domaine maritime, contribuant ainsi à un système de transport plus robuste et à un Canada plus fort.

The Influence of Weather and Ice on Ferry Cancellations: Modeling Present-Day Effects to Predict Future Trends – Andrew Sargeant, Ronald Pelot, Alireza Ghasemi

To better understand how weather and ice factors influence ferry operations, a statistical analysis is conducted on the traffic data of a ferry operator based in Atlantic Canada relative to historical weather and ice condition data. Random Forest models are constructed to predict ferry sailing cancellations using environmental factors as inputs, to examine the influence and relationships of specific factors and combinations of factors, and to project rates of cancellation in the coming decades. The results show that (1) environmental factors are good predictors of cancellations; (2) wind speeds are the most important environmental factor for cancellation prediction; and, (3) the ratio of cancelled sailings to total sailings is projected to increase over the next three decades.

Research on Dynamic Traffic Assignment on Urban Traffic under Extreme Weather – Xun Ji, Bobin Wang, Owen Waygood

Frequent extreme weather severely affects the operation of urban road traffic and transportation. In light of this, a travel cost function of road sections under extreme weather was established. This aims to reveal the travel cost composition across different vehicle types and to estimate the dynamic travel cost for degraded road sections under extreme weather. Then, using the path-sensing instantaneous travel cost as the basis for travel decision-making and choosing SDUE as the DTA principle, the departure time and the route choice models under extreme weather were proposed to clarify the propagation of traffic flow. The DTA model and algorithm were developed under extreme weather. Based on a case study, the temporal and spatial distributions of path flow under different scenarios were discussed. The research results can provide a robust theoretical basis for traffic emergency management and travel behavior under extreme weather.

3. Air Transportation & Aviation Policy

Airport Catchment Shifts in Atlantic Canada: A Spatiotemporal Analysis –Kaleab Woldeyohannes Yirgu, Kurt Fuellhart

This study aims to quantify the impact of restoration air services post-COVID 19 in Atlantic Canada by investigating how the smaller airports' catchment areas are likely to grow. The catchment areas will be plotted based on existing discrete airport choice model parameters of airfare, airport access distance, flight frequency, and number of nonstop destinations. The findings are expected to offer meaningful insights for airlines operating or planning to expand in the region, particularly in identifying and understanding their customer base. Furthermore, the study can support the region's quest to strengthen tourism and trade by spatially and temporally highlighting the impact of its ever-improving air service.

Is It Time For A National Air Accessibility Strategy? – Sonya Sula

Insufficient industry coordination and alignment of strategic priorities for accessibility have exacerbated inconsistencies in air travel for passengers. Despite regulatory frameworks (The Accessible Canada Act and the Accessible Transportation for Persons with Disabilities Regulations (ATPDR)) and industry efforts, people with disabilities continue to encounter barriers throughout their air travel journey. As we navigate towards 2040, there is a need to reflect on progress and determine a coordinated path forward. This paper argues that a National Air Accessibility Strategy (NAAS) is needed to reconcile the challenges the aviation industry faces and the barriers passengers experience. A national strategy would help to drive consistency in accessible services, products, and facilities across the aviation ecosystem. The NAAS would also shape future regulatory amendments to the ATPDR and ATPRR.

Knowledge and perceptions across Canadian air travellers and non-travellers – A cross-sectional survey study – Emma Neale

This paper seeks to assess Canadian's understanding and perceptions of the air travel industry. A cross-sectional survey of 1000 responses across Canada was conducted. The survey includes questions on airport and fee structure knowledge, along with various perceptions on aviation services and the environment. Findings suggest that Canadians are not knowledgeable of the aviation sector and have limited willingness to pay for their environmental impact. While travellers have a slightly higher knowledge level than non-travellers, there is overall no significant distinction between groups. This study provides insight for policymakers and stakeholders to engage Canadians in further knowledge mobilization of the air transport industry, to enable more transparency and support of future policy measures.

Remotely-Piloted Aircraft Systems (RPAS) in the Provision of Cross-Border Specialty Air Services in North America – Dean Corno and Dr. Marc Rioux

The provision of many services on a cross-border basis whether financial services, telecom, maritime or air services can pose challenges for service providers, regulators and consumers. In Canada, RPAS operations have yet to be taken up in a meaningful way in the commercial transportation of goods or people, though it is the eventual authorization of such operations that holds the most interest for industry stakeholders, either when provided through a commercial presence, or via when across international borders. This paper explores developments in Canada and the US.

4. Emergency Response, Resilience & Safety

From Risk to Resilience: A GIS-Driven framework for Measuring Community Connectivity – Erin Vedam, Nick Shaw, Ahsan Habib, Charlie Elliott, H.

This presentation highlights a GIS-based decision-support framework developed for Halifax Regional Municipality (HRM) that reimagines traditional Hazard, Risk, and Vulnerability Assessment (HRVA) through a transportation lens. The presentation will focus on the technical development of the framework, which leverages graph theory and python automation to quantify network connectivity. The connectivity framework demonstrates how advanced GIS modeling can support practical decision-making and prioritize a safer, more resilient future for Canadian communities.

The State of Practice in Validation of Risk Models in the Railway Application Area – Parastoo Azad and Floris Goerlandt

The authors examine how railway safety risk models are validated, with particular emphasis on highway-rail grade crossings. Using a systematic PRISMA approach, 25 peer-reviewed papers were analyzed to map the diversity of model types, validation approaches, and associated terminology. The finalized classification identified six model families, with regression-based statistical models most frequently applied, followed by system-theoretic and accident analysis approaches, Bayesian networks, multi-criteria decision-making, and machine learning/AI models.

Assessing the Transferability of a Port-Based Coordination Taxonomy to Maritime Accident Investigation – Elvira Meléndez, Floris Goerlandt

This study examines whether and how the Interorganizational Risk Management Coordination Taxonomy (IRM-CT), a STAMP-informed taxonomy originally developed for seaport risk management, can be meaningfully applied and potentially refined for maritime accident contexts. The analysis compares coordination mechanisms described in TSB investigation narratives with the operational and enabling adaptor categories defined by the IRM-CT. The findings provide an empirically grounded basis for improving the taxonomy's contextual validity in maritime settings and guiding future refinement efforts.

Maritime Search and Rescue Vessels Location-Allocation Problem with a Cost-Effectiveness Measure – Alireza Forouzangohar, Ronald Pelot

The author develops a location-allocation model to examine options for improving search and rescue coverage by repositioning vessels across the summer and winter seasons. The criteria include capital and operating costs, insufficiency probability, primary and backup coverage, and the effectiveness of a response resource in addressing a particular kind of incident. The results present the trade-off between cost and coverage, primary versus backup coverage, and the effectiveness of the response as a function of the vessel capabilities and allocations. A comparison with the existing fleet configuration is made and sensitivity analysis examines alternatives arrangements.

5. Ride-Hailing, TNCs & Shared Mobility

Modelling Transit Ride-hailing Access Egress – Ya Gao, Colin Ye, Eric J. Miller

The potential for ride hailing services to play a supportive role in transit, rather than just a competitive one remains under examined. It is hypothesized that collaborative Mobility as a Service solution may integrate ride hailing and transit to provide door-to-door connectivity, thereby generating increased transit ridership while supporting a ready market for ride-hailing services. This study first analyzes access/egress transit trips made via ride-hailing using the Transportation Tomorrow Survey data, then develops models to estimate ride-hailing demand as a transit access or egress mode.

Managing Ride-Hailing Supply: An Agent-Based Assessment Of Fleet Caps And Fare Regulations Using Toronto’s Regulatory Data – Shuoyan Xu, Ya Gao, Eric J. Miller

This study develops an agent-based simulation of ride hailing driver supply interaction in the City of Toronto to examine how fleet size and pricing policies affect network performance. Two policy levers are analyzed: fare adjustments through a sensitivity analysis to assess demand elasticity and spatial equity, and license capping to explore the effects of restricted fleet participation. Model outputs include vehicle kilometres travelled, waiting times, and accessibility indicators. Preliminary results indicate that combining moderate fare adjustments with targeted licensing caps can improve overall network efficiency while maintaining service reliability.

Spatial Analysis of Ride-hailing and Public Transit Competition with Explainable AI – Xinghua Liu, Bobin Wang, Xun Ji, Jing Fan, Xuan Shao

To bridge the gap (of assumptions of linearity and failure to account for nonlinear interactions between ride-hailing and public transit), this study introduces an explainable AI (XAI) framework, combining eXtreme Gradient Boosting (XGBoost) with SHapley Additive exPlanations (SHAP) to both predict and interpret the spatial factors influencing competition. The competition rate within 8,535 hexagons in Shanghai serves as the dependent variable, with independent variables including built environment factors. The results demonstrate that XGBoost outperforms traditional spatial models. Key variables, such as distance to the CBD and bus stop density, significantly influence competition. Nonlinear effects are also evident, such as the strong negative correlation between distance to the CBD and competition within 20 km, which diminishes beyond this threshold. These findings enhance the understanding of transportation competition and the value of XAI in spatial analysis.

6. Autonomous & AI-Based Modeling

Astra: A Behaviourally Rich Hybrid Transformer-LSTM Engine For Joint Daily Activity Generation And Scheduling – Mostaq Ahmed, Mahmudur Rahman Fatmi

This study proposes a hybrid graph-recommender retrieval method for generating behaviorally plausible choice sets for agent-based microsimulation. The author represent Metro Vancouver’s urban fabric as a multi-relational graph in which parcels are nodes and edges capture spatial impedance, co-visitation patterns, and functional similarity in land use and amenities. A graph neural network learns low-dimensional embeddings of destinations so that parcels that “behave alike” lie close in the embedding

space. Using the 2023–24 British Columbia Activity Time Use Survey, the author shows that the method achieves substantially higher recall of observed destinations, at comparable set sizes, than proximity- or zone-based baselines. By delivering a high-recall, behaviorally grounded choice set, the method provides a robust foundation for subsequent destination choice modeling.

City-Scale Spatio-Temporal Ride-Hailing Demand Forecasting with Deep Learning – Jing Li, Kang Tang, Harith Abdulsattar, Hao Yang

The authors develop a deep learning framework for spatio-temporal prediction of ride-hailing demand at the city scale using trip records from Austin, Texas, collected between 2016 and 2017. The proposed model jointly learns temporal dynamics (within- and across-day patterns) and spatial dependencies between zones using sequence-based and convolutional components. Its performance is benchmarked against classical statistical and machine learning baselines for short-term demand forecasting. The author evaluates prediction accuracy across different times of day, weekdays versus weekends. The outcome is a practical, data-driven tool that can support ride-hailing operators and city planners in proactive fleet management, congestion mitigation, and policy analysis.

Performance Evaluation of An Ai-Based Vehicle Classification Camera Under Varying Illumination and Weather Conditions – Janak Kharel, Phani Kumar Patnala, Alex Rogers, Jonathan D. Regehr, Babak Mehran

This study evaluates the accuracy of the count (detection) and classification data produced by iTHEIA, a novel AI-based video technology, under various weather conditions and compares these results to those obtained from a nearby WIM sensor and manually verified ground truth data. The iTHEIA camera was setup at a WIM device on CentrePort Canada Way near Winnipeg, Manitoba. The weather conditions under consideration are normal conditions, night, rainy, freezing rain, and blowing snow. Initial comparisons with WIM and ground truth data showed high overall classification accuracies. Further improvements in timestamp synchronization and vehicle matching, conducted using Extreme Gradient Boosting algorithms, are currently being investigated. Subsequently, classification accuracy will be evaluated across each class through the construction of confusion matrices. Ultimately, the findings aim to assess the effectiveness of deploying this system in real-world traffic monitoring programs.

7. Intercity & High-Speed Rail in Canada

Is there a Case for High-Speed Rail in Canada? – Sundar Damodaran

The Tri-patriate (Canada, Ontario and Quebec) study completed in 2011 concluded that there is no business case for the High-Speed Rail initiative for the entire corridor, whereas there would be net positive benefits for the Toronto-Ottawa-Montreal sector. But the government announced in early 2025 that “Canada is developing a high-speed rail network in the Toronto-Quebec City corridor. Since the project is in the co-development stage, much of the details related to cost, ridership and revenue forecasts, economic and financial cases will not likely be published. Nevertheless, a review of a business case for High-Speed Rail in Canada will be undertaken for this paper. Information and findings from previous studies will be used for this review. Although the focus for High-Speed Rail will be on the Toronto-Ottawa-Montreal-Quebec City corridor, the state of intercity passenger rail service in all corridors in Canada where passenger service has been in operation in the last 40-50 years will be used as a comparator.

The High-Speed Rail Project Between Québec City and Toronto: Issues And Recommendations – Jacques Roy, Jean Mercier, Pierre Filion

This paper compares the ALTO-Cadence High-speed train (between Quebec City and Toronto) with another possibility that would also reform the corridor, the High-frequency system (HFT), which would achieve much of the same goals as the HST project, more reliable schedules, better and faster service than the present system, but not quite as fast as the TGV, but costing about half of the HST price-tag,

estimated at between 60 and 90 billion. Our question is: How much do we want to pay for additional time saved by the super fast HST? We propose an explicit list of the essential elements that would compare systematically the two possibilities, HST and HFT, such as speed, time saved, alternative routes, costs and pressure on public finances and costs overruns.

Financing High-Speed Rail: Global Successes, Failures, and Policy Lessons – Alistair Bell

The author of this paper examines the financing of High-speed rail (HSR) through a comparative review of successes and failures. Drawing on OECD reports, empirical research, and case studies from Japan, Europe and California, the paper analyzes how funding mechanisms, risk allocation, land value capture, and supplementary revenue streams shape long-term viability. It highlights common traits of effective financing systems, including stable policy environments, early clarity on corridor benefits, credible cost forecasting, and diversified revenue strategies. It also discusses themes that lead to project underperformance, such as misaligned incentives, fragmented governance, and overreliance on uncertain future demand and concludes by outlining practical policy lessons for Canada seeking to develop HSR corridors.

8. Maritime & Marine Transportation issues

The Canadian Commercial Marine Industry: New Data to Assess Supply Chain Challenges – Zahra Aback and Lawrence McKeown

A pilot Survey of Marine Vessel Operators was launched to better navigate future challenges in view of challenges created by COVID-19 pandemic. The pilot aimed to gather financial and operational information on Canada's commercial marine industry. However, the pilot also included a short module on the supply chain challenges encountered by marine vessel operators. Those reported included, for example, labour shortages (on vessel and on shore), irregular water levels and extreme weather events, and port delays due to regulatory and other factors. This paper takes a deeper dive into these survey responses to quantify the type and prevalence of challenges reported along several dimensions such as vessel type and size as well as type and area of operation.

Econavigation: comparative analysis of fuel consumption by short-distance ferries – Marianne Pedneault-Gagnon, Pierre Miasnikof, Julien Lépine

Maritime transport contributes to air pollution and climate change by releasing greenhouse gases and fine particles. This research relies on the effective transformation of operational data into actionable information to guide energy consumption practices based on multivariate statistical analysis methods. It seeks to determine which decisions made by crews at key moments during the journey, for example, at departure, mid-crossing, on approach or during docking, have an impact on fuel consumption when confounding variables, such as weather, oceanographic conditions, traffic or load, are isolated.

Developing a Province-Wide Agent-Based Travel Demand Model for Nova Scotia with a Core-Satellite Structure – Vajeeran Arunakirinathan, Muhammad Ahsanul Habib

This study advances the current operational integrated Transport Land Use and Energy modelling framework to the whole province (NSiTLE). This study introduces a Core-Satellite approach to classify the counties in Nova Scotia into a three-layered hierarchical structure. The NSiTLE model begins with the base year synthesis, and includes several sub-modules, including Long-term decision simulator (LDS), Short-term decision simulator (SDS), and long-distance travel model (LDM). The level of detail of these modules varies by hierarchical tier. The core and T1S models include full-scale LDS, while the T2S adopts a simplified version. Similarly, the SDS, which simulates the daily urban trips is implemented only for Core and T1S models. LDM simulates the long-distance travel decision of Nova Scotia residents (intra and inter-provincial) and visitors from other provinces. The approach ensures that import countries are modelled with sufficient detail while reducing the computational burden. The model components are

calibrated and validated with the census and Nova Scotia Travel Activity Survey data. The model makes an operational provincial-level travel demand model for Nova Scotia.

9. Travel Demand Modeling & Transferability

Prospects for Activity-Based Travel Model Transferability – Eric J. Miller, Yu Zhang

This presentation explores the potential for building on recent international experience to develop a more truly transferable model system that utilizes common datasets (census, open datasets, etc.), generalizable parameters, a standard, easy-to-use software platform and has modest development costs. In particular, it is argued that the demand model system should be designed “from the ground up” to be transferable. The presentation concludes with suggestions for building a Canadian consortium to explore the “transferability hypothesis” in detail.

Modelling Commuter Bus Service & Demand: A Toronto Case Study – Grace Zhang, Eric J. Miller

Commuter bus services play an important role in many large urban regions. Taking GO Bus service in the Greater Toronto-Hamilton Area as its case study, this paper first conducts a descriptive analysis of the mode’s ridership, based on the 2022 Transportation Tomorrow Survey. It then assesses the performance of a GTHA travel demand forecasting mode system for modelling GO Bus route and mode choice. It concludes with recommendations concerning how to improve commuter bus modelling in the GTHA and beyond.

Generating a Synthetic Weeklong Travel Diary Using a One-Day Sample And 7-Day Sub Sample – Imrul Shafie, Mahmudur Fatmi

Traditional travel surveys based on single weekday diaries are limited in their ability to capture variability in weeklong travel behavior. While weeklong data provide richer behavioral insights, they are resource-intensive, smaller in sample size, and difficult to scale. A viable alternative is to expand single-day diaries into synthetic weeklong schedules. However, most existing expansion approaches rely on population-level resampling conditioned only on day type, ignoring individual-specific temporal dependencies across days and heterogeneity in weekly activity rhythms. This study addresses these limitations using the British Columbia Activity Time Use Survey.

Inter-Household Carpool Modelling in an Agent-Based Travel Demand Model – Ya Gao, Lai Ying (Coco) Lam, Eric J. Miller

Carpooling is an emerging travel mode that can save time, expand mobility for dependents and adults with impairments, support high-occupancy vehicle (HOV) use, reduce travel resource consumption, and help alleviate congestion. A prototype model was developed to identify possible carpool drivers and to estimate the driver-passenger matching probability. The prototype model will be integrated into GTAModel V4.2 to improve the estimation of carpool travel demand and to support policy analysis.

A framework for modelling dependent-serving activity/travel behaviour – Eric J. Miller, Usman Ahmed

In this study the author analyzes the activity/travel behaviour of persons serving dependent members of a household. The author focuses on the activity behaviour of young children as a critical use case. These activities involve supervision, chauffeuring, and joint participation in activities (e.g., visiting a doctor). Some serve dependent activities which are pre-planned can also be classified as mandatory activities. This paper presents activity behaviour of serve dependents and related household interactions. It also presents a framework to model these activities and household interactions in an activity-based travel demand model developed for the Greater Toronto-Hamilton Area.

10. Housing, Land Use & Mobility

Intercity Mobility in Quebec: Portrait of Current Travel Demand and Supply and Evaluation of Sustainable Transportation Options in Major Corridors – Hamed Malekzadeh, Catherine Morency

This project offers a comprehensive portrait of intercity travel by combining new empirical evidence from a pilot long-distance mobility survey with a behavioral assessment of sustainable transport options in the Quebec's major corridors. The results reveal strong sensitivities to travel time and cost—particularly in access and egress segments—and highlight substantial heterogeneity in traveler preferences. Together, these insights support evidence-based planning for improved multimodal connectivity and the potential integration of sustainable options, including high-speed rail, within Quebec's intercity mobility system.

Joint Modeling of Housing Choice, Telework Participation, and Teleworking Duration Using a Gumbel-Type Copula: Evidence from Halifax, Canada – Fatin Anzum Khan

In this study, the author jointly models dwelling type choice, telework participation, and telework time-allocation using a Gumbel-type Fully Nested Archimedean Copula (FNAC). The FNAC framework captures correlated unobserved components across these decisions, reflecting their joint determination. The results using 2022-2023 Halifax Travel Activity indicate that telework participation significantly influences dwelling choice. Telework behavior varies systematically with vehicle ownership and income. Joint modeling reveals strong dependence across decisions, with teleworkers residing in single-detached dwellings exhibiting the highest likelihood of full-day telework. Increased teleworking among higher-income households may stimulate demand for larger dwellings, potentially increasing residential energy consumption. Targeted energy-efficiency measures are therefore needed to preserve telework's transport benefits while supporting sustainable urban development.

Linking Environmental and Financial Costs of Housing and Daily Mobility: Toward an Integrated Residential Footprint of households – Mathilde Zanolini, Catherine Morency

The authors develop an integrated Life Cycle Assessment (LCA) framework to estimate households' residential footprint by combining the environmental and economic impacts of housing and daily mobility. This approach assigns equal importance to financial aspects by incorporating both housing and transport costs. This dual perspective acknowledges that financial constraints and trade-offs shape residential location choices, thereby influencing environmental outcomes. The results include mapping the spatial distribution of residential footprints across the study area, identifying inequalities in emissions and costs, and providing insights into interactions between housing and transport systems. This work contributes to refining the definition of sustainable housing by integrating environmental, financial, and social dimensions into residential decision-making.

Why Workers Change Jobs: A Reason-Based Job Duration Model – Md Nobinur Rahman, Mahmudur Rahman Fatmi, Muntahith Mehadil Orvin

This study develops a reason-based job duration model that explicitly distinguishes why workers change jobs. The reasons include job-to-job switching, job changes due to residential or partner relocation, returns to school, and retirement. The model accounts for endogeneity across transition reasons, as well as intra-household endogeneity in two-worker households, capturing how one partner's employment decisions affect the other's. Using data from the British Columbia Time Use Survey (BC ATUS), the model incorporates key socioeconomic and demographic characteristics. The results show that job mobility is highest early in employment and declines with tenure. Overall, the study underscores the importance of modelling job mobility as a joint household decision-making process.

2025 Canada-U.S. Travel Demand in Review: Are all modes created equal? – Sameer Esmail, Julien Carron,

With the significant challenges in the U.S.-Canada relationship throughout 2025, the transportation sector was significantly impacted in both countries as prospective visitors adjust their transborder travel habits. The author conducts a historical review of northbound and southbound crossings into Canada and the US by air and land. This review will highlight differences in the year-over-year changes (2024 to 2025) in

traveller volumes by the mode of travel. The overall objective is to demonstrate differences in Canadian and American transborder travel patterns in the last year and the resilience of specific modes of travel.

11. Transit Operations & Bus Systems

Battery Electric Bus Transit System Design Under Renewable Integration – Ahmed Foda, Moataz Mohamed

To promote the adoption of battery electric buses (BEBs) and address the challenges (investment and infrastructure), an optimization model is developed to design a sustainable and reliable BEB system that integrally optimizes capital and operational costs, while providing optimal charging station deployment decisions and fleet charging schedules. The analysis highlights the considerable environmental, economic, and operational benefits of incorporating photovoltaic panels, energy storage systems, and the bi-directional energy system. Furthermore, seasonal variation and operational uncertainties are critical components to be considered in the planning of BEB transit systems.

Doing More with Less: Leveraging Interlining for Efficient Electric Bus Deployment – Kareem Othman

This study investigates the potential of interlining to enhance the operational efficiency of electric bus (e-bus) systems. Interlining is defined as the operational practice of assigning a single bus to serve multiple routes consecutively, while offering particular advantages for e-buses due to their route-dependent energy consumption characteristics. The results indicate that pairing long routes with short routes yields the most substantial reductions in fleet size, as complementary energy usage profiles maximize the utilization of the battery capacity. Similarly, interlining routes with both high and low energy consumption rates further minimizes fleet needs by balancing operational energy demand across the system. These results demonstrate that strategic interlining can significantly optimize electric bus deployment and support more cost-effective transit operations.

Optimal Hydrogen Production and Inter-Depots Logistics for Fuel Cell Electric Bus Transit Systems – Yasser Kashwaa, Ahmed Foda, Moataz Mohamed

In this work, an optimization framework is presented for the design and operation of HFCB multi-depot systems in a transit network. The proposed model incorporates on-site hydrogen production, storage management and sizing, HFCB refueling scheduling, optimal HFCB tank size, and hydrogen transportation between depots. The model determines the optimal configuration and operational strategies to satisfy hydrogen demand at each depot, based on real bus data from GTFS, while minimizing the overall system cost.

Optimizing A Dense Urban Area Bus Network with a Genetic Algorithm- A Montreal Case-Study Using the Transition Open Source Platform – Gabriel Lefebvre-Ropars, Pierre-Léo Bourbonnais. Geneviève Bastien, Yannick Brosseau, Anjeli Narrainen, Simon Hamelin-Pratte, Catherine Plouffe, Julian Villafuerte Diaz, Catherine Morency

Designing an efficient public transit network is an NP-hard problem that cannot be solved exactly for any network of realistic size. The gap between algorithmic output and operational deployment remains wide. Chaire Mobilité has progressively addressed this gap through a series of applications to real Quebec transit networks. This paper reports the next step. Three features distinguish this application from prior work. First, the study area is a major urban environment, significantly denser and more complex than the medium-sized cities studied previously. Second, the optimisation operates on a mixed network: subway, light rail and commuter rail networks, as well as bus lines outside the study area, are treated as fixed constraints, while only bus lines intersecting the study area are optimized. Third, some STM operational constraints and requirements are incorporated.

12. Freight, Supply Chain & Logistics

Market Potential of Personal and Commercial Zero-emission Vehicles in Ontario – Ahmed Foda, Ali Shehabeldeen, Moataz Mohamed

This study develops a data-driven projection model for ZEVs that integrates the Bass Diffusion Model with machine learning algorithms to forecast annual ZEV adoption over a 20-year rolling horizon. The model offers a new perspective to ZEV adoption by addressing variations across geographical regions, vehicle classes (light-, medium-, and heavy-duty), operational contexts (personal and commercial), powertrain technologies (battery-electric, hybrid, fuel-cell, and fossil-fuel), and policy environments (sales mandates and incentives). The findings indicate significant regional variations together with sales mandates and incentives that have significant bearings on the ZEV market progression,

Out of Sight, Out of Mind: Optimizing the Forgotten Supply Chain of Farm Waste Through GIS-Based Spatial Analysis in Manitoba – Supul Muhandiram, Narendra Malalgoda, Srimantoora S. Appadoo

A staggering volume of waste originates on farms. This study reframes farm waste as a set of material flows that can be measured, routed, and optimized, rather than being treated as an inevitable by-product of farming. The study integrates Geographic Information Systems (GIS) with operations management and optimization models to design spatially explicit waste logistics networks. Initially, it maps the distribution and types of farm waste across Manitoba, identifying clusters of waste generation. Then, the study identifies existing and potential treatment facilities within the province. It then develops network designs and routing models to minimize transport cost and emissions while respecting capacity constraints.

Warehouse Location Choice Modelling with Supply Chain and Intra-Firm Interactions: A Case Study of the Greater Golden Horseshoe – Usman Ahmed, Carlos Rivera-Gonzalez, Matthew J. Roorda

The authors aim to model warehouse location choice in the Greater Golden Horseshoe (GGH) area of Canada. The author differentiates between single-establishment and multi-establishment firms in the location choice of warehouses to investigate intra-firm interactions. The study finds substantial intra-firm interactions for multi-establishment warehouses tend to minimize the overall distance to all other establishments belonging to the same firm while preferring to locate farther from other warehouse belonging to the same firm. It also finds clustering effects in some parts of the GGH where warehouses prefer locations closer to each other. Warehouses prefer locations with a higher concentration of manufacturing and wholesale trade establishments, while tending to locate farther from areas with a strong retail trade presence.

Logistics of Urban Monitoring with Moving Sensors – Amir Ahmadian, Mehdi Nourinejad, Matthew Roorda

This study proposes a systematic approach to optimize the fleet size of crowd-sourced vehicles and the range of their sensors. The authors aim to reach the desired ratio of events occurring within a given monitoring area to achieve a coverage goal. The study will define a base problem and explore two scenarios: one to identify the upper bounds and another to determine the lower bounds of fleet size and sensor range required to achieve the desired level of coverage. It provides a strategic framework for enhancing the efficiency and coverage of mobile sensor networks in urban monitoring. By optimizing the deployment of crowd-sourced vehicles and their sensor capabilities, the authors address critical challenges in achieving extensive and reliable data collection across urban landscapes.

Learning Route Practicality from Pickup-and-Delivery Operations – Dariusz Grabka, Hesam Rashidi, Serbo Dimic, Dariusz Grabka, Matthew Roorda

Pickup-and-delivery operations at parcel carriers are typically planned using routing algorithms that optimize efficiency- and service-related objectives such as travel time, distance, and deadline compliance. However, routes that appear efficient during planning are often executed differently in practice. The

author shows that these deviations are systematic and reflect execution-related considerations that are not fully captured by traditional routing objectives. Based on planner-provided quality labels, the author formulates route practicality as a supervised learning problem and develops a model that maps interpretable spatial and sequencing features to a probability of high-quality execution. This probabilistic measure provides a compact representation of route practicality that can be evaluated alongside traditional routing objectives.

13. Urban Form, Street Space & Curb Management

Who Gets the Curb? A Systematic Review of Responsive Curb Management Research – Elham Heydari-gharaei

The author provides a systematic review of responsive curb management research and classifies the literature into five groups: qualitative studies, empirical behavioral and causal evidence, predictive analytics and machine learning, optimization and control, and network level and multimodal system models that represent interactions across multiple curb locations, travel links, and transportation modes. For each group, the author explains the motivation, methodological approaches, core findings, and how each body of work connects to the others and fits. The study concludes by outlining cross-cutting limitations and research needs in demand and duration forecasting, optimization under uncertainty, network integration, and equity oriented governance for responsive curb systems.

Demand-Seeking or Demand Avoiding? A Functional Classification of Taxi Driver Behaviour – Mahin Alam, Faisal Bilal Memon, Yong Hoon Kim

This research develops a framework to classify taxi driver pickup behavior based on drivers' strategic movement toward or away from demand hotspots when seeking subsequent passengers. The author introduces the Index of Movement (IOM), a metric quantifying each driver's spatial tendency to approach or avoid hotspots between passenger trips. Analyzing 9.2 million trip records from 54,967 taxis in Seoul, South Korea, the author constructs individual driver IOM trajectories and decomposes them using Functional Principal Component Analysis to identify dominant behavioral patterns. Clustering analysis then reveals distinct driver types with consistent spatial strategies. These classifications could enable personalized dispatch recommendations that align with natural driver behavior, potentially improving system efficiency and driver acceptance.

Modeling Offer-Acceptance Behavior of Food-Delivery Crowd Shippers: Evidence from a Stated Preference Survey – Azin Golrizkhatami, Chi-Guhn Lee, Matthew J. Roorda

In this study, the authors address the gap of real-time decision-making of active food-delivery crowd shippers by developing a stated preference (SP) survey tailored to active food-delivery couriers. To our knowledge, this is the first application of an SP approach to examine offer-acceptance behaviour in this context. Through various designed offer scenarios, the survey evaluates how key job attributes—including pricing components, delivery distances, waiting times, and restaurant and neighbourhood characteristics—shape acceptance decisions. The results will support the development of behavioural models that can be integrated into platform matching algorithms and compensation design. By identifying the attributes most influential to acceptance behavior, this study provides insights to support more transparent, equitable, and economically stable outcomes for food-delivery crowd shippers.

The Feasibility of Sustainability: Developing a Sketch Plan Approach to Assess the Impacts of Sustainable Transportation Policies of Post-Secondary Institutions on Transit Services in Small Towns – Daniel Higdon

This paper describes a sketch planning technique to estimate the impact on a local transit system of varying modal shift percentages of traffic destined to a group of PSE institutions in Fredericton, NB. Data were obtained for Fredericton transit (including boardings, alightings and occupancy), as well as from a cordon study of the area. The analysis shows that modest (e.g. 5%) modal shifts from driving to

transit could result in overcapacity of existing transit buses serving the area. Provided the data are available, this sketch planning approach offers a “quick hit” way to assess impacts and could be valuable for informing new collaborative approaches for transportation planning in these communities.

Impact of EV Penetration and Ridesharing on the Energy and Operational Efficiency of Mixed BEV–ICEV Autonomous Fleets – Kang Tang, Jing Li, Harith Abdulsattar, and Hao Yang, Jinghui Wang

This study investigates how electric vehicle (EV) penetration and ridesharing jointly influence the energy and operational efficiency of mixed battery-electric and internal-combustion-engine (BEV–ICEV) autonomous ride-sharing fleets. The author develops a simulation framework that integrates real urban road networks, detailed energy consumption models, and a unified assignment algorithm capable of handling sequential dispatching and shared rides. The findings provide insights into the design of future sustainable autonomous mobility systems and insights for policy makers for decisions on electrification and shared-ride promotion.

14. Transportation Planning Practice & Tools

An Interactive Visualization and Scenario-Building Framework for Integrated Urban Microsimulation Models – Md Asif Hasan Anik, Adi Sahota, Venkata Vijaya Mandapati, Muhammad Ahsanul Habib

The authors develop an interactive visualization and scenario-building tool for an integrated transport, land use, and energy (iTLE) microsimulation model. The tool is designed as a modular system that interfaces directly with iTLE while remaining independent of the simulation platform. iTLE produces detailed, multi-entity outputs, which are consumed by the tool through standardized data structures. The results demonstrate that the framework effectively supports scenario development and policy analysis, such as housing densification and telework, providing policymakers and practitioners with an accessible and user-friendly tool for evidence-based planning.

A New Tool to Help Households, Governments, and Businesses Make Better-Informed Location Decisions – Yannick Brossea, Bitu Farokhian, Gabriel Bruno, Geneviève Bastien, Pierre-Léo Bourbonnais, Samuel, Duhaime-Morissette, Catherine Morency

This study proposes an open-source platform to evaluate the affordability of locations by integrating transportation costs. This platform aims to help three different targets: (1) households who need to estimate the true costs of residential location choices by considering both housing and transportation expenses, (2) cities and governments who need to quantify how supply scenarios and major projects affect accessibility and transportation costs for residents, and (3) public and private organizations who want to optimize the locations of facilities such as schools, hospitals, and businesses by taking into account accessibility and transportation costs. It integrates data from previous research on transportation costs, accessibility, and equity. This paper will present the new interface aimed at the general public, as well as a series of indicators integrated directly into the Chair’s platform.

Planning for Transportation Success: Developing a Maturity Assessment Model for Transportation Planning Practices – Trevor Hanson, Apoorva Rathod

Small to medium-sized Canadian communities (< 500000 people) are facing increasing pressures to address transportation infrastructure and service needs, yet there is often not a consistent approach for how communities can plan for these needs, or how this approach may need to change as communities grow. In this paper, the findings are presented of designing and piloting an approach to help communities better understand their transportation planning capacity through a Maturity Assessment Model.

Using Openstreetmap As A Data Source For Transportation Research – Yannick Brossea, Pierre-Léo Bourbonnais, Geneviève Bastien, Catherine Morency

The author begins by unpacking what can be found in the OpenStreetMap database: its data structure, its scope beyond roads and paths and the kinds of features you might not expect. The

study explores how to assess the data quality, recognizing that completeness varies widely across regions, and how to monitor changes in areas validated. It also introduces the rich ecosystem of open-source tools available to extract and analyze OSM data. More importantly, it discusses how researchers, practitioners and more generally organizations can all contribute back to the project: what tools are best for data collection and imports, and how to engage and motivate your local mapping community. Ultimately, we'll ask: how can we, as a research community, adopt a more concerted approach to strengthen and grow this digital commons?

Infrastructure Deferral in Cost Benefit Analyses: An Approach to Contextualizing and Broadening The Impacts of an Infrastructure Investment on the Wider Transportation Market – Sarah Harlley

This paper presents three case studies demonstrating how infrastructure deferral analysis has recently been applied to inform project decision-making. Canadian governments face continual budget constraints, and this assessment is an important tool that can inform the prioritization of infrastructure project spending. While assessing the value of building now versus later is speculative in nature and relies on robust input data, as is the case with any mechanism within a cost-benefit analysis, there is merit in helping policymakers see how investments in one infrastructure class can change the requirements for spending in another.

15. Multimodal & National Transportation Capacity; 16. Survey Methods & Behavioral Modeling

A multimodal framework for assessing transportation capacity in Canada – Daniel Saladini

Canada currently lacks a consistent, comparable, and scalable methodology for assessing transportation capacity across its multimodal network. Existing assessments are typically mode-specific, limiting the ability to evaluate system-wide performance and resilience. This paper presents a novel framework developed by Transport Canada to quantify and compare capacity assessments across marine, rail, road, and air transportation modes. The framework integrates three complementary metrics (throughput, observed capacity, and theoretical capacity) that enable the derivation of utilization and bottleneck indicators.

Walking Access to Transit: Entry-Line Options and Rider Captivity – Mehdi Hamdaoui, Catherine Morency

This research examines how transit supply creates rider captivity to the initial line, through the constraints of the pedestrian network riders must use to reach the first stop. Using origin–destination survey data from cities in the province of Quebec, the author assess for each reported trip whether other initial lines were reasonably reachable on foot and competitive in generalized cost, or whether the rider was effectively captive to the declared line. Alternatives to the declared path will be generated with Transition, the software developed by the Mobility Research Chair at Polytechnique Montreal, enabling systematic comparison of feasible options. The author also validates the plausibility of reported trips by testing their internal consistency against feasible options and schedules.

The Important Regulatory Developments in Canadian Transportation in 2024 and 2025 – Joseph Monteiro, Mark Hemmes, Barry E. Prentice

The authors review the most important regulatory and policy developments in Canadian transportation during 2024-25. It covers developments ranging from proposed air passenger protection regulations in air to measures to crack down on Driver Inc. in road. Since labour issues during this period were a prominent matter in the transportation sector, they will be briefly reviewed. The paper briefly concludes with some of the emerging policy themes that could shape future regulations.

Canadian Railway Performance: Recent Trends and Emerging Challenges – Yu Sui, Lawrence McKeown

This paper updates a previous study of railway performance metrics which traced the 25-year transformation of the industry following legislative reforms in 1987 and 1996. The first part of this study updates the performance metrics to cover the most recent five years, a period fraught with economic uncertainty. Despite a continuation in improving railway performance during this recent period, the industry is facing new challenges. The second part of the study examines recent changes in railway traffic by type of movement and commodity as businesses begin adjusting to new domestic and international trading patterns.

Understanding Network Resilience through Critical Link and Redundancy Analysis in Highway Systems – Anson Lau

This study presents a streamlined approach for evaluating highway system vulnerability and redundancy using graph-theoretical methods and GIS-based network modeling. The network is represented as a routable graph where each highway segment functions as an edge characterized by distance, speed, and travel time. A generalized utility measure is derived from each link's contribution to the shortest-path travel across the network. The method is applied to networks in two geographical contexts. In Western Canada, the proposed Howse Pass corridor is evaluated to understand travel-time savings and potential traffic redistribution. In Washington State, a redundancy assessment identifies freight-critical highway links and highlights vulnerabilities under closure scenarios. This framework supports strategic infrastructure planning and investment decisions across jurisdictions.

16. Survey Methods & Behavioral Modeling

Elicited choice probability to account for uncertainty in survey responses to hypothetical questions – Alexander Bigazzi, Amir Hassanpour

The author explores an alternative approach, Elicited Choice Probability (ECP), which allows respondents to explicitly report uncertain behaviour in hypothetical scenarios as a probability distribution over alternatives. The author analyzes survey data from two studies with ECP question formats (for e-bike purchase decisions and travel mode substitution) to investigate self-reported uncertainty in hypothetical behaviour and how it varies with personal attributes of the respondents. The ECP data are also used to generate synthetic data. The results reveal a large amount of self-reported uncertainty in respondent behaviour, which adds nuance to the dataset and could bias subsequent inference if neglected.

Analyzing Respondent Behavior in Travel Surveys Using Paradata: Insights from provincial and regional surveys – Genevieve Bastien, Samuel Duhaime-Morissette, Pierre-Léo Bourbonnais, Adlène Hamza, Catherine Morency,

The study uses paradata collected during the 2025 Quebec national and regional travel surveys to examine how respondents interact with the questionnaire and identify factors influencing perceived burden. Three dimensions of behavior are examined: drop-outs, cognitive burden, and engagement. These behavioral indicators, as well as perceived burden factors, are correlated with socio-demographic variables like household size, age, income, trip count, and survey duration. Recommendations for survey design improvements, such as interface adjustments and adaptive question flows will be implemented and tested in future iterations. By leveraging paradata-driven insights, this work aims to enhance respondent experience and ensure more reliable travel data for future transportation planning.

Increasing survey data variability through the merging of historical survey data – Hubert Verreault, Catherine Morency,

This paper proposes a methodology to combine samples from several surveys conducted in the Montreal region (2003, 2008, 2013, 2018, and 2023) while ensuring that the resulting sample is representative of the population and mobility behaviors of the most recent survey (2023). Merging these datasets can generate several positive externalities, including an increase in the number of observations, a reduction in the size of weighting factors or an increase in the variability of observed behaviors, including spatial

locations (home, origins and destinations). Additionally, merging these data can help minimize certain data privacy issues and allow more people to access precise and high-quality spatial information for their analysis. In addition, certain challenges must also be taken into consideration.

Systematic Method for the Multifunctional Allocation of Street Space – Simon Brassard, Catherine Morency

The present research develops an indicator-based methodology grounded in principles of equity and utility to guide the balanced reallocation of street space. The approach starts with a typology of multimodal, multifunctional street configurations adapted to varying right-of-way widths. These feed an iterative optimization process using various approaches such as a genetic algorithm to maximize a composite function combining network capacity, travel time, and diversity of uses. Empirical analysis will use origin–destination data and detailed street attributes from areas of Montreal and Quebec region. The outcome is a scalable decision-support tool for street-space allocation, offering cities a strategic framework for multimodal planning and resilient urban design.

Supply-Demand Interactions Across Multimodal Transportation Networks: A Case Study of Montréal – Bita Farokhian

The author aims to quantify travel demand cross-elasticities, defined as the elasticity of public transit demand in response to changes in the level of service of surrounding modes. The analysis covers bikesharing, carsharing, bus, subway, and private cars in Montréal. The results show strong short-term complementarity between bus and subway, while bikesharing and carsharing exhibit mixed competitive–complementary effects depending on service area and route type. The findings emphasize the importance of temporal dynamics and service heterogeneity in post-pandemic multimodal planning.

17. Urban Mobility & Travel Behavior Modelling Tools

Desire Line Trajectory Clustering: A Performance-Optimized Parallel Rust Implementation of Traculus_DL – Léonard Pouliot, Yannick Brosseau, Catherine Morency

The goal of this work is to develop a fast, integrated alternative that incorporates new functionalities, such as batch execution and flexible input formats, while remaining conceptually similar to Traculus_DL. To achieve this, the author explores a parallel Rust-based implementation with a strong focus on performance-oriented data structures and clustering algorithms. The author also aims to integrate the tool in the Transition ecosystem, to further improve the usability of the tool. The proposed approach will be benchmarked against the original tool using open data to compare execution speed and clustering accuracy. It expects this new system to significantly reduce computation time, enabling users to adjust input parameters more freely and obtain higher-quality trajectory aggregations. Demonstrations of Traculus_DL outputs will be shown using a diversity of data sources: Origin-Destination travel surveys, bikesharing / carsharing data and taxi trips.

Leveraging household travel survey mode frequency data and built environment indicators to better understand multimodality – Jérémy Gelb, Chris Harding, Hamzeh Alizadeh

The 2023 Perspectives mobilité (Pm23) survey introduced an innovative approach to collecting richer household travel survey (HTS) data by asking additional questions to subsets of respondents. This allowed testing new questions without significantly increasing response burden. Among these, self-reported frequency of use for each transportation mode complements the traditional single-day travel diary. The author demonstrates how these data open new avenues for analyzing the determinants of multimodal behaviour.

Speed Profiling and Bottleneck Analysis Using Crowdsourced Traffic Data – Dimantha De Silva, Ashok Kinjarapu

The objective of this research is identification of road bottlenecks based on travel time variation and variation of space mean speed. The bottlenecks should be able to identify under spatiotemporal elements and be able to obtain an idea about their occurrence and significance. The third objective is to demonstrate the possibility and validity of using of Google distance matrix application programming interface travel times for bottleneck identification and apply it in the context of Canadian cities.

Developing an Integrated Machine Learning and Parametric Duration Modelling Approach for Firm Survival: Assessment of Firm-Specific Survival Risk and Spatial Determinants – Niaz Mahmud, Muhammad Ahsanul Habib

The author develops an integrated, stacked modelling framework to analyze firm survival using a combination of machine learning and parametric duration modelling. First, a machine learning-based survival model estimates latent firm-specific failure risk. Then, a parametric duration model captures the effects of spatial and built environmental attributes on firm survival. This study focuses on business establishments in the Halifax Regional Municipality over the period of 2022 to 2024. The results highlight the dominant influence of internal firm features, such as employee size, sales volume, organizational structure, and type of sector, on survival. This influence is captured through a machine learning-derived index.

Assessing the Impacts of Introducing Autonomous Transit Services for a Mid-Sized Canadian City – Uthpalee Hewage, Mahmudur Rahman Fatmi, Shoumic Shahid Chowdhury, Bijoy Saha

This study employs an agent-based activity model to investigate how the introduction of autonomous transit services (ATS) affects transport network performance, including congestion and accessibility. The study area is Kelowna - a mid-sized city in British Columbia. A mode choice model is estimated using combined revealed-preference and stated-preference data and developed. Alternative scenarios are generated to evaluate the network impact. By comparing these scenarios, the study quantifies changes in demand, efficiency, accessibility, and operations during ATS integration. The analysis provides insights into the benefits and trade-offs of adopting ATS in mid-sized urban contexts. Findings add to the literature on sustainable urban mobility and offer guidance for policymakers aiming to improve transport networks amid technological transformation.

18. Transportation Funding & Economic Policy

Towards Better: How are and How Should Transportation Infrastructure And Services be Funded? A Case Study Of Ontario, Canada – Victor Copetti, Matthias Sweet, Murtaza Haider

Transportation funding systems are under mounting fiscal pressure as traditional sources of revenue decline and infrastructure costs outpace available funds. To understand how to address these pressures, this study examines Ontario, Canada, a province undergoing a generational investment in public transit infrastructure. A two-phase qualitative approach, 23 interviews and three focus groups were conducted with transportation experts from public, private, and non-profit organizations across Ontario. The study offers practical insights for governments seeking to design adaptive, transparent, and politically feasible funding systems that advance broader mobility, equity, and sustainability objectives.

Market Liberalisation and the Distribution Of Economic Welfare: The Case Of Air Service Agreements – William G. Morrison

The liberalization of air travel has been credited with significantly lowering the real price of air travel and generating consumer welfare. However airlines through lobbying efforts can influence other aspects of aviation policy in ways that redistribute welfare in favour of airlines to the detriment of passengers. This paper develops a theoretical framework in which increases in economic welfare via liberalization can be redistributed by lobbying effort. The model and its implications are applied to competition law immunity and profitability for US airlines and to domestic airline opposition to unilateral open skies in Canada.

A Decade to Deliver: Policy Choices In Canada's Export Diversification Strategy – Jonathan Thibault, Olivia Russo, R.

This paper examines price trends for Canada's exported commodities as well as transportation costs throughout the supply chain. To keep rates competitive and stable, while increasing efficiency throughout the supply chain, the government should introduce supportive policies, such as 100% immediate depreciation on supply chain investments, and remove harmful ones. The paper indicates that 10 years is a tight deadline for such an ambitious goal and action must be taken today.

Canada wants to diversify its Trade: The answer may be in the air – Sameer Esmail, Jody Kositsky,

The authors highlight that Canada's trade-enabling infrastructure is currently focused on the movement of resources to the United States by land and to most other foreign markets by sea. With a significant portion of Canada's high-value trade with overseas markets occurring by air, there is an opportunity for a new focus on investment in aviation. This paper presents examples of current trading relationships where air cargo represents a critical portion of value of goods moved. The paper then turns to examine the enabling tools available to government to stimulate additional development in air-based trade including investments in airport infrastructure and air transportation agreement liberalization. In sum, this paper underscores the importance of investment in aviation to accelerate Canada's trade diversification plan.

Staged Capacity Expansion of Urban Air Mobility Vertiports Using Embedded Flexibility – Faisal Bilal Memon, Mahin Alam, Yong Hoon Kim

UAM vertiport infrastructure usually has very high costs and entails a lot of uncertainty in future demand. This research illustrates a decision framework consisting of multiple stages, used to determine how expansion is done under budget constraints. The results demonstrate that having staged decisions produces lower total cost, compared to having predetermined static decisions under uncertainty. The proposed approach offers a practical tool for decision makers to balance cost, flexibility, and ensure reliability.

Quantifying the Benefits of Car Ownership Reduction Caused by Carsharing – Emilie Savard, Martin Trépanier, Catherine Morency

This research proposes a methodological framework to quantify the benefits of car ownership reduction caused by carsharing. It provides a robust empirical foundation for assessing carsharing's influence on car ownership, parking space and modal shares. Through this foundation, the author hopes to advance understanding of carsharing's contribution to sustainable urban mobility and offer transferable tools for evaluating similar systems elsewhere.

19. E Bikes, Active Travel & Well-Being

Worth the wait? What a 2-year waitlist reveals about the effects of e-bike purchase rebates – Alexander Bigazzi, Polina Polikakhina, Kyla Yu, Amir Hassanpour

E-bike incentive programs such as purchase rebates are growing in popularity, with studies demonstrating a range of benefits for affordability, sustainability, and health. The author compares survey data of the BC e-bike rebate program from rebate recipients in the 2023 and 2025 funding waves to investigate shifts in purchase decisions and motivations, as well as self-reported purchase "marginality" (likelihood they would not have purchased without the rebate). The results reveal an increase in average marginality for low-value rebates, which is consistent with the expected behaviour of non-marginal purchasers. The findings provide enhanced empirical evidence for e-bike rebate program effects, and implications for more effective program design.

An Analysis of the Connection Between Mental Well-Being and Active Travel Using the Canadian Community Health Survey 2022– Laura Weli, Adam Weiss

The presented research seeks to understand how the average, daily “time spent travelling” via active transportation, in comparison to transit-use and vehicular travel can impact public health. The data used for this research was extracted from the 2022 General Social Survey on Time Use and the Canadian Community Health Survey 2019-2020. These surveys are conducted by the federal government to gather information on social trends affecting the living conditions of Canadians across the country. In using this data to categorize how “time spent travelling” impacts public health, the goal is to show the daily, average duration of travelling via different modes infers social conditions.

Simulating Cycling Network Growth Under Multiple Planning Objectives – Loïc Miara, Catherine Morency

This study addresses challenges facing bicyclists (sparse networks, unsafe or inefficient routes and infrastructure) by proposing an algorithmic approach to cycling investments prioritization, aiming to maximize network performance. The author develops an iterative algorithm to grow cycling networks dynamically, allowing users to re-route their trips during the growth process, mimicking real behavior. This framework is used to test multiple growth strategies and explore their viability and to compare network expansions in multiple Canadian cities, characterizing the growth mechanisms over different territories. By systematically optimizing infrastructure investments, this research offers a practical framework for improving bicycle networks that can be used by city planners to support a modal shift towards cycling.

Study of station usage patterns to inform bikeshare network development – Alexander Becker, Catherine Morency

The project aims to understand the factors that drive network demand asymmetry, leading to potential shortages of bicycles and docks at stations. Another objective is to study the evolution of system demand year on year. Clustering, community detection, and anti-community detection algorithms are applied to analyze key station interactions through proximity and usage patterns, while also studying trip trajectory groupings. The challenges of harmonizing data from various sources and handling analyses across time periods are overcome to reach these goals. The project’s conclusions may be used to understand current bikeshare network usage dynamics and to inform system growth.

Shaping Mobility Futures: Unlocking Maas Potential Through Policy and Behavioural Drivers in North America’s Transport Networks – Wilson Wellington Biney, Osama Abdul Hafeez, Nelson Wellington BineyAbimbola Grace Oyeyi

This study investigates the specific policy and behavioural drivers critical for improving Mobility-as-a-Service (MaaS) integration and uptake within North American transport networks. Recruiting professionals with expertise in MaaS, transportation planning, and policy, this paper uses semi-structured interviews guided by purposive and snowball sampling to provide an evidence-based framework to guide policymakers and industry leaders, paving the way for accelerated and effective integration of MaaS within North America’s unique transport ecosystem. By addressing this critical interplay, this endeavour illuminates the path for MaaS to evolve from a technological novelty to the backbone of a connected and sustainable North American mobility future.

20. Accessibility & Equity.

Advancing equitable transport planning in low-density areas: Indicators of accessibility to key destinations via regional Public transport – Frédéric Cournoyer, Célestin Sitbon, Laurence Letarte, Martin Trépanier, Geneviève Boisjoly

This study proposes a methodology to generate accessibility indicators for fixed route and demand responsive transit in three administrative regions in Quebec, Canada. It first deploys a typology of services and a framework to produce GTFS data for each service type. Then, cumulative accessibility to grocery stores, healthcare, and educational facilities is calculated via the r5r Rapid Realistic Routing R

package. Results are analyzed quantitatively and spatially, with aggregated indicators introduced to support interpretation. The study highlights methodological opportunities and challenges in measuring regional PT accessibility and uncovers socio-spatial disparities in service provision.

Comparing Accessibility Indicators: Methodological Divergence and Equity Implications – Juan Esteban Sánchez-Gómez, Frédéric Cournoyer, Kevin Manaugh, Geneviève Boisjoly

The authors in this study undertake a comparative analysis of selected metrics within a defined territory, with particular emphasis on the spatial and social equity dimensions. Using Montreal as a case study, the following open-access sets of public transport-based accessibility indicators are compared: Public Transportation Spatial Accessibility (developed by Statistics Canada), and Access to Amenities (developed by Polytechnique Montréal and McGill University). Each dataset reflects a unique methodological framework. This study will employ statistical models and spatial autocorrelation methods to assess local discrepancies between accessibility measures and their differential distribution across socio-economic groups. By comparing existing measures, this study will highlight potential spatial and equity biases in the different proposed approaches to measuring accessibility. For the planning practice, the findings provide new insights on the best practices for using equity-sensitive measures that reflect access to amenities.

Spatial Access and Modal Share Analysis: Exploring Equity and Infrastructure in Montreal – Jean Pamphile, Yanick Clément-Godbout

This paper examines the relationship between Spatial Access Measures (SAM) and modal share for public transit, cycling, and walking within Montreal's metropolitan region. The study explores how spatial accessibility influences sustainable transportation behavior. The results indicate strong positive correlations between accessibility and sustainable mode share, emphasizing the role of targeted investment in low-access areas. The paper concludes with policy recommendations and outlines future research directions for integrating spatial and socio-demographic data to promote inclusive mobility.

Gender Differences in Public Transportation Trip Components in Montréal – Maxwell Francis White, Andrés Henao, Martin Trépanier, Geneviève Boisjoly

The authors investigate public transportation (PT) trip characteristics between women and men to understand how PT service provision aligns with travel behaviour through a gender lens. It will examine the following trip components: access and wait times, total travel time, in-vehicle travel speed, overall trip speed, percent of trip time spent in access and wait (off-vehicle time) and number of transfers. An intersectional approach will also analyse how income, employment, transit poverty and access to mobility tools (e.g., car ownership) influences these components for men and women. The study will seek to demonstrate the relevance of developing gender-sensitive performance measures, offering guidance to practitioners and policy makers seeking to incorporate gender equity into PT planning.

Early Impacts Of The Rem On Accessibility And Travel Behaviour In Montréal – Vincent Chabin, Jérémy Gelb, Imed Essid, Hamzeh Alizadeh

Geospatial analysis integrating Réseau Express Métropolitain projected service levels and known feeder redesign plans were used to estimate anticipated benefits: improvements to accessibility, equity, transit service levels and competitiveness with other modes, such as the private car. Next, longitudinal and cross-sectional analyses were carried out to identify early adoption patterns. Comparison of theoretical gains in ridership with actual usage statistics provides critical insights into early adoption dynamics and highlights where projections may have fallen short. The knowledge gained in carrying out such analyses will serve as a valuable input for the design of future transportation network expansions and feeder redesigns.