

INTRODUCTION TO THE CTRF 2022 CONFERENCE

Joseph Monteiro, Barry E. Prentice and Joseph F. Schulman

The theme of the 2022 conference is “Transportation and Supply Chains in Unprecedented Times”. With the vast changes wrought by the Coronavirus pandemic, the main focus of the conference is re-imagining transportation in the post Covid-19 world, including how transportation, supply changes, and transportation planning have been impacted and will be different in the future. The advancing coronavirus vaccinations have injected hope that those sectors in distress will regain prior activity, albeit with some modifications.

The 57th Annual Meeting attempts to address issues such as how has the Covid-19 pandemic disrupted transportation and supply chains? Can the Canadian transportation systems face this challenge? How have certain industries and transportation modes reacted? How has Covid-19 impacted passenger vs. freight transportation? How have consumers responded to the new restrictions imposed by the regulatory requirements of Covid-19? Have they switched to online purchases? The conference proceedings contain a rich collection of papers on these issues with particular emphasis on the impact of Covid-19 on transportation systems and about 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.

Organization of the Proceedings and an Overview of Individual Papers

The papers in this Proceedings are organized under seventeen sessions. 1. Regulation and Effects. 2. Transit Planning and Decision Making. 3. Urban/Regional Modelling and Applications. 4. Maritime Provinces — Applications and Cases. 5. Supply Chain Disruptions and Effects. 6. Bus Transit Operations. 7. Air Transportation. 8. Rail Transportation. 9. Trucking Industry — I. 10. Marine Port Issues. 11. Cycling Issues. 12. Long Term Perspectives. 13. Trucking Industry — II. 14. Performance and Optimization - I. 15. Marine — Special Topics. 16. Road Safety Topics. 17. Performance and Optimization — II.

1. Regulation and Effects.

Steve Pratte - Regulatory Reform and Investment in Grain Hopper Cars: Enabling Generational Transformation in the Western Canadian Grain Handling and Transportation System

In this paper, the author examines the multi-decade process towards reforming the regulatory framework that led to an immediate and significant investment in the renewal of the grain hopper car fleet in Canada, beginning in May 2018. Specifically, it highlights the role of the Canada Transportation Act Review’s treatment of this issue which led to Bill C-49 the *Transportation Modernization Act*, and how the provisions therein, addressed a long-standing peculiarity of the original Maximum Revenue Entitlement regulation. Once amended, a wave of investment by the railways began to replace the aging hopper cars.

Jody Kositsky - FOA versus FORR: A Comparison of Canadian and US Rate Dispute Mechanisms

Both Canada and the United States, have shipper options for rate review if the shipper is dissatisfied with the rate being paid for rail transportation. In Canada, there is provision in the *Canada Transportation Act* for final offer arbitration (FOA), which has been used by shippers for decades. In the U.S., there are regulatory options available, but these have tended towards larger value disputes, given the cost and time involved in bringing forward a claim. The U.S. Surface Transportation Board (STB) is actively reviewing proposals to introduce additional remedies — including an arbitration process currently known as Final Offer Rate Review (FORR). Potential lessons could be learned from comparing the FORR to the FOA.

Sanjay Castelino, Joseph Monteiro, Barry E. Prentice - The Important Regulatory Developments in Transportation in 2020 and 2021

Regulations that affect transportation have been used to achieve various policy goals. This paper reviews the important regulatory and policy developments in Canadian transportation during 2020-21. Major developments are examined in each transportation subsector (air, rail, water and road) together with a brief comment. These developments have had a profound impact on passenger transportation in air, rail and water. The conclusion considers some of the impact of these regulations and the emerging policy themes for the next few years.

Barry E. Prentice, Narendra Malalgoda, Joseph Monteiro - Regulation and Taxicab Licence Values: Winnipeg 2000-2021

High fares and restricted entry led to the capitalization of taxicab holders' licenses that were freely traded. After almost seven decades of protection under the Manitoba Taxicab Board (MTB), the trading value of a taxicab license for Winnipeg exceeded \$500,000. Of course, years of shorting the market and overcharging ultimately led to public complaints and reviews. Technological advances opened the door for Network Transportation Companies (NTC), to present a new model for urban transportation. The MTB resisted the NTCs longer than most regulators, but finally when the provincial government changed, the door was opened to competition. The MTB was disbanded in 2018, and responsibility for taxicab regulation was returned to the City that approved NTC competition. Theory would suggest that the capitalization of taxicab licenses should decline when competition increases. This research uses taxicab license data from 2000 to 2021 to examine the impact of NTC competition in the Winnipeg market.

2. Transit Planning and Decision Making.

Shaila Jamal, K. Bruce Newbold - The Promise of Co-Design for Improving Transit Service for Older Immigrants: Development of a Co-Design Framework For Hamilton, Ontario

The authors discuss the potential of co-design for transit service improvement. An application-ready co-design methodology was developed to create a plan for improving transit services for older immigrants in Hamilton, Ontario, Canada – something that has never been applied in this sector. The developed methodology will address lived experiences of older immigrants, enhance public engagement, and develop trust and compassionate partnerships among stakeholders. In this paper, a step-by-step process with the underlying reasoning for considering those steps in the co-design process is described. The entire process will allow transit service providers and other community partners to engage with, get insights from, and learn about the impact of their services on older immigrants' mobility needs. The final output of the process will be a transit service improvement plan.

Haesung Ahn, Sungho Lim, Seungchul Shin, Yong Hoon Kim - Analysis of the Reverse Trip Directions of Overnight Workers From Smart Card Data

This research suggests a methodology to identify the overnight workers' travel based on analyzing smart card data. The research explores individuals' smart card data, covering about thirteen million peoples' usages in Seoul, South Korea. The authors analyze the regularity of trip time, time duration of activities from the gap between alighting and boarding time, and land use to create criteria to find overnight workers' trips. The results would capture the veiled overnight workers' demands and create their origin-destination data. This data could help transit authorities to offer enhanced transit services by improving the frequency and span of service at midnight.

Jacob Terry, Chris Bachmann - Your Transit Driver Has Arrived: Suburban Preferences for Transit-Integrated Ridesourcing

This paper discusses the findings of a revealed-preference/stated-preference survey conducted in Waterloo, Ontario, which explored how suburban residents perceive transit-integrated ridesourcing configurations under various combinations of trip alternatives. Results of the survey were used to

estimate a mode-choice model to quantitatively understand their preferences. Trip attributes of existing modes were analyzed to understand their current levels of competitiveness. Post-survey questions about COVID-19 comfort, vehicle ownership, and demographics provide additional insights into residents' transportation preferences and the feasibility of higher transit usage in suburban areas.

Mario Iacobacci, Ali Latif - Cost-Benefit Analysis Tool for Transit Investments

The authors review the Deloitte LLP (Canada) and the Global Infrastructure Hub tool which facilitates preliminary cost-benefit analysis (economic and financial) of bus transport projects in a faster, more accessible, and more affordable way. This shorthand tool is built in Microsoft Excel and is designed to be used without specialized cost-benefit analysis or transportation planning expertise. It incorporates leading practices to enable analysis that guides early-stage decision-making around bus transport projects in more than 90 countries. In this regard, the shorthand tool integrates elasticities and real-time mobility data to estimate changes in travel behaviour. It quantifies and monetizes both market factors, such as travel cost and capital and operating expenditures, and non-market factors, such as travel time and quality, health and safety, and their environmental impacts and can also be used elsewhere.

3. Urban/Regional Modelling and Applications.

Usman Ahmed, Jason Hawkins, Matthew J. Roorda - Establishment Location Choice Model Considering Firm Membership

Location choice is an important decision made by business establishments which has broad regional impacts. In this paper, the authors focus on the problem of establishment location choice of wholesale and retail trade establishments. They consider the membership of establishments in a firm, which owns multiple business establishments. They find that establishments from the same firm tend to locate farther from each other and co-locate with other establishments from the same industry. This highlights a gap in existing methods of analysis, and the authors propose location choice models that could represent such dynamics.

Muntahith Mehadil Orvin, Mahmudur Rahman Fatmi - Covid-19 and Housing Price: Modeling Housing Price for an Integrated Urban Model

This study predicts the Housing price (HP) before and during the pandemic period utilizing the housing transaction dataset for the Central Okanagan region of BC from 2016-2021. The majority of past studies have adopted conventional techniques to predict HP. However, prediction accuracy of conventional empirical/statistical models is affected by the strict requirements on input variables, non-linearity and multi-dimensionality. Previous research suggested that machine learning-based (ML) techniques are found to achieve better prediction accuracy. Therefore, this study develops a hybrid hedonic-ML model to identify potential determinants of HP. The developed models will be included in an integrated urban model (IUM). This study will provide important insight about the impact of the pandemic on the housing market and enable IUM to incorporate the effect of the pandemic while simulating the land use pattern of a region over time and space.

Hamed Ali Zadeh Catherine Morency, Martin Trépanier - Mode Competitiveness Analysis of Interregional Corridors

In Province Of Quebec In this study, a competitiveness analysis is used to assess how competitive different travel modes are with the private vehicle mode for important corridors of the Quebec Province. The variation of access and egress travel time for travel by intercity bus and train are very important elements. Travel time, distance, fare, and availability of other modes are the four variables used in this study to assess competitiveness. Each intercity public transport trip includes three parts, access to the station, intercity leg duration (with or without transfer) and access to the destination. The paper discusses the authors findings.

Jerome Laviolette, Owen Waygood, Catherine Morency - Does the Built Environment at Home and Work Locations Affect the Willingness to Reduce Car Use for Commuting?

This paper uses a 2019 Mobility survey from Montreal to investigate people's willingness to reduce car use for commuting to work as well as their satisfaction with their current household car ownership levels. Using a combination of multinomial logistic models and of Gradient Boosting Machines Decision Trees, this paper aims to assess what characterises people in each state to make changes in terms of attitudes and socio demographic. It also investigates if built environment characteristics at home and work locations influence people's willingness to change and reduce car ownership satisfaction. Preliminary results indicate that those living in lower population density areas are more likely to see no reasons to change and less likely to make some effort to reduce car use.

4. Maritime Provinces — Applications and Cases.

James D. Frost and Mary R. Brooks - Sustainable Urban Ferries: The Halifax Case

The author examines sustainable ferry operations for Halifax. Sustainable ferry operations require services that not only meet public transport requirements but also contribute to meeting 'zero emissions' targets set by the International Maritime Organization. The paper sets out criteria for comparing maritime public transport options with traditional BRT (Bus Rapid Transit), LRT (Light Rapid Transit), and other options. It then discusses the case of Halifax where only conventional ferries have been chosen in the past. Conclusions are drawn on how successful, sustainable ferry operations for a modern city can be implemented and reports on progress to date in the planning for new zero-emissions ferry services in Halifax

Kristen Burns, Trevor Hanson - Four-step Modelling Active Transportation for Small Cities: Challenges and Opportunities

There is a growing need to be able to quantify active transportation (AT) demand in small cities in order to help justify investments. This research using a 4-step travel demand modelling approach in the program VISUM for forecasting explored the use of a new AT link connecting two neighbourhoods across a highway in Fredericton, NB. Three trip types were modelled (Home-Based Work, Home-Based Other, Non Home-Based). The network was modeled before and after the link was added to estimate the change in modal split (driving vs. walking), travel times, and estimated demand following calibration appeared commensurate with historic observations of pedestrian behaviour in the area. Based on this work, data resolution and availability are likely the two biggest challenges for small cities when modelling AT.

Barry Riordon, Brianna Morehouse, Trevor Hanson - Using the Gravity Model for Health Transportation Planning

This paper applies a gravity model as a health transportation planning tool to determine whether the impacts of changing the status of a health facility (e.g. bed reduction, closure) could be quantified in terms of travel distances by older adults. Older adult health trips to physicians and hospitals were "generated" at a county level, then "distributed" geographically as a function of number of hospital beds. The gravity model was able to allocate health trips for hospital and physician visits within an average percent difference of 37% (range 0.4%-100%) and 14% (range 0.6%-34%), respectively, when compared to actual origin-destinations values at the county level. The model was then applied for a single county where travel distances to the new destinations were quantified.

5. Supply Chain Disruptions and Effects.

Narendra Malalgoda, Derek G. Brewin, Barry E. Prentice - Effect of Rail Barricades and COVID-19 on Grain Movement in Canada

The year 2020 was one of the most challenging years for the agriculture sector across the world. In this paper, the impact of disruptions created by the COVID-19 pandemic and the rail blockades that prevailed in the 2019-2020 crop year on grain movement across Canada was assessed. The results suggest that

although rail blockades that occurred during this time negatively impacted grain movement, the pandemic had a significant positive effect on overall grain movement across Canada.

Shivam Khaddar, Mahmudur Rahman Fatmi - Modeling Teleshopping and Telecommuting Preferences in the Post-Pandemic Era

This study aims to fill this gap and investigate future preferences towards online shopping by utilizing an ordered logit framework. The data comes from a web-based survey conducted for the Central Okanagan region of Canada from November 2020 to January 2021. The findings of this study will assist policymakers to promote online shopping in the future and reduce mobility, indirectly cutting greenhouse emissions.

Sidra Anis and Lawrence McKeown - Measuring Package Delivery in Canada: Challenges and Opportunities

Online and e-commerce sales have soared during the Covid-19 pandemic. The extent to which this surge remains temporary is unknown, but retail e-commerce sales appear poised to expand. As such, there is a need to better understand how packages are being delivered, particularly business to consumer (B2C). Having data on last mile deliveries will help to quantify the related impacts from supply chain disruptions and commercial traffic congestion to employment trends and carbon emissions. This paper examines efforts to gather data to cover this critical gap in measurement and features a pre-pandemic estimate of package volumes in Canada.

6. Bus Transit Operations.

Ahmed Fodal and Moataz Mohamed - Optimizing Battery Electric Bus System Configuration in Transit: A Comparative Assessment

This study aims at quantifying the optimal utilizing battery-electric buses (BEB) system configuration. This is carried out from three different perspectives, including minimizing: infrastructure costs, utility grid impact, and GHG emissions. As such, three optimization models are developed for a real-world bus transit network in Belleville City, Ontario, Canada. The results show significant variations in the BEB system configurations resulting from the three models. This highlights that a trade-off is required to maximize resource allocation and further signifies the importance of utilizing multi-objective optimization to inform BEB system configuration in transit.

Hatem Abdelaty, Tinghui Shang, Moataz Mohamed - Temporal Assessment of Bus Transit Networks Dynamic Robustness

The authors in this study aim at building a framework for assessing the robustness of bus transit networks under several disruption scenarios that include bus routes and passenger flow. Measures of complex network theory are utilized to determine critical bus stops/stations/routes in the network based on their topological characteristics. Subsequently, the authors applied disruption scenarios on critical components of the network using a targeted attack approach. The results show severe cascading impact for targeted removal of the bus stations with the highest degree and betweenness on the passenger loading profile of the bus transit network. However, more importantly, this cascading impact varies significantly over time, questioning the findings of previous studies that relied on static-based robustness assessment. Overall, the study also provides directions to enhance the robustness of bus transit networks.

Hatem Abdelaty, Moataz Mohamed - E-Bus Energy Planning Framework Through Open-Source Low-Resolution Data

This study develops an e-Bus planning framework that integrates a data-driven prediction model and low-resolution open-source data collected by transit providers. The data accommodates vehicular, weather, operational, topological, and passenger loading parameters. The framework is evaluated using dual validation approaches. The validation of the proposed framework resulted in a powerful goodness-of-fit, and the model explained more than 80.35% of the energy consumption variation. Moreover, the

passenger loading data (0 passengers to 70 passengers) and the weather condition data (between -20° C and 30° C) yielded a very accurate prediction with an R^2 of 0.969 and 0.967, respectively. The proposed framework would provide transit planners and agencies with an optimal transit planning tool to inform e-Bus system design.

7. Air Transportation.

Mo ElSayed, Moataz Mohamed - 4d Airspace Discretization And Trajectory Optimization Framework for Autonomous Unmanned Aerial Vehicles in Cities

Unmanned Aerial Vehicles (UAVs) are being heavily adopted in smart cities and dense urban contexts. The use of airspace consumerization calls for a unified optimum infrastructure operational model including the creation of routes, traffic design, maximizing capacity, and trajectory optimization. The authors conduct a case study on the city of Toronto to test the proposed infrastructure design algorithm. The results show that the proposed algorithm enables the maximization of airspace capacity utilization by up to 10% as compared to cartesian methods of discretization based on a circle packing method. Furthermore, due to the detailed 3D generation capabilities, the UAV trajectories are 50% more energy-efficient and significantly safer eliminating cross-trajectory proximities. The proposed algorithm is a comprehensive operational model capable of efficiently designing a full UAV infrastructure network.

William G. Morrison - Blockchain and the Distribution of Air Travel Services

The author presents an economic analysis of the potential adoption of distributed ledger and Blockchain technologies on the distribution of air travel services and related products. Distributed ledger technology (DLT) and Blockchain in particular have the potential to radically transform air travel distribution with changes in distribution system costs, the productivity and costs of channel effort, the potential exit of current intermediaries, changes in market structure, profits and economic efficiency. A model of vertical distribution is developed to analyze these potential changes and to determine the conditions under which DLT-Blockchain technology adoption becomes profitable for airlines. The model provides insights regarding the trade-offs and profit implications in the decision to adopt DLT-Blockchain in air travel.

Fatou-Kiné Niang, Robert Larmour, Lawrence McKeown - The Impact of COVID-19 on Canadian Airfares

This paper examines the changing level and composition of airfares for the three years encompassing the pandemic. After a review of measuring airfares in Canada as well as other countries, the study examines airfares using Global Distribution Systems (GDS) data over three years, 2019 to 2021. In particular, the study reviews total fares for domestic, trans-border and other international passenger traffic, distinguishing between base fares and other fees including surcharges and taxes. In addition to assessing the impact of the pandemic on airfares, the study also demonstrates the potential of GDS data to cover a key data gap in aviation statistics.

Valeriya Mordvinov, - Canadian Aviation Amid the COVID-19 Pandemic

The author in this paper examines the impact of the pandemic on Canadian aviation using data from Statistics Canada. It builds on an earlier paper which focused on the financial and operational impacts on Canadian airlines in 2020. This paper extends both the scope and the time period by looking for signs of recovery. The first part focuses on the impact on Canada's large and medium air carriers through a lens of passenger and cargo metrics, and financial statistics. The change in airline operations – for example, the shift from passengers to cargo – is also examined. The second part explores the effects on various flying activities and compares the pace of recovery.

8. Rail Transportation.

Ben Chursinoff, Jonathan Thibault, Caroline Healey - The Critical Role of Shortline Railways In Canadian Supply Chains

Shortline railways in Canada provide numerous benefits to their surrounding communities. In this paper, the authors document the economic, employment, environmental, industry (contributions to supply chain efficiency) and community benefits of shortline railways by examining 3-4 case studies across Canada. Furthermore, the case studies will illustrate the missed opportunities for growth, whereby government support could lead to significant benefits to Canada's prosperity and climate action progress.

Malcolm Cairns - The Development of Passenger Rail in Canada

This paper provides a summary of the development of passenger rail in Canada from its beginnings in the late 1800s through to the present day. It reviews the current profile of the passenger sector in the following areas: inter-city, commuter rail, urban transit and tourist train segments; traffic and safety; and cost recovery rates by segment. It also reviews the passenger outlooks for electrification, hydrail, high-speed rail, and high-frequency rail. Lastly, the existing impacts of the COVID pandemic are highlighted by segment together with the prospects for the future.

Ryan Gallagher, Julia Loney - Rail Fuel Surcharges – History and Recent Developments

Canadian shippers generally have been subject to the fuel surcharges of Class I railways, including CN and CP. Since the early to mid 2010s, CN and CP both have made substantial improvements to their fuel efficiency without proportionate reduction to their fuel surcharges. Recently, CN has gone a step further with its main fuel surcharge tariff to the detriment of most shippers on CN. This paper examines the evolution of fuel surcharges in the North American transportation industry, analyzes CN's recent change to its fuel surcharge tariff and the potential impact on shippers, and analyzes potential regulatory solutions in respect of fuel surcharges.

9. Trucking Industry – I.

Terence Dimatulac, Hanna Maoh, Rupp Cariveau - An Archetypal Network Model for Identifying Potential Charging Locations for Long-Haul Electric Trucks in Ontario, Canada

The authors in this paper utilize GPS trip data that were generated by conventional heavy-duty trucks (i.e., Class 8), to develop an archetypal routing network that would help in identifying candidate locations of charging stations for big rigs in the Province of Ontario, Canada. Knowing the usual trajectory of these trucks, as well as the duration of their stay at their intermediate and final destinations, will help to determine the most ideal candidate locations for the planned charging stations that would maximize their utility. Results from the spatio-temporal analysis of the GPS data suggest that most of these long-haul electric trucks recharging stations should be located along critical road links in Ont. like Hwy 400 & 401.

Shervin Espahbod, Michael Haughton, Victor Shi - Bidding in Freight Spot Markets: How Does Information Influence Outcomes?

The paper designs a novel experiment to investigate the effects of information support on carriers in freight trucking spot markets. The paper will assess bidding behaviours based on bidding amounts and spot market outcomes, including the carrier's profit, the shipper's profit, and total carbon dioxide (CO₂) emissions. Unlike previous studies, this essay will consider multiple levels of information on the load-to-truck ratio and shippers' perceived values. This information reflects real-world practices in trucking spot markets. The fragmentation of the trucking sector in spot markets has added contributions to this research. There continues to be heterogeneity among carriers in the spot markets at the firm level (e.g., differences in available information resources) and at the individual level (e.g., differences in analytical skills between drivers). The third essay contributes to the extant literature by discussing tailored policies that can capture the fragmentation of carrier sizes.

Barry E. Prentice, Md Erfanul Hoque - Truckload Freight Rates: Putting Theory to the Test

The purpose of this study is to analyze the time series price data by different trailer type (e.g., dry vans and flat-decks) and trip characteristics to test theoretical propositions. It has access to a novel database collected by Evotrux (www.evotrux.com) to undertake statistical analysis of truckload freight rates.

Structural econometric models are developed to test the impact of distance, direction of movement and the barrier created by the Canada-U.S. border. This research is complementary to other databases that have been developed to calibrate goods movements based Big Data. As a public benefit, this research could help governments and market participants understand prices movements and monitor the health of the trucking industry and the general economy.

Yashar Zarrin Zadeh, Kevin Gingerich - Stated Preference Study of Trucking Carrier Route Choice Behavior in Ontario

Research on commercial vehicle route choice with a focus on market toll pricing and user willingness to pay is needed to inform strategies that balance mobility and sustainability. A shortlist of the most influential factors was identified in this study including travel time, delay, distance, and toll cost. These factors were then incorporated into the generation of an efficient stated preference (SP) survey on routing decisions. The SP survey was complemented with a questionnaire to collect socio-economic/demographic information. An online survey was designed and distributed to Ontario trucking companies. The results of this survey are used to calibrate mixed multinomial logit models estimating the probability of route selection for trucks. The findings indicate heterogeneity in truck route choice for time and cost where, on average, they are willing to pay up to \$81 (2020 CAD) to save one hour of their travel time.

10. Marine Port Issues.

Bradley Hull - Three Opportunities to Relieve East Coast Supply Chain Disruptions

This paper examines the Covid-related disruptions of 2021 and 2022 as well as attempts made to date to mitigate them. The goal is to identify alternate operational strategies that might reduce the severity of future disruptions. More specifically it analyzes the maritime hub-and-spoke model which has been central to the rapid development of global trade. Three possible opportunities emerge to alleviate future disruptions: increased use of the Seaway, increased use of the main Canadian east coast ports as gateways to North America, and increased use of smaller coastal ports in the US and Canada.

El Hadji Amadou Dieye et Emmanuel Guy - Projets de création des nouveaux terminaux à conteneurs dans les ports de Montréal et Québec

Cet article présente les résultats d'une étude de cas de deux projets: le projet Laurentia et le projet d'extension à Contrecoeur. L'étude est axée sur une l'analyse de contenu des documents liés aux évaluations environnementales respectives des deux projets ainsi que des articles de la presse écrite québécoise. Ceci a permis d'inventorier et de contextualiser les arguments de toutes les parties prenantes, tant celles faisant la promotion des projets que comme celles militant pour leur rejet. L'analyse permet de mieux comprendre la réalité de la problématique dans la mise en œuvre des politiques d'extensions des infrastructures portuaires et d'identifier les facteurs qui peuvent expliquer pourquoi que le projet à Québec a été rejeté alors que celui à Contrecoeur a reçu l'appui des autorités gouvernementale. L'analyse permet au final de cerner certains aspects fondamentaux dans la gouvernance portuaire pouvant permettre une meilleure acceptabilité sociale des activités de manutention.

11. Cycling Issues.

Amir Hassanpour, Alexander Bigazzi – E-Assist on Cycling Facilities: How it Affects Speed and Comfort

The objective of this study was to investigate the effects of electric-assist on 1) the speed of bicycles, scooters, and skateboards in cycling facilities and 2) other travellers' comfort in sharing the path with each vehicle. The naturalistic speeds of bicycles, scooters, and skateboards (electric and conventional) were recorded on off-street cycling facilities in Metro Vancouver, and an intercept survey was conducted to study interactions among travellers, particularly their comfort in sharing path on the scale of -10 to 10 (most uncomfortable to most comfortable). Mixed-effect regression was used to estimate the effect of electric-assist on speed and comfort while controlling for relevant confounding factors. The results suggest that electric-assist increases speed by 4 to 12 km/hr and for every 5 km/hr increase in mean speed

of a vehicle, comfort in sharing path with that vehicle drops by 1 unit among travellers. Moreover, the mere presence of electric-assist in a vehicle drops comfort levels by 1.5 units.

Haniyeh Ghomi, Mohamed Hussein - Spatial Autocorrelation Analysis of Violation-related Bike Collisions

This study investigates collisions that involve cyclist violations and the contributing factors to such collisions. It identifies key factors that impact the violation-related collisions as the degree of bike network coverage, network directness, and the density of bike-share stations and bike racks. The authors indicate that these findings will aid in designing bike-friendly networks that mitigate cyclist unsafe behaviours and enhance the overall bike safety level.

Emily Atwell, Trevor Hanson - Will cyclists use it? Applying regression models from NCHRP Report 941 to score cycling routes for comfort, safety, and willingness to try

Smaller cities have growing interest in developing their active transportation (AT) networks, but effectively estimating potential user demand on a route-by-route basis remains elusive. This paper profiles an application of regression models found within NCHRP Report 941 Bicyclist Facility Preferences and Effects on Increasing Bicycle Trips to estimate cyclist comfort, safety, and willingness to try routes based on an assessment of physical roadway characteristics. AT routes and segments in Saint John, New Brunswick were evaluated according to bicycle facility types, roadway characteristics, and “framing effects”, which were inputted into the regression models to return a score out of 5 for segments and a weighted average score for the route for three factors (comfort, safety, and willingness to try). This approach offers a quantifiable method to assess these three factors and estimate how select infrastructure improvements may impact rider experience.

12. Long Term Perspectives.

Andrew Tam - A Three Decade Odyssey: A Bird's-Eye View of Key Developments in Ontario's Trucking Sector Over 30 Years

Over the last thirty years, many regulatory reforms have changed the trucking industry. Since then, many significant changes have unfolded affecting almost all aspects of trucking in Ontario, such as cross-border trucking, vehicle standards and technologies, truck emissions, diesel fuel content, truck safety and driver market. Some of these changes and impacts are reviewed in this paper as part of a 30-year odyssey, based on experience or observation together with policy perspectives.

Gamal Eldeeb, Moataz Mohamed - Connecting the Dots of Two Decades of Public Transit Quality Research: A Text Mining Approach

Despite the plethora of studies on public transit quality, there remains a lack of knowledge synthetization that brings together previous findings and unveils latent patterns of public transit research in a single self-contained study. That said, this study aims at identifying key latent themes and patterns in the public transit literature while highlighting the emerging and declining research topics. It utilizes a dataset of 3,121 research articles, elicited from the Web of Science database, which covers the literature on public transit quality from 2000 to 2021. The results of the LDA model identified 22 latent key research topics which cover the broad spectrum of the transit quality and user perception literature.

Andrew Tam - The First and The Last. Comparison of the 1995 Agreement on Internal Trade and the 2017 Canadian Free Trade Agreement - Transportation Chapter / provisions

This paper focuses on a direct comparison of the transportation provisions which are significantly different in two agreements - the 1995 Agreement on Internal Trade and the 2017 Canadian Free Trade Agreement. It evaluates the potential implications, such as the inclusion of “air, marine and rail” transportation modes under exceptions for future measures (whether related to passenger or freight transport), which all fall principally under federal jurisdiction.

13. Trucking Industry — II.

Usman Ahmed, Matthew J. Roorda - Freight Vehicle Type and Shipment Size Modelling Using Discrete Choice Methods

The authors in this paper investigate the relationship between vehicle type and shipment size as sequential or joint choices, and identify the behavioural factors that affect these choices. They compare sequential and nested logit models to represent the choice process with both possible sequence (or nesting) structures i.e., vehicle type first (upper level) shipment size second (lower level), and vice-versa. Their research finds that both sequences and nesting structures can be reasonably applied to these choices, in addition they find that a joint model structure may also be suitable based on the strong correlation found.

Tufayel Chowdhury, Colin Smith, Maren Outwater, Matthew J. Roorda - A National Agent-Based Carrier Selection Model

The selection of motor carriers by shippers is a key logistics process that needs to be properly represented in a behavioral freight model. Typically, such choice decisions are implemented using a random utility maximization (RUM) – based approach like multinomial logit models. This is not often feasible due to data limitations and because attributes like carrier reputation, service quality, etc. cannot be simulated in an agent-based microsimulation model. This paper provides an overview of a heuristic algorithm that addresses these limitations. The model has been implemented in a national agent-based freight microsimulation model platform for the United States. A high-level analysis of the model result is included in this work. Some policy applications of the model are also discussed.

Ucchas Saha, Kevin Gingerich, Peter Park - A Swept Path Analysis of Intersection Designs for Long Combination Vehicles

This paper focuses on the range and combination of geometric factors leading to successful Long Combination Vehicles (LCVs) right-turn movements, such as curb radii and lane widths. Swept-path simulations are conducted for seven intersections in the Region of Peel using AutoTURN software to classify scenarios as pass or fail. Binomial logit models are estimated from these results. The correct prediction rates of the models range from 74% to 97%. Then, a quick-response toolkit is developed to assist roadway authorities with the LCV route acceptance process.

14. Performance and Optimization — I.

Artem Solovey, Kevin Gingerich, Mehdi Nourinejad - Optimization of Hybrid Ride-Sharing with Passengers and Freight

This paper proposes a matchmaking algorithm that enables ride-sharing services for dual delivery of people and packages to a single destination. The algorithm utilizes Benders Decomposition to solve the problem due to added complexity of the dual system. The algorithm is applied to a university student community travelling to the York University Keele Campus and is expected to eventually replace a passenger only ride-sharing system. This paper shows how a rideshare company can adopt this algorithm to increase its potential earnings by maximizing profit with constraints to ensure increased utility for all users. In addition, the improved efficiency arising in the transportation system is expected to provide broader contributions to social, economic, environmental, and technological sustainability.

Ruowei Li, Tho V. Le, Matthew Roorda - Performance of Person-following Delivery Robots in Crowded Pedestrian Environments

The aim of this study is to assess the performance of a person-following robot in indoor environments with high pedestrian density. A variety of laboratory experiments are conducted to determine a person-following robot's operating parameters, such as maximum speed, acceleration, and following distance, under different contexts of maximum robot speed, robot movement trajectory, and presence of pedestrians. The movement of the robot and its leader is recorded by a system of indoor ultrasonic positioning devices. Parameters estimated from the experiment data will provide ground truth for

calibrating a simulation model of robot behaviour in a pedestrian environment. The insight gained from this study will supply quantitative evidence to help logistics companies.

15. Marine — Special Topics.

Desai Shan, Alexander Medley - Return to Work Following Workplace Injuries: Legal Challenges for Seafarers in Canada

Absences due to disability or illness are among the most challenging situations faced by workers and employers today. As legal principles established by the *Canadian Human Rights Act*, all individuals should be protected against discrimination related to a disability. Employers also have the duty to accommodate workers to identify and change any rules and practices that may have a discriminatory impact. However, the law pertaining to accommodations and return-to-work varies across provinces. Canadian workers' compensation and healthcare for work-related injuries largely fall within provincial jurisdictions. The implication within this system is that eligible workers throughout Canada forfeit their ability to pursue legal action against employers under tort law in exchange for the right to compensation.

16. Road Safety Topics.

Saeideh Esmaeili, Yong Hoon Kim, Stefano Caserini - A Cooperative Traffic Control System for Level 3 Conditional Autonomous Vehicle

This study proposes a cooperative platoon vehicle control framework for an impending emergency condition caused by the subject vehicle (e.g., vehicle mode transition from automated to manual). While several studies focused on mitigating the risk caused by the subject vehicle itself, our proposed approach seeks to provide a safety buffer zone for the subject vehicle, by positioning surrounding vehicles in a short-term period. This methodology suggests an advisory acceleration rate for surrounding vehicles based on a physics inspired model, the spring-mass-damper model. It provides efficient rules for the longitudinal/latitudinal control of surrounding connected and autonomous vehicles (CAVs) considering a trade-off between the level of risk and headway among vehicles in the platoon by adjusting the spring constant and damper coefficient. The simulation results show that the proposed methodology ensures vehicles safety under CAV environment in complicated dynamic traffic conditions.

Abdul Razak Alozi, Mohamed Hussein - Autonomous Vehicles Safety in Urban Environments: Analysis of Onboard AV Video Recordings

The authors utilize three Autonomous Vehicles (AV) video datasets to evaluate the governing safety conditions of Autonomous Vehicles in urban settings travelling through three different urban centers. The data is processed to extract the trajectories of the AVs and the surrounding road users and derive relevant safety indicators for AV-road user conflicts. The conflicts were categorized based on the traffic and environmental parameters (e.g., conflict speed, weather conditions, and traffic control). Their analysis provides insight into the characteristics and impacts of the AV technologies on the current mixture of road users using real-world data collected in everyday field conditions. It also sets the scene for future research to dive deeply into quantifying the safety implications of AVs on other road users.

17. Performance and Optimization — II.

Adonai Garcia, Kevin Gingerich, Mehdi Nourinejad - Electric Cargo Cycles and the Capacitated Vehicle Routing Problem with a Single Depot

Electric Cargo Bikes (ECBs) are commonplace in European countries such as the Netherlands but have not been widely adopted yet in North America. For logistics companies, electric cargo bikes are limited by their payload weight and subsequent battery range. This paper produces a formulation of the Capacitated Electric Cargo Bike Routing Problem (CECBRP) to provide a case study for companies interested in shifting their conventional fleet to an environmentally friendly alternative. The model is implemented using Python code to test various patterns and intensities of customer demand and determine how many bikes are required to fulfill all deliveries and pickups. There is an emphasis on analyzing the

distance from customers to the depot. A numerical example is presented to demonstrate the model and analyze the feasibility of various vehicle models and capabilities.

Shang Zhang, Kianoush Mousavi, Matthew Roorda - Community Noise Survey for Off-peak Delivery in the Greater Toronto Area

One of the main concerns regarding Off-Peak Delivery (OPD) programs is the adverse effect of noise from delivery activities on residential communities during the evening and night time hours. To assess the OPD impact on the community noise level in the Greater Toronto Area (GTA), the authors conducted a noise survey to collect responses from residents in the vicinity of 22 retail stores that receive considerable deliveries in off-peak hours. The survey aims to collect information regarding the noise sources and their frequency by the time of day before and during the pandemic. The results from the 327 responses indicate the overall noise reduction since the beginning of the pandemic. Furthermore, the results from the responses near the off-peak delivery sites show no clear evidence of the OPD activities' adverse effect on the noise level compared to the control group.

Zhiyuan Liang, Yili Tang, Yacan Wang, Jianing Yu, - A Collective Incentive Strategy for Ridership Rebound and Peak Congestion Management in Mass Transit Systems

Demand for public transit in metropolitan areas has suffered during the COVID-19 pandemic. To solve the problem of luring ridership and improving capacity efficiency in mass transit system in post-COVID, the authors propose an off-peak transit incentive strategy which is designed and optimized in a mass transit system where commuter equilibrium choice of departure time is based on the trade-off among the schedule delay cost, queuing time cost, crowding cost and the discount of fare cost. For this collective incentive strategy, commuters who purchase an off-peak pass could enjoy a fare discount for off-peak travel and the specific fare discount depends on the total number of commuters that purchase and travel during off-peak. A bi-level optimization model is further established to capture the optimal design and departure time equilibrium after the implementation of off-peak transit incentive. Finally, a case study is conducted on a commuting metro line in Toronto. The results demonstrate that the proposed collective incentive strategy simultaneously reduce commuters' average generalized trip costs, increase the off-peak ridership and has the potential to increase revenue depending on the original fares.