



TransitData 2020
Sixth International Symposium on the
Use of Public Transit Automated Data for Planning and Operations

Hosted by the Transit Analytics Lab (TAL)
at the University of Toronto Transportation Research Institute (UTTRI)

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Subject to change

Tuesday 11 August, 2020

- 09:00 **Plenary 1: Introduction to Symposium and to Transit Analytics Lab**
Words of Welcome and Introduction to UTTRI's Transit Analytics Lab (TAL).
- 09:45 **Plenary 2: A Conversation with Professor Nigel Wilson: The Long Road to Data-Powered Transit**
Emeritus Professor Nigel Wilson of MIT is the eminence grise on research related to the use of automated transit data for planning and operations. We will engage him in conversation to discuss his perspectives on the use of transit data, and where we are today.
- 10:30 Break
- 10:50 **Parallel Sessions of Lightning Presentations - Part 1**
Our Call for Submissions resulted in over 80 accepted submissions from academics and practitioners alike. These studies will be presented in an innovative format of 6-minute lightning presentations, a sort of *tapas tasting buffet*, offering a broad menu on data-driven tools for planning and operations, methodology enhancements, and perspectives on related policy and organizational issues. (**NOTE:** Presentations are listed in alphabetical, not final, order in this draft program)

Session 1-A: Planning Analyses

- Analysing the Impacts of Long-Term Service Disruptions on Passenger Travel Behaviour: a Smart Card Analysis from the Greater Copenhagen area, Nils Breyer, Morten Eltved, Jesper Bláfoss Ingvardson and Otto Anker Nielsen, Linköping University, Technical University Denmark
- Corridor-Based Bus Performance Analysis, Graeme Brown, TransLink
- Harnessing Smart-Card Data to Understand Our Clients Better: a Customer Segmentation Study at Société de transport de Laval, Anna Dushina and Gregory Wielinski, Société de transport de Laval
- Public Transit Accessibility Changes Over Time and Space: Measuring the Effects of Network Modifications and Bus Speed Variation From Years of Continuous GPS and GTFS Data, Renato O. Arbex, University of São Paulo
- Use of Automated Transit Data to Evaluate Public Transit as An Alternative to Shared Mobility Rides in Chicago, Patrick Meredith-Karam, Hui Kong and Jinhua Zhao, Massachusetts Institute of Technology
- Visualization Tool to Analyze Data-Driven Bus Lane Allocation Guidelines, Shaked Ofek-Kaufman, Eran Ben-Elia, Noam Tractinsky and Peter Bak, Ben-Gurion University of the Negev, IBM

Session 1-B: Origin-Destination Enhancements and Analyses

- Completing an Origin-Destination Matrix by incorporating not recorded stages of trips using only passive data of Transmilenio BRT in Bogota, Colombia, Carolina Palma, Camilo Leng and José Imbarack, Chile CityPlanning
- Estimating Transit Route OD Flow Matrices from APC Data Using the IPF Method when Passengers Travel Through Terminals: Methodology and Evaluation, Aijing Chen, Rabi Mishalani and Mark McCord, Ohio State University
- Estimation of passenger flows through AVL data with different dwell time functions, Wenzhe Sun, Jan Dirk Schmoecker, Koji Fukuda and Toshiyuki Nakamura, Kyoto University
- Long-Term Ridership Forecast Using Heuristic, SARIMA and Random Forest Methods, Zhanhong Cheng, Hamzeh Alizadeh, Mohsen Nazem, Martin Trépanier and Lijun Sun, McGill University, Exo, Polytechnique Montréal
- OD Matrices Generated from Smartphone-Based GPS Survey VS Traditional CATI survey, Ali Yazdizadeh, Hamzeh Alizadeh, Mohsen Nazem, Zachary Patterson and Martin Trépanier, Exo, Concordia University, Polytechnique Montréal
- Transition: A New Platform for Transit Network Design and Optimization, Pierre-Léo Bourbonnais, Catherine Morency and Martin Trépanier, Polytechnique Montréal

Session 1-C: Policy Applications Using Automated Data

- A Social Equity Lens on Bus Bridging and Ride Hailing Responses to Unplanned Subway Disruptions, Rick Liu, Matthew Palm, Amer Shalaby and Steven Farber, University of Toronto
- Data-driven advocacy: Encouraging and supporting open data analysis to enhance public input in transit projects, Willem Klumpenhower, Klumpentown Consulting

- Data-Driven Analysis in Support of a Fare Reform, Ka Kee Alfred Chu and André Lomone, ARTM
- New Paradigm of Equity in Transportation Modelling, Kiarash Ghasemlou and Murat Ergün, Istanbul Technical University
- Spatial Analyzing of Cash to Smart Card Payment Ratio at the Bus Stop Level, Yuval Hadas and Genadi Birfir, Bar-Ilan University
- Using automated transit data for narrative-building, Alissa Zimmer, Brendan Fogarty and Emma Ingallinera, Massachusetts Bay Transportation Authority

11:50 Lunch Break

1:15 Lunch Activity (TBD)

1:40 **Parallel Sessions – Part 2**

Session 2-A: System and Route Performance Monitoring Applications

- Automated Transit Capacity Analyses, Mischael Raj, OC Transpo, Canada
- Customer Insights to Growth, Maureen McLeod, Michael Parravani and Sam Behnood, Metrolinx
- Driving GO Bus into the Future: Strategic Planning & Performance Measurement using Big Data from PrestoBI & APC, Anthony Smith and Eddy Ionescu, Metrolinx, University of Waterloo
- Grand River Transit Application of Automated Data for Planning Decisions, Blair Allen, Lucas Braun and Shen-Hao Howard Chang, Grand River Transit
- Open Source Tools for Visualizing Stop-Level Performance Measures: A Case Study in Calgary, Saadiq Mohiuddin, City of Calgary
- Smart Systems for Big Data: MTA's Route Grades & Performance Monitoring Program, Sandy Brennan, Jeremy Strauss, FourSquare

Session 2-B: Operator Performance and Operations Applications

- Developing a Smart System to Identify Bus Drivers Drowsiness Caused by Physical or Mental Fatigue, Vahid Abolhasannejad and Mohammad Abdoli-Eramaki, Ryerson University
- Empirical Identification of Location-Specific Carbon Monoxide Patterns Using a Low-cost Sensor Mounted on a Transit Bus in Operational Service, Mark McCord, Rabi Mishalani, Andrew May and Yangyang Zou, Ohio State University
- Performance Chauffeur - A standardized metric on drivers' operational performance based on peers performance: A methodological framework developed at Société de Transport de Laval (STL), Grzegorz Wielinski and Vincent Dionne, Société de Transport de Laval
- Two-Way Adaptive Transit Signal Priority for High Frequency Bus Lines using Deep Reinforcement Learning, Wen Xun Hu and Amer Shalaby, University of Toronto

- Using Aggregate Operator Data to Improve Extraboard Planning, Qing Yi Wang, Haris N. Koutsopoulos and Nigel H.M. Wilson, Massachusetts Institute of Technology, Northeastern University

2:40 Break

3:00 Plenary 3: **Data-Driven Analyses and Visualizations in Response to COVID 19**

The entire world is grappling with responding to the COVID-19 pandemic. Transit agencies have had to scramble to rethink their schedules, services and sometimes networks, and data has played a critical role in these analyses. This session will provide some perspectives on the use of data to assist planning and operations in response to the pandemic.

- Analysis of Public Transportation Demand and Passenger Behavior during Covid-19 Pandemic: Case Study of Tehran, Saeid Saidi, University of Calgary
- Critical MaaS: Applications of Journey Planning Data, Jonathan Scheff and David Block-Schachter, Transit App
- Leveraging Twitter Data to Support Transit Planning and Operations, Omar Kabbani, Tamer El-Diraby and Amer Shalaby, University of Toronto
- Real-Time Local Bus Crowding Information for MBTA Riders, Logan Nash and Anna Gartsman, Massachusetts Bay Transportation Authority
- Using the APC Ridership Tool to Develop a Demand-Responsive Service Plan During the COVID-19 Pandemic in Toronto, Ontario, Jasmine Eftekhari, Conor Adami and Herman Hui, Toronto Transit Commission
- Virus Transmission Risk in Public Transportation Systems: A Microscopic Simulation-Based Analysis, Jiali Zhou, Haris N. Koutsopoulos, Northeastern University

Discussion

4:30 End of Day 1

Wednesday 12 August, 2020

09:00 Plenary 4: **Spotlight on Transit Data / Analytics Laboratories**

A small number of research laboratories from around the world have been on the forefront of conducting applied research related to transit data and analytics **in collaboration** with Public Transport authorities and operators. This session will provide a spotlight on some of their activities.

10:40 Break

11:00 **Parallel Sessions - Part 3**

Session 3-A: Matching Performance and Customer Experience, and Customer-Centric Analyses

- Improving Real-Time Elevator Status Information with User-Centered Design, Simon Hochberg and Dan Howard, San Francisco Municipal Transportation Agency
- Modelling the Effects of Objective System Performance on Customer Satisfaction Metrics, Mark Hickman, Tianwei Yin and Alexis de Germay de Cirfontaine, Queensland University
- Perception of seat and boarding probability in crowded metro systems, Menno Yap and Oded Cats, Delft University of Technology
- TRANSIT-performance: Using open GTFS and GTFS-realtime data to measure transit agency performance, Farah Machlab and Ritesh Warade, IBI
- Visualization Dashboard for Bus Performance Evaluation and Analysis, Nicholas Caros, Xiaotong Guo, Anson Stewart, John Attanucci and Jinhua Zhao, Massachusetts Institute of Technology
- Who is complaining the most? Combining bus operational data with customer complaints in Portland, OR, James DeWeese, Ehab Diab, Miles Crumley and Ahmed El-Geneidy, TriMet, McGill University, University of Saskatchewan

Session 3-B: Transfer Analyses

- A bus location estimation algorithm by integrating chip card and general transit feed specification static data, Li He and Charles de la Chevrotière, Autorité régionale de transport métropolitain
- A combined use of sensor count data and smart card data to study the flows of a multimodal transport hub, Paul De Nailly, Latifa Oukhellou, Allou Same, Etienne Come, Laurent Gerardin, Nelly Darrort and Jacques Ferriere, Régie Autonome des Transports Parisiens, Université Gustave Eiffel
- Determining transfer times and correspondence attractiveness in multimodal public transport systems using AFC and AVL data, Morten Eltved, Niklas Christoffer Petersen and Philip Lemaitre, Technical University of Denmark
- Public transit transfer analysis from smart card data, Benjamin Disson, Martin Trépanier and Catherine Morency, Polytechnique Montréal

Session 3-C: Data Quality and Governance

- CERT&Info module, an advanced tool for the assessment of Public Transport service performance: the results of two case studies in Tuscany Region, Giorgio Ambrosino and Claudio Disperati, MemEx
- GTFS Feed Comparison, Visualization, and Quality Control to Improve the Customer Navigation Experience, Wylie Timmerman, Thomas Orgren and Sandy Brennan, FourSquare
- Improving Data Governance by Expanding Access to Data, Joaquin Osio-Norgaard and Laura Riegel, Massachusetts Bay Transportation Authority
- Six Flavors of AVL: How differences among AVL data systems affect bus performance evaluation, Catherine Vanderwaart, Washington Metropolitan Area Transit Authority

- Stop Making Sense: Internally Inconsistent CAD/AVL Data, Joseph Reid, Metro Transit-Minn
 - The City Data Model Collaboratory: Towards an ontology-based standard for transit data (and more), Megan Katsumi, Mark Fox, University of Toronto
- 12:00 Lunch Break
- 1:00 Lunch Activity (TBD)
- 1:45 **Plenary 5: Data Management Challenges and Initiatives – Panel Discussion**
A few transit agencies have moved beyond just ensuring quality assurance of their data to developing comprehensive data management programs and sophisticated analytic capabilities. This panel discussion will bring together some of the managers from these agencies to discuss the organizational challenges they have faced, and their different approaches to these challenges.
- 3:00 Break
- 3:20 **Parallel Sessions - Part 4**

Session 4-A: Passive Data Applications

- Can we improve public transport route recommendation using passive data?, Felipe Vera and Marcela Munizaga, University of Chile
- Driverless Shuttle User’s Perception and Experience: Global Assessment using Twitter Data, Mahmood Mahmoodi Nesheli, Jiaying Li, Amer Shalaby and Tamer El-Diraby, University of Toronto
- Estimation and Prediction of Queues at Bus Stops Using Wi-Fi Signal Data, Hyungsub Jee, Jan-Dirk Schmöcker and Toshiyuki Nakamura, Kyoto University
- Interactive Dashboard Tools for Transit Market Analysis using Location-based Services Data: Experiences from Transit System Redesign Projects in Three Large US Cities, Pragnu Vinayak, Jingjing Zang, Salah Uddin Momtaz, Amit Ranjan Mondal and Anurag Komanduri, Cambridge Systematics Inc
- Re-Inventing SORTA’s Network through Innovative Data Analysis, Khaled Shammout, Mark Samaan and Waleed Ismael, SORTA-Cincinnati
- Redesigning Winnipeg: The role of Automatic Passenger Counters, Location Based Devices, and WebGIS in the development of the Winnipeg Transit Master Plan, Aaron Baxter, Stantec

Session 4-B: Analytics for Improving Prediction Accuracy and Other Applications

- A Customer-Focused Methodology for Measuring Prediction Accuracy Using Automatically Collected Data and Metrolinx Case Study, Farah Machlab and David Duong, IBI, USA

- A machine learning approach to estimate transit travel times using sparse GPS data, Ramón Bahamonde, Hans Löbel and Ricardo Giesen, Pontifical Catholic University of Chile
- An Open-Source Framework to Implement Kalman Filter Bus Arrival Predictions, Sean Òg Crudden and Simon Berrebi, Georgia Institute of Technology
- Dynamic holding control to avoid bus bunching: A multi-agent deep reinforcement learning framework, Lijun Sun and Jiawei Wang, McGill University
- Real-Time Bus Travel Time Prediction within a Reliability Space Framework, Ryan Williams, Amer Shalaby and Siva Srikukenthiran, University of Toronto
- Studying “The Danger Zone of Express Services” with simulation, Carlos Olivos, Homero Larrain and Juan Carlos Munoz, Pontifical Catholic University of Chile

4:20 Plenary 6: **Pertinent Initiatives Related to Data Specifications and Management**

This session will highlight some current studies or recent initiatives that support enhanced data management or encourage the use of data specifications. One such study is TCRP Project G-18 entitled *Improving Access and Management of Transit ITS Data*.

- TCRP Study G-18: Improving Access and Management of Transit ITS Data, Catherine Vanderwaart, WMATA / Cecilia Viggiano
- GTFS-ride, J. David Porter, Oregon State University
- TBD

5:20 End of Day 2

Thursday 13 August, 2020

09:00 **Parallel Sessions - Part 5**

Session 5-A: Service and Operations Planning Applications and Studies

- A Methodology for Identifying Inconsistencies Between Scheduled and Observed Travel and Transfer Times using Transit AVL data: Framework and Case Study of Columbus, OH, Yuxuan Wang, Andre Carrel and Zhenhua Chen, Ohio State University
- Deep troubles in a bus station: let’s investigate it with deep learning! An introduction to AI tools in a transit agency real case, Florian Cys and Gregory Wielinski, Société de transport de Laval
- From pings to planning: developing, analyzing, and using ITS data to improve transit performance, Eric Lind and John Levin, Metro Transit-Minneapolis
- From Taps and Beam-breaks to Service Design: Developing and Evaluating Service Design Scenarios using AFC and APC, Joseph Reid, Metro Transit-Minneapolis
- Improving Local Transit Connections at GO Rail Stations using GTFS and PRESTO Data, Eddy Ionescu, University of Waterloo
- The practicalities of dealing with open data for use in live transit operational control rooms and public-facing applications, Matt McInnes and Ryan Burt, Lynxx

Session 5-B: Network Analyses and Optimization

- A frequency-based transit assignment model that considers online information, Nurit Olikier, Université de Montréal
- Automated modular bus systems: A macroscopic perspective, Igor Dakic, Kaidi Yang and Monica Menendez, ETH, Stanford University, New York University
- Considering the problem of common bus line for public transit accessibility evaluation to enhance network analysis, Rattanaorn Kaewklungklom, Fumitaka Kurauchi, Toshiyuki Nakamura and Takenori Iwamoto, Gifu University, Nagoya University, Shizuoka Railway Co
- Forecasting delay distribution in public transport to measure service reliability and move towards reliable vehicle schedules, Léa Ricard, Guy Desaulniers, Andrea Lodi and Louis-Martin Rousseau, Université de Montréal, Polytechnique Montréal
- Stochastic Transfer Synchronization in Transit Networks: Comparison of Alternative Formulations and Their Associated Data Input's Structure, Zahra Ansarilari, Merve Bodur and Amer Shalaby, University of Toronto
- Transit Origin-Destination Estimation for Special Events: A Compressed Sensing Approach, Pramesh Kumar and Alireza Khani, University of Minnesota, Twin Cities

Session 5-C: Rail Applications

- Incorporating AVL and AFC data for Mesoscopic Modeling of Train Operations, Saeid Saidi, Nigel H. M. Wilson, Haris N. Koutsopoulos and Jinhua Zhao, University of Calgary, Massachusetts Institute of Technology, Northeastern University, Canada
- Integrating travel behavior regularity into passenger flow prediction, Zhanhong Cheng, Martin Trépanier and Lijun Sun, McGill University, Polytechnique Montréal
- Leveraging data to modernize transportation, Jeremy Foran, Alexander Witte, BAI Communications
- New York City Transit Subway Visualization, Alla Reddy and Tuan Huynh, New York City Transit Authority
- Train Dwell Time in relation to adjacent services and previous stops, Taku Fujiyama, University College London
- Using Spatiotemporal Train Stops to Link Customer Delays with Trouble Tickets and Assets, Michael Eichler, Washington Metropolitan Area Transit Authority

10:00 Break

10:20 Plenary 7: New Data Sources: Perspectives and Challenges - Panel Discussion

Automated transit data has primarily been derived to date from transit ITS or smart card technologies. But new potential sources of data, including Location-Based services, social media, etc. are being used in research and applications, opening new horizons on their use for transit planning and operations. This panel discussion will provide some perspective on these new sources of data, their potential use in transit, and some of the challenges they raise, including quality assurance, manipulation, protection of privacy, cybersecurity, etc.

- 11:50 Lunch Break
- 1:15 Lunch Activity (TBD)
- 1:45 **Plenary 8: Academic/Industry Collaboration on Data Analytics and Applications – Panel Discussion**
Academic researchers and transit agency staff often inhabit two separate worlds. However, in recent years the use of automated data to develop analytics applied to transit planning and operations has become an area of growing common interest, where collaboration is feasible and of mutual benefit. This panel includes experts who have worked to build such collaborations and will discuss both benefits and challenges in pursuing academic/industry collaboration to enhance transit effectiveness and efficiency through the application of data.
- 2:45 **Plenary 9: Looking to the Future**
The final session will provide some concluding remarks about the Symposium, and open up perspectives on the future with thoughts for participants to reflect on as they move forward.
- 4:00 End of Symposium