Transportation Association of Canada

Report on the workshop of March 25, 2010

Quantifying and Forecasting Greenhouse Gas Emissions from Urban Passenger Transportation

FINAL

Prepared for
Transportation Association of Canada

By
Noxon Associates Limited

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Chapter 1: Introduction

On March 25, 2010 the Transportation Association of Canada (TAC) hosted a workshop entitled "Quantifying and Forecasting Greenhouse Gas Emissions from Urban Passenger Transportation" at the Crowne Plaza Hotel in downtown Ottawa, Ontario.

Purpose. The workshop was intended to be a forum for exchanging ideas and knowledge, rather than for reaching consensus on best practices in greenhouse gas (GHG) emissions quantification and forecasting. Its objectives were:

- to explore the state of practice in Canada and elsewhere related to the quantification and forecasting of GHG emissions
- to assess opportunities and challenges for Canadian jurisdictions and practitioners
- to identify practitioner needs that could be addressed by TAC members and partners (i.e. various orders of government, non-governmental organizations, academics and private-sector businesses)

Sponsorship. The workshop was a sponsored project of TAC's Urban Transportation Council (UTC), proposed by the UTC's Sustainable Transportation Standing Committee (STSC). To cover the costs of running and documenting the workshop, TAC solicited financial support from its membership. Sponsorship funding was received from by Transport Canada, the Federation of Canadian Municipalities (FCM), the Ministère des Transports du Québec (MTQ) and the City of Toronto. The STSC struck a Project Steering Committee consisting of the following members:

- Transport Canada – David MacIsaac, Reena Kokotailo
- FCM – Elizabeth Allingham
- MTQ – Pierre Tremblay
- Province of Alberta – Peter Dzikowski
- Metrolinx – Joshua Engel-Yan
- TAC – Katarina Cvetkovic

Structure. The one-day workshop was divided into two main parts. In the morning, participants heard opening remarks from the workshop host and sponsors, followed by presentations on several case studies in emissions forecasting. In the afternoon, participants heard opening remarks from several expert panelists and then held breakout discussions followed by plenary reports, a group discussion involving the panelists, and some closing remarks. Appendix A contains the workshop agenda.

Participants and speakers. Invitations to participate in the workshop were sent from TAC to its list of members, and spaces were reserved for individual participants on a first-come, first-served basis. Speakers were invited by TAC, based on recommendations generated and discussed by the Project Steering Committee. The workshop was chaired and facilitated by Geoff Noxon of Noxon Associates. Appendix B contains a list of the 44 participants.

Chapter 2: Case studies in emissions forecasting

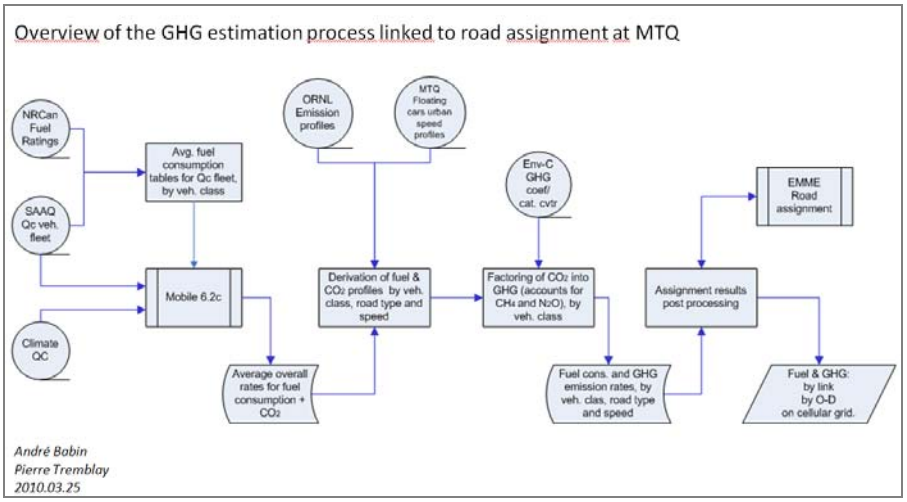
This chapter summarizes outcomes of the morning portion of the workshop.

2.1 Welcome by workshop sponsors

All project sponsors welcomed the participants to the workshop and thanked them for committing their time and effort to exchanging information and advancing the state knowledge on quantifying and forecasting GHG emissions from urban passenger transportation.

Eric Sévigny – Transport Canada
Eric observed that Transport Canada has been involved with the development of emission estimation tools and practices since 2001, when the Urban Transportation Showcase Program was launched. He noted that work in this area has proved to be challenging and complex, and remarked on the availability of the Urban Transportation Emissions Calculator (UTEC) on the Transport Canada website. He also noted that Transport Canada will continue working in this field given that reliable and meaningful measurement is of great importance and should be integrated in all projects.

Pierre Tremblay – Ministère des Transports du Québec
Pierre noted that his agency uses MOBILE6 software and has been adding data for its vehicle fleet. Certain limitations of the MOBILE program and the assumptions that have to be considered lead to some challenges with using the program and interpreting the results. He noted that his agency is interested in getting better data and performing the modeling (see figure, below) in a simpler way.



Nazzareno Capano – City of Toronto
Nazzareno remarked that the City of Toronto has embarked on an ambitious program to reduce GHGs and has a clean air action plan and a strategy for mitigation and adaptation of climate change. He added that he's looking forward to learning from the experts involved in this workshop.

2.2 Presentations

Five speakers were invited to give 20-minute presentations on notable GHG emissions forecasting initiatives. The title and speaker for each presentation are given below. Four speakers used PowerPoint slides to accompany their remarks; these slide decks are included in the Technical Annex to this report (under separate cover). The remarks of the fifth speaker are summarized below.

Planning for transportation greenhouse gas emissions reductions in the Greater Toronto and Hamilton Area

Joshua Engel-Yan – Senior Advisor, Policy and Planning, Metrolinx
Joshua was involved in many aspects of development of the Metrolinx Regional Transportation Plan, including emissions estimation and planning for GHG emission reductions.

See the Technical Annex to this report (under separate cover) for the slides used in this presentation.

Public transit: A key to reducing greenhouse gases – The Montréal case

Catherine Laplante – Head Economist, ADEC Consultants
Catherine has worked on transportation plans, surveys and models, feasibility studies of large infrastructure projects, and economic analyses.

See the Technical Annex to this report (under separate cover) for the slides used in this presentation.

Visioning and backcasting for transport in Victoria, B.C.

David Crowley – Vice President, Halcrow Consulting
David specializes in travel market research, demand forecasting for toll roads and transit services, transit service planning, and transportation policy analysis. He was Project Director for the VIBAT Victoria study.

Dr. Robin Hickman – Associate Director, Halcrow and Research Fellow & Lecturer, Transport Studies Unit, University of Oxford
Robin leads transport research at Halcrow, specializing in areas including transport and climate change issues, and integrated transport and urban planning strategies. He was project manager for the VIBAT Victoria study.

See the Technical Annex to this report (under separate cover) for the slides used in this presentation.

Case studies for SNC-Lavalin projects

Jean-Luc Allard – Vice President of Environment, SNC-Lavalin
Jean-Luc has spent many years seeking solutions to the global challenges of ozone depletion and GHG emissions.

Jean-Luc reviewed the various types of projects which require estimates of GHG impacts. These include environmental assessments (which use emission estimates to compare alternatives and identify the need for mitigation), regulated projects (which specify how emission estimates are done), and emission reduction projects (e.g. transit or highway system improvements). He noted that a main challenge facing the latter group of projects is that the GHG benefits are typically outweighed by modeling errors, and this limits the "bankability" of the projects. He viewed a formalized approach to dealing with carbon credits as a major opportunity, and identified a number of needs:

- Better validation of models after project implementation, and use of results to improve models.
- Supportive policies such as carbon pricing.
- Better model documentation, considering that French and English documentation often use different factors and units, and differ in their instructions.
- Alignment of input data with model requirements (e.g. passenger vehicle data for use in MOBILE).
- Better measurement of actual changes in emissions, such as yearly monitoring and verification for carbon credits.
- More precise models, given that current uncertainties lead to carbon credits being discounted by 50%.

Moving Cooler: An analysis of transportation strategies for reducing greenhouse gas emissions

Joanne Potter – Senior Associate, Cambridge Systems
Joanne managed Moving Cooler*, a national multi-sponsor study that assessed the effectiveness of transportation activity strategies in reducing GHG emissions. She also led the development of a U.S. DOT report on transportation's climate change impacts and solutions involving technology, fuel and behavioural approaches.*

See the Technical Annex to this report (under separate cover) for the slides used in this presentation.

Chapter 3: Meeting the challenge – Models and tools

This chapter summarizes outcomes of the afternoon portion of the workshop.

3.1 Opening comments by panelists

Four experts were invited to act as panelists for the afternoon portion of the workshop. They stimulated discussion by making five-minute remarks on three focus questions before participants divided into breakout groups. Their subjects, names and key points are given below; none used slide decks to accompany their remarks.

Vehicle Emissions Modelling at Environment Canada

Brett Taylor – Pollution Data Division, Environment Canada
Brett is an expert in MOBILE and MOVES software, and his work is focused on criteria air contaminants and toxics rather than GHGs. His colleagues Pascal Bellavance and Scott McKibbon participated in the workshop and were available to provide additional information on GHG modeling.

Brett noted that Environment Canada is responsible for maintaining an inventory of data, providing emission estimates for all types of transportation, and preparing annual reports to the United Nations on Canadian emissions. The agency also collaborates with provincial governments to determine pollutant definitions and criteria.

B. Taylor observed that MOBILE6.2C is not used for GHG estimation. MOBILE6.2 Vehicle Emissions Modelling Software was originally developed by the U.S. Environmental Protection Agency, and has been adapted for Canadian use by Environment Canada (more information at www.tc.gc.ca/eng/programs/environment-urban-menu-eng-1799.htm). Users of this program may contact him to obtain the most up-to-date version of the program. Environment Canada will likely embrace the MOVES software for modeling purposes in the near future.

Emissions Estimation Tools for Urban Transportation

Brian Hollingworth - Director, IBI Group
Brian specializes in transportation planning and sustainable development, and has conducted numerous sustainable transportation studies for Transport Canada, Environment Canada, Natural Resources Canada, TAC and the Canada Mortgage and Housing Corporation. He is a member of TAC's Urban Transportation Council and a past Chair of its Sustainable Transportation Standing Committee.

Brian summarized his experience in emission calculations and modeling. He worked with the Canada Housing and Mortgage Corporation (CHMC) on an emissions model that incorporated climate change

issues, and conducted a review of emission calculation tools for Transport Canada in 2009. His firm was also retained by Transport Canada to develop the Urban Transportation Emissions Calculator (UTEC), a user-friendly tool for estimating GHG and criteria air contaminant emissions from personal, commercial and public transit vehicles (more information at www.tc.gc.ca/utec).

Brian highlighted a sustainable transportation study led by the Organization for Economic Co-Operation and Development (OECD) as an interesting and innovative example to gather knowledge and experience on emissions. The project was set up in such a way that different groups competed in finding ways to reduce GHGs, resulting in a wide range of approaches and solutions.

Brian cautioned against agencies getting too deep into fine details around GHG quantification and forecasting, and that we are looking for order-of-magnitude rather than fine-grained numbers. He added that we need tools, we need to decide where to start, and we need to act now. He noted that current gaps include emission factors, baseline data (particularly in urban areas and also from goods movement), and corridor identification. Useful tools include case studies (real or artificial scenarios) and simple models. There is also a need for requirements or other motivation for planners and transportation professionals to include GHG estimation in their work.

Integrating Transportation Demand Models with Emissions Estimation Tools

Marianne Hatzopoulou – Research Scientist, Massachusetts Institute of Technology
Marianne's expertise involves linking large-scale microsimulation land use and transportation models with emission models, and assessing the impacts of policies on emission reduction at the individual and household levels.

Marianne provided a brief overview of models she has developed or used. These include the University of Toronto's ILUTE research framework and model that links land use and transportation. Another microsimulation model (TASHA) emulates system-wide 24-hour tripmaking; it is linked to a car allocation module that assigns specific cars for specific trips, and the MATSim traffic network model that estimates emissions based on household and personal use.

GHGenius Model for Lifecycle Assessment of Transportation Fuels

Derek McCormack – Fuels Policy and Program Division, Natural Resources Canada
Derek manages development of the GHGenius lifecycle analysis model, and performs analysis and provides advice on various technical and policy issues related to conventional and alternative fuels, including lifecycle analysis.

Derek noted that he deals with cradle-to-grave analysis of fuels and uses MOBILE for some aspects of his work. However, most of his efforts are focused on the GHGenius model that Natural Resources Canada has supported for about 10 years. GHGenius calculates the life-cycle emisions from a fuel's extraction (or growth) through its conversion to produce vehicle power. He added that the GHGenius

is now being used in provincial regulations, is very powerful and has good data in it; however, more resources are needed to maintain it (more information at http://oee.nrcan-rncan.gc.ca/transportation/tools/greenhouse-gas-info.cfm?attr=8).

Derek observed that the modeling work is very complicated, and that no consensus exists on model harmonization. The quality of data continues to be an issue, and it is getting more difficult to obtain good data within cost constraints. An additional challenge is that increasing demands are being placed on these models.

3.2 Results of breakout discussions

After the panelists' initial remarks, workshop participants divided themselves into four groups and spent one hour discussing three focus questions:

1. What challenges face practitioners in estimating and forecasting GHG emissions from urban passenger transportation? Which are most important, and most urgent?
2. What measures could help overcome these challenges (data, policy, research, tools, resources)?
3. What implementation issues could arise for these measures (roles and responsibilities; policy, technical or resource constraints)?

After the breakout discussions, one member of each group gave a verbal report to the plenary. The text below summarizes their main points in response to the three focus questions, and additional comments heard from the four invited panelists and other workshop participants.

Question 1: What challenges face practitioners in estimating and forecasting GHG emissions from urban passenger transportation? Which are most important, and most urgent?

Data – general

- Data are critical—they must be more accurate, compatible and readily available, especially GHG factors and fuel sales data. On the other hand, information is now a commodity and many data are available from commercial sources.
- There is a need for more measuring and reporting, and for more staff and financial resources to carry out that reporting and measuring.
- Privacy and liability issues make it challenging to receive and use data.
- There is a need for better political will to get better data and to make it easily available.
- There are many differing practices and assumptions associated with VKT measurements in different jurisdictions—some provinces require annual mileage reporting, others do not.
- Data can't be taken at "face value"; they need to be understood and appreciated and some judgment has to be applied when interpreting data and results from models.

Models and methodologies

- There is a lack of incentives to develop and use GHG models at the local level.

- Ownership of models is sometimes not defined. Whose responsibility is it to maintain models, inform users of upgrades, and so on?
- Methods and models must be more consistent among communities to allow project comparisons.
- Models can be too complex to produce clear or useful answers.
- Peak-hour transportation models are commonplace but provide poor visibility into total emissions, and overemphasize the impact of commuting behaviours (both baselines and changes).
- Models need to be simpler to use.
- There is a need for an established quantifying/forecasting methodology.
- Emissions factors are difficult to obtain, and of questionable quality.

Transportation activities and sources

- We need a better understanding of who is making what trips and what influences affect their behaviour (e.g. aging, land use patterns).
- We need a better understanding of active transportation modes and their emission impacts.
- There is a significant lack of good-quality data on goods movement.
- We focus primarily on personal vehicles, but transit is a large source of GHGs and requires more data collection and modelling. Furthermore, the relationship between bus efficiency and emissions has to be understood; we have empty buses, old buses, buses that frequently stop on busy routes… there is opportunity for optimization.
- Emissions from construction and maintenance of physical roadway infrastructure should be understood and taken into account as well.
- Figuring out GHG emissions from an organization's fleet is challenging.
- New regulations are needed for methane and nitrogen dioxide emission measurements; at this time these measurements are not required when testing new vehicle models, so they are not part of the vehicle emissions identification label. Lack of this data means that a consumer does not have all the information to make an informed decision when purchasing a vehicle.

Other challenges

- There is a need for consistent targets across different levels of government.
- Policy-making requires research, and generating results from research takes time—overall, the process is very slow.

Question 2: What measures could help overcome these challenges (data, policy, research, tools, resources)?

- Senior levels of government could provide more leadership and emphasis on the importance of GHG data collection and tool development, e.g. by requiring data collection through policy.
- Emission targets at each level of government should be agreed upon to bring about both accountability and action; they would provide a starting point for more widespread use of backcasting as a planning tool.
- A national clearinghouse of research, cases studies and best practices, as well as the availability of training on models such as MOBILE and MOVES, would help individual organizations and practitioners to improve their own activities.

- Governments should make data collection and use mandatory with standardized procedures for data collection and maintenance, and the establishment of common, open-source data sets.
- Funding from senior governments for data collection at the local level could be contingent on the return of completed data sets for additional analysis and sharing with others.
- Co-benefits of data collection and modeling efforts need to be highlighted; these go beyond learning about GHG emissions, because interest in co-benefits can drive public and government support for action on GHGs.
- Would report cards for communities provide motivation for action?
- The use of 24-hour transportation models would provide better total emission estimates than peak-hour models.
- The use of grams/passenger-kilometre travelled as an emissions indicator provides a more system-level view (and may be more suitable for formulating objectives) than vehicle-kilometres travelled.
- A long-term strategy of equipping vehicles with electronic data collection modules could resolve numerous issues related to data availability and quality (N.B. the Canadian Vehicle Survey is moving from a paper format to in-vehicle electronic measurement), as well as enabling new management tools such as pay-as-you-drive insurance.
- In-vehicle technology is being developed and will likely lead to a wealth of good data; this technology will also help plan incentives and implement policy. However, it brings costs as well as privacy and liability issues.
- Incentives could encourage people to participate in data sharing through self-reporting or automated in-vehicle data collection.
- Incentives such as reduced insurance premiums or income tax reductions could encourage people to reduce their GHG emissions.

Question 3: What implementation issues could arise for these measures (roles and responsibilities; policy, technical or resource constraints)?

- Overcoming governments' use of different, inconsistent models requires consensus on the need and direction for action.
- It is necessary to determine which jurisdiction is responsible for model development versus model use; more senior jurisdictions (regional or provincial) may be more appropriate to bear responsibility for model development, in terms of financial resources and the benefits in terms of consistency among municipalities in a given region or province.
- Better incentives are required to motivate data collection and model use; environmental benefits are not enough.
- The development of 24-hour transportation models and the data collection to support and populate those models would be costly for individual communities.
- New strategies and policies based on peak hour data or models have built-in limitations.
- The development and maintenance of an effective information clearinghouse on GHG quantification and forecasting would require financial resources.
- In-vehicle automated data collection (if not voluntary) raises significant issues around privacy, cost and liability.

- Proper life-cycle analysis of required energy (including embodied energy in transportation infrastructure) and generated emissions is an ambitious task requiring consideration of different materials, processes, vehicles and conditions.

3.3 Wrap-up comments

Ralph Torrie – Managing Director, Energy, Navigant Consulting
Ralph has been actively engaged in climate change issues since 1988, when he organized the Toronto Conference on the Changing Atmosphere. His pioneering methods and conventions are now used throughout the world in local GHG quantification and analysis. He has also developed methods and tools for integrating GHG and criteria air contaminants in harmonized approaches to clean air and climate protection policy.

Ralph summarized some of the key issues identified and observations made during the workshop and also offered his own professional perspective. He noted that decisions should not be based on a single indicator such as GHG emissions or VKT data, since oversimplification can lead to wrong or inappropriate conclusions. Ralph used public transit as an example of lessons learned and how priorities and needs change over time: while post-WWII transit connected downtown to the suburbs, this concept no longer matches commuting patterns. Transit services are increasingly expensive and need to be fundamentally revamped, taking advantage of advanced dispatch technologies and smaller vehicles.

Ralph noted that mobility is an intermediary need, rather than an end in itself, and that models need to recognize the difference between mobility (supply orientation) and access (demand orientation). Around this question he drew some parallels between electric power plant planning and transportation planning: the electric power system changed significantly several decades ago, leading to models being rebuilt to provide more visibility into the variability of demand in space and time. Ultimately, this led to a better understanding of markets and greater efficiency in meeting market needs. We need to do the same with transportation: the current focus on vehicle-kilometres travelled needs to be rethought, to avoid corrupting our strategic thinking. Let's consider why we are counting GHGs: it shouldn't only be to meet our commitment to international reporting. Current data collection methods and available models may not be the most useful tools for municipalities and other users. Absolute emission figures are useful for reporting, but not for planning responses; the latter requires the ability to estimate a "delta" only. We need the ability to estimate before-and-after scenario differences in terms of the number and duration of person trips, number of vehicle occupants, vehicle energy use and emissions. This can be done using bottom-up tools rather than large macro-level models—which will lead to a decoupling of measurement from forecasting, but that's okay. Simpler, more useful models can help us make better decisions.

The issue of GHG reductions must also be examined as part of a bigger picture that considers benefits for air quality and community livability, cost savings and a better quality of life overall.

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In closing, Geoff Noxon noted the workshop report would be submitted to TAC's Urban Transportation Council, and the results integrated by TAC's staff and volunteers into the business of its various councils and committees. Individual TAC members and partners (e.g. federal and

provincial governments, regional and local municipalities, NGOs, consultants and academics) may also be interested in the results of the workshop. In view of TAC's increased emphasis on climate change mitigation and adaptation in recent years, we can anticipate that additional work will occur.

Appendix A: Detailed agenda

MORNING SESSION:
Case Studies in Emissions Forecasting

Introduction

Workshop Overview and Objectives
Geoff Noxon, Noxon Associates

Welcome by Workshop Sponsors
Eric Sévigny, Transport Canada
Pierre Tremblay, Ministère des Transports du Québec
Nazzareno Capano, City of Toronto

Case Studies

Planning for Transportation GHG Emissions Reductions in the Greater Toronto and Hamilton Area
Joshua Engel-Yan, Metrolinx

Public Transit: A Key to Reducing Greenhouse Gases – The Montréal Case
Catherine Laplante, ADEC Consultants

Visioning and Backcasting for Transport in Victoria
David Crowley and Robin Hickman, Halcrow

Case Studies for SNC-Lavalin Projects
Jean-Luc Allard, SNC-Lavalin

Moving Cooler: An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emissions
Joanne Potter, Cambridge Systems

AFTERNOON SESSION:
Meeting the Challenge—Models & Tools

Panelist Comments

Vehicle Emissions Modelling at Environment Canada
Brett Taylor, Environment Canada

Emissions Estimation Tools for Urban Transportation
Brian Hollingworth, IBI Group

Integrating Transportation Demand Models with Emissions Estimation Tools
Marianne Hatzopoulou, MIT

GHGenius Model for Lifecycle Assessment of Transportation Fuels
Derek McCormack, Natural Resources Canada

Breakout Discussions

Question 1: What challenges do practitioners face in estimating GHG emissions from urban passenger transportation? Which are most important, and most urgent?

Question 2: What measures (data, policy, research, tools, resources) could help overcome these challenges?

Question 3: What implementation issues (roles and responsibilities; policy, technical or resource constraints) could arise for these measures?

Breakout Reports

Closing Comments

Wrap-up Observations
Ralph Torrie, Navigant Consulting

Appendix B: List of participants

Jean-Luc Allard
SNC-Lavalin

André Babin
Ministère des Transports du Québec

Pascal Bellavance
Environment Canada

Ian Borsuk
McCormick Rankin

Nazzareno Capano
City of Toronto

David Crowley
Halcrow Consulting

Katarina Cvetkovic
Transportation Association of Canada

Shawn Doyle
Dillon Consulting

Joshua Engel-Yan
Metrolinx

Britt Erickson
Transport Canada

Charles L'Espérance
Transport Canada

William Ferreira
Canadian Construction Association

Michael Giroux
Natural Resources Canada

Ed Hamilton
Statistics Canada

Bassam Hamwi
Morrison Hershfield

Lisa Hatina
Federation of Canadian Municipalities

Marianne Hatzopoulou
Massachusetts Institute of Technology

Robin Hickman
Halcrow (via teleconference)

Brian Hollingworth
IBI Group

Jeff Johnson
Transport Canada

Reena Kokotailo
Transport Canada

Nadine Lafond
AECOM

Catherine Laplante
ADEC Consultants

Ryan Mancini
Transport Canada

Derek McCormack
Natural Resources Canada

Scott McKibbon
Environment Canada

Geoff Noxon
Noxon Associates Limited

Rajan Phillips
City of Guelph

Mike Pinet
County of Renfrew

Isael Poirier
Federation of Canadian Municipalities

Joanne Potter
Cambridge Systems

Eric Sevigny
Transport Canada

Brett Taylor
Environment Canada

Shawn Tippins
Transport Canada

Ralph Torrie
Navigant Consulting

Pierre Tremblay
Ministère des Transports du Québec

Gwen Zhang
City of Guelph