
TRAVEL MODELLING GROUP

TERMS OF REFERENCE

June, 2014

PREAMBLE

The ability to generate credible, timely, policy-sensitive travel forecasts is an essential component of regional transportation planning. The testing of alternative investment and other policy options within formal models of travel demand and transportation network performance is an important component of defining the likely benefits and costs of these alternatives. Major metropolitan regions around the world all engage in travel demand modelling and forecasting as a standard, key element within their overall planning process. The Greater Toronto-Hamilton Area (GTHA) is no exception to this rule, with a number of regional travel demand forecasting systems currently being used in operational planning practice by various provincial, regional and even local municipal transportation agencies. This need for strong, systematic analytical support for decision-making is particularly the case within the GTHA given:

- The complexity of the GTHA transportation system.
- The wide variety (and very high cost) of infrastructure investment and other policy options available for potential implementation within the region (including the need to evaluate combinations of complementary policies).
- The diversity of interest groups affected by the transportation system (the young and the old, the rich and the poor, inner cities and outer suburbs, etc.).
- The range of uncertainty associated with “macro factors” affecting regional growth, economic activity, and travel demand (gasoline prices, unemployment rates, etc.).
- The wide range of environmental, economic, and social benefits and costs that need to be considered in evaluating alternative transportation investments and policies.

In 2008 Metrolinx commissioned a study by the University of Toronto to investigate alternative organizational structures for managing travel demand modelling within the GTHA that would cost-effectively ensure implementation and use of policy-supportive best-practice modelling methods. This study recommended:¹

- Establishment of a “technical modelling group” that lies outside the GTHA planning agencies but that would be collectively funded and supervised by the participating agencies.
- This technical modelling group would lead the development, maintenance and upgrading over time of a common modelling software framework for GTHA travel demand modelling.
- This common modelling software framework would support multiple model systems that would be directly accessed and used by individual GTHA agencies and that would be custom-tailored to their individual modelling needs.

¹ Miller, E.J. and M. Hatzopoulou (2008) *Organizational Structures for Regional Travel Demand Modelling*, final project report to Metrolinx, Toronto: Cities Centre, University of Toronto.

Building upon the 2008 report, the University of Toronto submitted a proposal to a consortium of provincial and regional transportation planning agencies in the GTHA to host and operate the Travel Modelling Group (TMG) at the University of Toronto.² It proposed that TMG would be funded by this consortium for the purpose of developing improved travel demand modelling methods and modelling support tools for common use within the GTHA. Response to this proposal was positive and the TMG was instantiated in 2011 on a trial basis. At the time of preparation of this document it is nearing completion of its third year of operation. During this three-year period TMG operations and GTHA planning agency participation has grown. It is generally agreed among the partner agencies that TMG has successfully demonstrated its capability to develop and support improved travel demand modelling practice within the region and that it is time to formalize its terms of reference as a basis for ensuring sustainable funding and operations going forward. This document contains these terms of reference.

1. ROLE AND FUNCTIONS

- 1.1. The primary role of the TMG is to facilitate the development of common methods, tools, and techniques pertaining to transportation demand modelling and analysis, and to aid in the application and advancement of modelling and analytics in transportation planning. Areas of interest of the group include:
 - 1.1.1. Research, development, and testing of innovative modelling techniques for the simulation and analysis of a wide range of policy areas of interest. This can include applications to all modes of transportation (auto, transit, active transportation), modelling both passenger and freight demand, all components of travel demand (trip generation, distribution, mode choice, assignment), both trip-based and activity-based modelling methods, ancillary model components such as auto ownership and emissions modelling, etc.
 - 1.1.2. Development of software and tools to implement and support modelling techniques. Currently this includes *XTMF eXtensible Travel Modelling Framework*, and the *TMG Toolbox for Emme Modeller*.
 - 1.1.3. Consolidation of common data to support modelling. This includes the development of “baseline” transportation network representations aligned with Transportation Tomorrow Survey (TTS) years, and possibly extending to historical or even future year networks.
 - 1.1.4. Training and outreach to funding agencies, including documentation of TMG products, modelling techniques, and research.
 - 1.1.5. Additional detail concerning potential tasks that might be undertaken by TMG is provided in Appendix I of this document.
- 1.2. As a research unit located at the University, TMG functions as a link between the research community and transportation demand modelling practitioners to promote greater interaction to facilitate the advancement of modelling practice for the benefit of transportation planning agencies in the Greater Toronto and Hamilton Area (GTHA).
- 1.3. TMG is a “neutral” non-governmental technical and expert group that provides funding agencies with transportation modelling, analysis expertise and tools.
- 1.4. Work with non-funding agencies (such as consultants, university students, or non-governmental organizations) in a limited fashion is permitted, as long as such work does not unduly interfere with the ability of staff to implement TMG’s work plan in a timely manner and such work supports the overall TMG mandate of supporting and advancing travel demand modelling practice within the region.

² Miller, E.J., M.J. Roorda & K.M.N. Habib (2010) *Travel Demand Modelling in the Greater Toronto-Hamilton Area: A Proposition*, Toronto: Cities Centre, University of Toronto.

2. ORGANIZATION

- 2.1. TMG is housed within the University of Toronto Transportation Research Institute within the Faculty of Applied Science & Engineering, University of Toronto.
- 2.2. TMG is led by a Director who is a tenured (or tenure-stream) professor within the University of Toronto. The Director is responsible for providing the intellectual leadership of TMG as well as the day-to-day management of TMG work, budget and administration.
- 2.3. The TMG Director reports to a Steering Committee, comprising senior staff or their designates from the funding agencies. The Steering Committee sets the overall direction for TMG activities, including the approval of annual work plans and authorization of funding.
- 2.4. A Technical Advisory Committee (TAC) consisting of staff from funding agencies along with TMG staff provides technical guidance, and develops annual work plans for approval by the Steering Committee.
- 2.5. TMG comprises at least 2 staff employed by the University of Toronto, working full-time on TMG projects and activities. In addition, TMG may engage any researchers/students, who are undertaking research in a related topic as part of their academic work, as associates to collaborate on TMG projects.
- 2.6. The TMG Director presents a report to the Steering Committee annually (by March 31st) outlining each year's progress with respect to its approved work plan.
- 2.7. The TMG operating and fiscal year is from April 1 to March 31 of the subsequent calendar year, corresponding to the provincial fiscal year.
- 2.8. The TMG work plan for each year is prepared by the TAC for submission to the Steering Committee by February 1 of the preceding year for Steering Committee approval by March 1.

3. OWNERSHIP AND DISSEMINATION OF TMG PRODUCTS

- 3.1. All Intellectual Property and products (software, data, and models) developed by TMG staff as part of the TMG work plan are owned by the University of Toronto. Such products are to be freely and jointly accessible to all funding agencies for their use without any restrictions.
 - 3.1.1. This does not apply to TMG work on existing models with already-established ownership. In such a case the original owner shall retain ownership of the model's parameters and data (although the code used by the model is subject to clause 3.2 below).
 - 3.1.2. This also does not apply to proprietary data provided to TMG by an agency in support of TMG tasks. In such cases TMG will maintain the confidentiality of the data supplied and will not disseminate it to third parties without the express consent of the agency.
- 3.2. All software being developed by TMG (such as XTMF and TMG Toolbox) will be developed under an open source software licence, with TMG being the license holder. It is expected that all software based on TMG-developed products will be open source compliant.

4. FUNDING

- 4.1. The direct costs of TMG operations are funded by contributions by the partner agencies. These direct costs include the fully-loaded salary and benefits of TMG staff, TMG computer operating and maintenance costs, etc.
- 4.2. The standard University of Toronto overhead of 40% is applied to all direct TMG costs.
- 4.3. The TMG budget and the allocation of funding among the partner agencies are determined by the Steering Committee.

4.4. The University of Toronto provides in-kind support of TMG indirect operating costs. These include office space, telephone and internet connections, UofT Library access, and access to Data Management Group and other University-based datasets (Census data, etc.) maintained by the University of Toronto.

APPENDIX I – AREAS OF INTEREST

The following list of projects or topics is included here, in order to aid and inform the Steering Committee in developing TMG's annual work plan and priorities. It should be noted that this list is illustrative and reflects the current interests of TMG funding agencies when this document is prepared and the Steering Committee may take up any task/project not listed here but within the scope of role and functions described in Section 1.0 of the Terms of Reference.

- ❖ Common data and standards to support modelling (to aid consistency and coordination)
 - Network coding standards for
 - base year
 - past years (for historic trends, backcasting, etc.)
 - current year /continuous upkeep, update, etc.
 - future/forecast years (coordinating infrastructure projects in various stages planning and method of creating/maintain future networks)
 - Land use and other input data, such as parking, fares, etc.
 - Traffic zones and layers of zoning system for modelling and analysis
 - Organization and archiving of data to support model development and model validation, e.g., count data (other than cordon count), parking supply/cost, etc.
 - Spatial data analysis for model input and visualising results (GIS-transport model)
- ❖ Modelling methods and techniques
 - Travel behaviour and choice
 - Activity/agent-based methods of travel demand modeling
 - Modeling auto ownership, transit pass ownership, car/bike share membership, etc.
 - Trip distribution/destination choice models
 - Mode choice – new modes, multi-modal alternatives, active transport modes, etc.
 - Carpooling, ridesharing, carsharing, etc.
 - Time-of-day choice, peak spreading, etc.
 - Special generators, event-related, visitor trips, and other sectors
 - Freight/goods movement, truck demand, etc.
 - Network modelling
 - Volume-delay function, treatment of intersection delays and turns, turn-penalty function, etc
 - Dynamic traffic assignment, microsimulation, etc.
 - Interface/link feedback between macro-meso-micro models
 - HOV modelling
 - Toll roads, HOT/Managed Lanes, and Congestion Pricing
 - Freight/truck model, integration between passenger and truck modelling
 - Transit crowding/capacity constraint, fare-based methods, dynamic/microsimulation of transit trips
 - Multimodal trips (park-n-ride, kiss-n-ride, bike-n-ride, etc.)
 - Active transport modes (walking, bicycling, others)
 - Others
 - Common modeling parameters such as value-of-time, transit times/weights, etc.
 - Model convergence
 - Applications e.g., sensitivity testing, extracting/reporting and visualising results, quantifying benefits and impacts, etc.

- ❖ Modelling software (XTMF) and tools
 - XTMF continuous development and support
 - Tools for analysis, synthesis, and visualisation of model results, as well as for model validation
 - Emme modeller toolbox
 - Other tools e.g., GIS, etc.
- ❖ Training and outreach
 - Documentation, i.e., regular technical working papers on procedures, standards, methods, research applications, user-guide, etc.
 - TMG website, wiki, discussion/exchange forum, etc.
 - Training: conducting training workshops, webinars, symposium, etc.