travel modelling group

tmg

WORKPLAN 2016-17

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1. Introduction

This document presents the proposed workplan for Travel Modelling Group (TMG) operations for the fiscal year 2016-17 (April 1, 2016 through March 31, 2017). Section 2 of the report presents and discusses the major tasks to be undertaken during this time period by TMG. Section 3 defines the deliverables and milestones associated with these tasks. Section 4 then presents the budget for the 2016-17 fiscal year.

2. Major Tasks & Schedule

Based on discussions with the TMG Technical Advisory Committee (TMGTAC), a "long list" of possible tasks was assembled by TMG staff, along with our best estimates of the time requirements (level of effort) required for each task, broken down by sub-task. This long list was distributed to the TMGTAC for comments and for ranking of each task from the perspective of each individual agency. The results of this survey are shown in Appendix A.

TMG 2016-17 Work Plan		**MONTH**											
No.	**TASK**	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1	Support for agency usage of TMG model systems & components	1	1	1	1	1	1	1	1	1	1	1	1
2	Transit fare class model	3	3	3	3	3	3						
3	HOV demand modelling							3	3	3	3	3	3
4	Commercial vehicle generation (including special generators)	1	1	1	1								
5	Active transportation mode choice					1	1	1	1				
6	PORPOS modelling									1	1	1	1
7	Updating NCS2011 to NCS2016 (includes traffic zone guidance)	2	2	1									
8	Commercial vehicle network upgrades				1	1	1						
9	Future Year Base Network(s)							1	1	1			
10	Multi-class, congested transit assignment	3	3	3	3	3	2						
11	2016 base network						2	2	2	2			
12	Surface transit speed updating							2	2	2	2	2	2
13	Volume-delay function calibration; intersection delay										3	3	3
14	Disaggregate transit assignment			1	1	1							
15	TMG Toolbox Improvements												
16	XTMF Maintenance												
17	Documentation of TMG products												
18	Outreach & Training (3 workshops)			W1			W2		W3				W3
19	Meetings: TMGSC (2) & TMGTAC (6)	TAC	SC	TAC			TAC	SC	TAC		TAC	TAC	SC

Staff Average Weekly Time Allocation (Days)

1. Numbes in cells indicate estimates of the approximate average number of days per week spent on the task in the given month.
2. TMG Toolbox improvements, XTMF maintenance and documentation are all on-going activities.
3. One-half to one day per week per staff person is expected to be allocated to documentation of the work on an on-going basis.

	Primarily Software Developer task
	Primarily Network Modeller task
n	Light, on-going effort
n	Heavy, focussed effort

n = approximate, average number of days per week for this task
Includes allocation of time for documentation, meetings, etc.

Suggested Workshops (includes consultants as well as TMG members)

W1	June: NCS2016
W2	September: V4.0 modelling
W3	November: Multi-class, congested transit assignment
W4	March: Surface transit speed updating

Table 1 2016-17 TMG Major Tasks & Schedule

Based on these agency rankings a draft workplan was prepared and discussed in detail with the TMG Technical Advisory Committee (TMGTAC) at a meeting on February 3, 2016. Based on these discussions, Table 1 presents the proposed 2016-17 schedule of tasks. As indicated in this table the work plan consists of 19 tasks. Dark shaded boxes in Table 1 indicated a primary work area in the given month, while more

lightly shaded boxes indicate lower-level, more "background" levels of effort on an on-going basis. Each of the 19 tasks listed in Table 1 is briefly discussed in the following sub-sections.

Note that Tasks 2, 3, 5 and 6 will be supervised by Prof. Nurul Habib. Tasks 4 and 8 will be supervised by Prof. Roorda. Prof. Miller will supervise the other tasks and will have overall responsibility for the management and execution of the 2016-17 TMG workplan.

2.1 Support for Agency Usage of TMG Model Systems & Components

This tasks will involve three related types of activities:

- Now that GTAModel V4.0 is operational, it is being used by some member agencies (currently City of Toronto and City of Mississauga, with other agencies considering possible adoption). TMG staff time needs to be allocated within the workplan for a "reasonable" amount of technical support for agencies and their consultants in the use and modification of V4.0. Requests for very large time commitments from TMG would need to be negotiated as work funded outside of the TMG base workplan.
- While GTAModel V4.0 is built in a very modular fashion within XTMF, individual components are still not necessarily readily usable by member agencies outside of the full GTAModel package. This task will "extract" and document individual model components as XTMF modules (or very simplified "model systems") for stand-alone use.
- Conversely, there are many models, procedures, etc. which could be very usefully implemented as XTMF modules or simple model systems as a mechanism for sharing and disseminating best practice procedures within the region. These might include components of GGH Model or other regional model systems that have unique components that are of general interest and application. In particular, two immediate candidates for this task might be the GGHM household auto ownership model and the GGHM population synthesis procedure.

2.2 Transit Fare Class Model

We believe that we have made significant progress at TMG in terms of developing robust fare-based transit assignment methods. These methods, however, are still based on the assumption that all transit users pay an "average adult fare" for their trip. This clearly is not the case and could represent a bias in our current models that is not completely compensated for by our calibration efforts. To rectify this problem we need a transit fare class model that determines the fare that is "actually" paid by each trip-maker, depending on the trip-maker's age (school-age, senior, etc.) and fare media (transit pass, cash, etc.) choice. Developing such a model is a non-trivial task, but is feasible to do given available TTS data, as well as possibly other transit agency data concerning transit pass ownership. Combined with implementation of a multi-class transit assignment model (see Task 10 below), such a transit fare class model might well facilitate a significant improvement in our mode choice and transit assignment models, both in terms of their ability to replicate base year demand patterns and with respect to their sensitivity to alternative fare policies. Sub-tasks within this work include:

- Assembling data on fare class usage by transit agency, fare media, trip-maker type, etc. from TTS, transit agency data, etc.
- Reviewing the state of the art/practice in transit fare class modelling.
- Developing and testing a prototype transit fare class model for the GTHA within XTMF.

2.3 HOV Demand Modelling

GTAModel V4.0 endogenously models within-household car allocations, ride sharing and "serve passenger" trip-making. Inter-household carpooling and other non-household-based "auto passenger"

trips (taxis, Uber, etc.) are very simplistically modelled. In particular, the linkage between these "passenger" trips and the vehicular trips that convey these passengers is not explicit. This means that a full representation of HOV travel is not possible within the current model system. While details vary from one model system to another within the region, it is fair to say that HOV travel demand modelling is still not well developed, especially relative to the policy importance of the issue.

The main obstacles to developing improved extra-household passenger travel models include: (1) the large combinatorial problem usually associated with characterizing the "choice sets" involved (i.e., who might share rides with whom; who has what services available; etc.); and (2) limited data for model building and testing (although available data are increasingly available). Given the importance of this issue and the gap in our current modelling methods, this is a topic of some priority. Sub-tasks within this work include:

- Gathering together all available data relevant to HOV modelling (TTS, MTO surveys, etc.) and assessing its usefulness for HOV modelling.
- Reviewing current methods used within the GTHA for HOV modelling.
- Reviewing HOV modelling best practice elsewhere.
- Developing and testing a prototype HOV demand model for the GTHA within XTMF.

2.4 Commercial Vehicle Generation Modelling

As a significant step towards improving regional commercial vehicle demand modelling in the GTHA, generally applicable models of commercial vehicle generation will be developed. This will include investigating the potential for modelling major "special generators" of commercial traffic, in addition to "regular" commercial traffic generation. Sub-tasks involved in this work include:

- Scan the most recent literature on the determining factors for commercial vehicle generation in urban areas.
- Assess the land use attributes that are most closely correlated with truck trip generation (employment, number of establishments, industry class, floorspace).
- Develop trip generation rates based on information from the GTHA commercial travel survey, Peel Region Commercial Travel Survey, and Durham Region Commercial Travel Survey.
- Identify recent literature (local and other jurisdictions) on commercial vehicle special generators.
- Identify key commercial vehicle special generators in the GTHA (intermodal facilities, major distribution centres, airport, manufacturing facilities).
- Identify best practices for modelling commercial vehicle flows from special generators.
- Accumulate data from available sources to support these models.

2.5 Active Transportation Mode Choice

Current GTHA model systems generally include active (walk/bike) modes, but typically in a relatively simplistic formulation. The importance of these modes within today's policy environment is significant and growing. The need, therefore, exists to improve the precision and policy sensitivity of our mode choice models with respect to walking and biking. Active transportation modes, however, are conventionally difficult to model well in regional travel demand models due, in part at least, to the mismatch in spatial scales between the trip distances and network details for walk and bike trips relative to longer-distance auto and transit focussed models. The general lack of operationally practical bike and walk route choice models also limits the ability to generate useful path attributes for these modes for use in mode choice modelling in the same way that we routinely do for the auto and transit modes. A further traditional limitation within the GTHA specifically with respect to walk trips is the systematic under-reporting of walk trips with TTS, which results in most non-work/school walk trips not being recorded.

Considerable graduate-student-based work is currently underway within the University of Toronto investigating various aspects of active transportation modelling that can provide a starting point for developing improved operational models of active transportation mode choice. Key challenges within this work include:

- Dealing with the level of spatial precision needed to adequately model active transportation modes (especially walk) within a typical zone-based model system.
- Developing improved characterizations of the walk & bike environment, again particularly within a zone-based model system and using attributes that can be robustly used in long-term forecasting applications.
- Modelling bicycle network attributes and (ideally) explicitly modelling bicycle route choice

The products of this task will be implementation of an improved active mode choice model within XTMF; documentation of the model and its associated XTMF modules; and recommendations for further work in this area, including steps for their implementation within operational GTHA model systems.

2.6 Improved PoRPoS Models

Place-of-Residence-Place-of-School (PoRPoS) are used in both GTAModel and GGHM to link the residential locations of students to the students' school locations. These models are quite simple in formulation and could certainly be improved. The availability of the recently available, large-sample (>15K) StudentMoveTO survey of post-secondary student travel within the City of Toronto provides an exciting new opportunity to explore post-secondary PoRPoS distributions in a manner never before available. It is also possible to link TTS data with elementary and secondary school board enrollment data to perhaps improve our models for these classes of students as well. Sub-tasks within this work include:

- Development of a prototype PoRPoS model for post-secondary students attending the four City of Toronto universities (UofT, Ryerson, York and OCAD-U) based on the StudentMoveTO dataset.
- Assessment of the extent that this model can be extended to other post-secondary institutions (universities, community colleges, etc.) within the GTHA.
- Assembly of school locations, enrollment data and school district information for GTHA elementary and secondary schools.
- Using TTS data, develop and test options for improved elementary and secondary PoRPoS models.
- Recommend further work in this area, including improvements to GTHA travel data collection methods to facilitate improved PoRPoS modelling in the region.

2.7 Updating NCS11 to NCS16

We now have 5 years' experience with the NCS2011 coding standard which has led to a number of suggestions for possible updates and extensions to the standard. The coming year is an opportune time for reviewing the standard and updating it, given the 2016 TTS and the need to construct an associated 2016 base network for the region (see Task 11).

A suggested addition to the coding standard is guidance concerning traffic zone definitions that would help standardize zone definition practice within the region, including helping agencies more routinely deal with "zone splitting" tasks when dealing with sub-area analyses or future-year development of large, previously rural zones.

TMG staff will consult through TMGTAC with member agencies concerning suggested changes to NCS11 and will prepare a draft NCS2016. This draft will iterate as needed through TMGTAC, leading to a final new standard for adoption within the region.

TMG Toolbox and other modules will be updated as needed to conform to the new coding standard once it is available,

2.8 Commercial Vehicle Network Upgrades

This task will investigate the coding of truck route restrictions, by time of day, across the GTHA road network. It requires collaboration with Regional Municipalities and potentially the local area municipalities to obtain information about truck restriction bylaws, determine the best means to encode, and enter the information into the GTHA network. A summer research student will be hired by TMG to assist with this work under the guidance of Prof. Roorda and the TMG Network Modeller.

2.9 Future Year Base Network

Discussion and consultation began in 2014-15 concerning how best to develop a database of future year network elements that might be shared among and used by TMG members. This issue was explored in some detail during the 2015-16 work year, but no final conclusion was reached in terms of how to best design and build a comprehensive, useful future year network "database". In this year's workplan TMG will undertake the less ambitious (but still challenging) task of assembling a base future year (2031 in the first instance) consisting of "committed" road and transit additions to the base 2016 network (see Task 11 below). The starting point for this exercise will be MTO's future year base network which they have been assembling and which should be available for sharing sometime in the spring or early summer of 2016.

Successful completion of this task will require willingness on the part of member agencies to share their future year "base" plans, as well as to assist TMG staff in the checking and validation of the constructed base year network.

2.10 Multi-Class, Congested Transit Assignment

GTAModel V4.0 has demonstrated the usefulness of congested, fare-based transit assignment. The next very important step in evolving regional transit assignment capabilities, however, is to make this procedure multi-class so that different values of time (VOT) can be used for different user groups within the assignment process, where these class-specific VOTs should be consistent with those used in the mode choice model. A multi-class, congested transit assignment capability has only recently become available within Emme. This procedure is currently being tested in the final months of the 2015-16 work period, but it is expected that this work will need to be continued into 2016-17, especially given the need to jointly estimate transit assignment and mode choice model parameters so as to maximize the consistency of the two models.

The detailed workplan for this task depends on the progress made on this task in the final months of the 2015-16 work period. It is expected, however, that initial testing and calibration of a multi-class assignment model will have been accomplished by the end of March, 2016. In this case, much of the 2016-17 work will involve more comprehensive testing of the use of multi-class transit assignment within a joint mode-route choice context. The GTAModel V4.0 model system will be used as the modelling framework within which this R&D work will occur. A major challenge in this work involves the extent to which joint estimation of mode and route choice parameters is (a) desirable and (b) feasible, given the

significant computational burden and theoretical challenges associated with any joint parameter estimation procedure. On the other hand, "sequential estimation" of the mode choice and assignment models comes with its own theoretical and behavioural challenges.

2.11 2016 Base Network

As in past years, it is essential that a 2016 road and transit network be constructed for the region to support use of the 2016 TTS data as they become available. In past times this has often been a bit of a "catch-up" task undertaken post-TTS. It will be much easier (and probably will generate a higher-quality product) if we can collect the necessary network data and code and "debug" the networks in the fall of 2016 in parallel to the first wave of the TTS.

Note that in the case of transit, this will involve constructing a "24-hour" network in which variations in transit services and frequencies over the course of the full weekday will be represented. GTFS data for the regional transit agencies will be used as much as possible for this task.

2.12 Surface Transit Speed Updating

The development and testing of robust transit assignment methods within Emme has been a significant focus of TMG activity throughout its existence. This has led to very significant improvements in our transit assignment capabilities, including the implementation of fare-based transit assignment; the introduction of "congestion" (transit vehicle crowding) effects; development of an "integrated" representation of transit services and sub-modes; and advanced transit assignment model parameter estimation and calibration procedures.

An important element of transit assignment modelling that TMG has not yet addressed (and, arguably, has been underdeveloped generally within regional demand models) is the updating of surface transit speeds as a function of roadway congestion. This is potentially a quite important feature in the correct determination of surface transit travel times, which, in turn, can affect the quality of both transit route choice and overall model choice. In particular, failure to account for shared right-of-way (SROW) congestion effects on transit speed and times may bias model assignments in favour of SROW routes relative to exclusive right-of-way (EROW) routes.

Limited experience exists in the GTHA with surface transit speed updating procedures. UofT did some experimenting with this during its "GTAModel V3" research project, but did not arrive at a robust, implementable model. We are proposing to take an in-depth "run" at this problem this summer with the intent of developing a validated, operational speed updating procedure suitable for implementation within GTAModel and other regional demand forecasting model systems.

The work will involve using auto and transit travel times, speeds and roadway congestion levels for the 2012 base network to develop a robust statistical relationship between transit line speeds and auto speeds and/or roadway congestion levels. A significant obstacle in past modelling efforts has been the fact that most surface transit lines are not coded with segment speeds; i.e., typically an average speed is applied to the entire line. This clearly is not correct, particularly for long lines that pass through many "operating regimes" during a single run. The work will have to investigate the feasibility of developing segment speeds, among possibly other options.

2.13 Road Volume-Delay Function (VDF) Calibration

We have historically spent little/no time calibrating our VDF parameters for the region. TMGTAC has also from time to time discussed the potential for improved modelling of turning movements and/or introducing explicit intersection delays in the Emme road assignment procedure. This is potentially a major task "to do right". In this workplan TMG will take at least the first steps at systematically addressing this issue. Sub-tasks within this work include:

- Assemble and assess GTHA data that may be of use in calibrating link and/or node volume-delay functions.
- Review the state of best practice with respect to:
  - Volume-delay function specification
  - VDF calibration methods.
  - Intersection delay modelling within static equilibrium assignment models.
- Develop appropriate parameter estimation methods within XMTF for estimating/calibrating VDFs using available GTHA data.
- Undertake preliminary estimation/calibrations for the 2012 GTHA base road network using 2011 TTS data, etc.
- Report on findings and recommend future work in this area, including possible improvements in regional data collection methods to support improved VDF calibration and validation.

2.14 Disaggregate Transit Assignment

A task that was not included in the "long list" of suggested tasks for ranking (see Appendix A) but which was suggested by Metrolinx is to investigate/test the disaggregate transit assignment procedure within Emme for possible inclusion in the TMG Toolbox for potential use by member agencies. All transit assignment work to date by TMG has involved the use of aggregate (zone centroid to zone centroid assignment of aggregate flow) procedures, as opposed to the point-to-point, individual trip[1] capability provided by the disaggregate procedure. Disaggregate transit assignment is of potential interest for use in microsimulation applications, since it permits the model to track individual trip-makers (agents) through the transit system, as well as permitting trips to potentially begin and/or end at points other than zone centroids.

Only limited experience exists to date within the region is testing/using the Emme disaggregate transit assignment procedure. This experience generally is not encouraging in that the disaggregate procedure is very significantly slower than the aggregate procedures available. Thus, it is far from clear that any additional precision in the assignment procedure is worth the very serious computational burden involved.

Nevertheless, it would be useful to spend a small amount of time systematically investigating this issue so as to see whether it holds promise for the development of future methods or not. This investigation will involve the following sub-tasks:

- Reviewing and documenting past experience within the region and elsewhere with the Emme disaggregate transit assignment procedure.
- Undertaking a small but systematic set of tests of the Emme disaggregate transit assignment procedure to benchmark it against the standard aggregate methods.

[1] Aggregate flows (weighted trips) can also be assigned using the "disaggregate" procedure. The key feature of this approach is that it frees the trip origins and destinations from having to be located at zone centroids.

- Discussing with TTC their use of the disaggregate MADITUC transit assignment model and exploring whether any potential exists for bringing it into the XTMF suite of procedures.
- Briefly reviewing disaggregate transit assignment capabilities of other major commercial and open-source network modelling software.
- Preparing a report documenting TMG findings for this task and recommending further steps with respect to TMG disaggregate transit assignment modelling activities, if any are warranted.

2.15 TMG Toolbox Improvements

A primary rationale for the TMG is to develop standard tools, procedures and templates for general use by member agencies. These tools are primarily of two types: XTMF-based modules and Emme/4 Modeller procedures. Tool development will be an on-going, primary activity of the TMG throughout its existence, as it evolves an ever-increasing suite of tools for members' use. Tool development occurs in two primary ways. First, TMG staff are constantly refining/extending existing tools and developing new tools through the course of their on-going model system development, network coding and testing and other work tasks. Second, recommendations for tool development are regularly generated by the TMGTAC on an on-going basis.

2.16 XTMF Maintenance

Now that the XTMF Core 1.1 has been deployed, it needs to be maintained, and technical support needs to be provided for its use by member agencies, their consultants, etc. Incremental additions and improvements (and associated updating of documentation) will occur as needed and as they are generated by continuing development of the TMG Toolbox and other TMG modules and models. This will be a low-level, on-going task.

2.17 Documentation of Software & Models

Continuous updating of documentation of XTMF, GTAModel and TMG Toolbox software and procedures is an on-going task on TMG. As indicated in the discussions in the preceding sub-sections and in Table 2 below, documentation of all TMG activities and products is an integral component of all tasks and deliverables. Although not explicitly indicated in the time allocations in Table 1, it is expected that 0.5 – 1.0 days per week per staff member will be allocated to documentation. All documentation is available on the TMG website.

2.18 Outreach & Training

A critical component of TMG activities in all phases of its work must be training, technology transfer and outreach. In order to succeed, TMG must be responsive to its collaborating partners' needs. It must also get the tools that it is developing into the hands of its partners for their use. The TMG's role is intended to be one of tool developer, not to be the user of these tools on behalf of its partners in operational applications (except in special cases). These activities in 2016-17 will include:

- On-going updating and elaboration of the TMG web site.
- Documentation of all procedures, etc. developed by the TMG (Task 17).
- Regular (approximately every other month) meetings will be held with TMGTAC to discuss work in progress, next steps in the workplan and to disseminate work plan results (see Section 2.19).
- Training workshops will also be organized providing the opportunity to present and discuss in greater detail recent TMG work and products. As shown in Table 1, four workshops are proposed for 2016-17. Workshop topics will be finalized in consultation with TMGTAC, but at time of writing of this workplan, the proposed topics are:

- W1: NCS2016
- W2: Modelling using GTAModel V4.0.
- W3: Multi-class, congested transit assignment
- W4: Surface transit speed updating.

2.19 Meetings

In addition to the TMGTAC meetings discussed in Section 2.18, regular meetings with TMGSC will be held to discuss workplan progress, budget, overall TMG directions for work and other administrative and supervisory matters.

An important role of the TMGTAC meetings will be to monitor workplan progress and to identify and recommend "mid-course" changes to the approved workplan as might be warranted by either work progressing much more slowly or more quickly than originally anticipated or by new priorities, needs or opportunities emerging during the course of the work. Given the research nature of the TMG workplan, it is important to maintain "nimbleness" in the workplan in order to maximize its effectiveness as conditions and opportunities evolve over time.

It is proposed that 6 TMGTAC and 3 TMGSC meetings be held during 2016-17, approximately as shown in Table 1. Each meeting is generally 2 hours in length and is usually held on a Wednesday morning (10:00-12:00) at the University of Toronto.

3. 2016-17 MILESTONES & DELIVERABLES

Table 2 lists the primary deliverables and milestones for the 2016-17 workplan.

Task	Deliverable	Date
1	Support for agency usage of TMG model systems & components	On-going
2	Prototype transit fare class model developed & documented	Sept. 30, 2016
3	Report documenting HOV demand modelling results	March 31, 2017
4	Report documenting commercial vehicle generation modelling (including special generators)	July 31, 2016
5	Prototype active transportation mode choice model developed & documented	Nov. 30, 2016
6	Report documentation PORPOS modelling R&D work	March 31, 2017
7	NCS2016 draft final report	June 30, 2016
8	Draft commercial vehicle network upgrades completed and documented	Sept. 30, 2016
9	Draft 2031 future year base network completed and documented	Dec. 31, 2016
10	Multi-class, congested transit assignment developed, tested and documented	Sept. 30, 2016
11	Draft 2016 base network completed and documented	Dec. 31, 2016
12	Surface transit speed updating procedure developed, tested and documented	March 31, 2017
13	Report documenting volume-delay function calibration work	March 31, 2017
14	Report documenting disaggregate transit assignment work	August 31, 2016
15	TMG Toolbox Improvements	On-going
16	XTMF Maintenance	On-going
17	Documentation of TMG products	On-going
18	Outreach & Training (3 workshops)	Various dates
19	Meetings: TMGSC (2) & TMGTAC (6)	Various dates

Table 2 Summary of 2016-17 TMG Deliverables & Milestones

4. 2016-17 BUDGET

Table 3 presents the proposed budget for 2016-17 TMG operations, based on agreed contribution levels for each participating agency. Draft budgets for 2017-18 and 208-19 are also included in this table to indicate how contributions and expenditures are anticipated to change over the next two years. Note that a considerable carry-forward of $40,000 from 2015-16 exists due to "buy-out" of TMG staff time to support the 2015-16 City of Toronto SmartTrack Ridership Project. This carry-forward is spread across the three budget years to keep member contributions as constant as possible over this time period.

University of Toronto cash and major in-kind contributions are also explicitly shown in Table 3 in order to make clear the full costs of the project and the University's significant contribution to it. These exceed the total project overhead paid by the member agencies to the University as part of their contributions.

TMG Budget	2016-17	2017-18	2018-19			
Expenses	**Amount**	**Amount**	**Amount**			
Salaries[1]	$169,446.78	$169,744.65	$176,294.43			
Supplies, Misc. Expenses	$250.00	$250.00	$250.00			
Emme Licence Maintenance	$3,000.00	$3,000.00	$3,000.00			
Contingency	$0.00	$0.00	$0.00			
Overhead (@40%)	$61,714.29	$65,571.43	$67,142.86			
Total Expenses	**$234,411.06**	**$238,566.07**	**$246,687.29**			
Revenues	**2016-17**	**2017-18**	**2018-17**		**2014-15**	**2015-16**
Member Contributions	**Amount**	**Amount**	**Amount**		**Actual**	**Actual[3]**
Metrolinx	$60,000.00	$64,000.00	$64,000.00		$61,000.00	$54,200.00
MTO	$30,000.00	$32,000.00	$32,000.00		$30,600.00	$27,200.00
City of Toronto	$30,000.00	$32,000.00	$32,000.00		$30,600.00	$27,200.00
City of Hamilton	$18,000.00	$19,000.00	$20,000.00		$18,600.00	$16,500.00
Region of Durham	$18,000.00	$19,000.00	$20,000.00		$18,600.00	$16,500.00
Region of Halton	$18,000.00	$19,000.00	$20,000.00		$18,600.00	$16,500.00
Region of Peel	$18,000.00	$19,000.00	$20,000.00		$18,600.00	$16,500.00
Region of York	$18,000.00	$19,000.00	$20,000.00		$18,600.00	$16,500.00
City of Mississauga	$6,000.00	$6,500.00	$7,000.00		$6,100.00	$5,420.00
City of Brampton[2]	$0.00	$0.00	$0.00		$6,100.00	$0.00
Total Member Contributions	**$216,000.00**	**$229,500.00**	**$235,000.00**		**$227,400.00**	**$196,520.00**
Carry-Forward from Previous Year	$40,000.00	$21,588.94	$12,522.86			
Additional Revenue (UofT Subsidy)	$0.00	$0.00	$0.00			
Total Revenues[4]	**$256,000.00**	**$251,088.94**	**$247,522.86**			
Avg. Increment relative to 2014-15 base	-5.0%	0.9%	3.3%			
Avg. Increment relative to previous year	9.9%	6.3%	2.4%			
Total Revenues-Total Expenses	$21,588.94	$12,522.86	$835.58			
Contributions-Actual Expenses	-$18,411.06	-$9,066.07	-$11,687.29			

Notes:

1. Salaries and benfits for TMG + summer research students. 2 students in 2016-17; 1 student in 2017-18 & 2018-19. TMG staff salary increases based on an assumed increase of 4% per annum.
2. The City of Brampton seems to have dropped out of TMG. I have been unable to get them to respond to any correspondance for about 2 years now.
3. 2015-16 contributions were reduced relative to 2014-15 due to "buy-out" of staff time for the SmartTrack Ridership Study.
4. "Total Revenues" include carry-forward from the previous year.

University of Toronto In-Kind Contributions	
Principal Investigator Time	$45,000.00
Co-Investigator Time	$29,000.00
Office Space & telephones	$6,194.26
Total	$80,194.26

This excludes many other in-kind contributions by UofT to TMG that are very difficult to quantify. These include:

- Data Management Group support of TMG
- Internet access
- University of Toronto library access
- Administrative support
- TMG computers & software

Table 3 TMG 2016-17 Budget & Draft Projected Budgets for 201-187 & 2018-19

Appendix A: TMGTAC Rankings of Long List Tasks

POTENTIAL TASK	Dur	Halt	Ham	Miss	MTO	Mx	Peel	Tor	York	Avg	Min	Max
Support for Agency Modelling Efforts												
V4.0 implementations/applications	2	2	3	5	3	0	2	5	2	2.7	0	5
"Unbundling" V4.0 advances	3	2	4	3	5	0	4	2	4	3.0	0	5
Implementing Agency Modules in XTMG	3	2	3	3	0	0	2	2	0	1.7	0	3
Person Demand Modelling Components												
Improved models of non-work/school (shopping, "other") destination choice	2	5	5	3	2	0	2	3	2	2.7	0	5
Modelling HOV demand (inter-household carpooling)	4	5	4	4	2	0	3	3	3	3.1	0	5
Transit fare class model	2	2	5	3	3	0	4	5	4	3.1	0	5
Improved modelling of active transportation (walk/bike) mode choice	4	3	5	4	2	0	2	3	2	2.8	0	5
Improved PORPOS models (elementary, secondary, post-secondary)	5	3	3	3	2	3	2	4	2	3.0	2	5
Improved PORPOW model	2	3	3	4	1	3	1	4	1	2.4	1	4
Synthesis of income & inclusion of income in models	2	3	3	2	3	0	3	4	3	2.6	0	4
Improved airport access/egress model	1	1	4	5	2	3	4	3	2	2.8	1	5
Other special generators models (e.g., hospitals, sporting events?, …?)	2	3	3	3	1	0	0	2	0	1.6	0	3
Visitor (non-resident) trip model	1	1	1	2	1	0	0	2	0	0.9	0	2
Better external trip modelling (including "through" trips)	2	2	2	3	1	0	2	3	1	1.8	0	3
Freight Modelling												
Commercial vehicle network upgrades	3	2	4	5	5	0	5	3	4	3.4	0	5
Revisit commercial vehicle trip generation	3	2	3	5	2	0	5	2	4	2.9	0	5
Commercial vehicle special generators	2	3	3	4	3	0	5	2	4	2.9	0	5
Public sector fleet flows	1	2	1	3	1	0	2	2	1	1.4	0	3
Impact Modelling Components												
Transportation emissions modelling	3	2	3	3	2	0	3	2	2	2.2	0	3
User (driver, transit rider) costs	2	2	4	3	2	0	2	2	2	2.1	0	4
Transit operating costs	2	1	4	3	2	0	2	2	2	2.0	0	4
Road Assignment												
Intersection delay modelling (turning movements?)	3	3	5	5	2	0	2	2	2	2.7	0	5
Volume-delay function (VDF) calibration	4	4	4	5	3	0	3	4	4	3.4	0	5
Experimentation with dynamic traffic assignment (DTA) packages (DynusT, MATSIM, etc.)	2	1	3	3	2	0	2	3	2	2.0	0	3
Transit Assignment												
Surface transit speed updating (held over from 2015-16)	4	2	3	5	2	2	2	5	4	3.2	2	5
Multi-class, congested, fare-based transit assignment (continued)	3	2	5	5	4	2	4	5	4	3.8	2	5
Networks												
Updating NCS2011 to NCS2016	4	4	4	5	5	3	5	4	5	4.3	3	5
Constructing 2016 base network	4	4	5	5	5	4	4	4	5	4.4	4	5
Converting historical networks to NCS11 (1986-2001)	2	1	2	0	0	0	1	2	0	0.9	0	2
Additional Suggested Tasks, Metrolinx												
Documentation/workshops/knowledge transfer to consultants						5						
Disaggregate transit assignment						3						

	Average ranking ≥ 3.5
Please provide a 0-5 score for each task in the above list:	3.0 ≤ Average ranking < 3.5
0 -- absolutely of no interest.	2.5 ≤ average ranking < 3.0
1 -- low priority/interest	
2 -- low-to-medium priority/interest	
3 -- medium priority/interest	
4 -- high priority	
5 -- very high priority	