UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING
Transportation Research Institute

datamanagementgroup

2019

Data Management Group

Annual Report

Prepared by:

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Contents

INTRODUCTION

The Data Management Group (DMG) was established in 1988 on the basis of a proposal from the University of Toronto's Joint Program in Transportation for an autonomous research group with the following objectives:

(a) to establish a common, centrally accessible database containing information on transportation activities, zone systems, transportation networks and land use activity,
(b) to provide a transportation data retrieval service to the participating agencies,
(c) to monitor the adequacy of available data and propose approaches for adding to or updating the data as mutually agreed upon by the agencies,
(d) to promote greater interaction between university researchers and practitioners in the field of urban transportation planning,
(e) to promote the communication of transportation information and data obtained or administered by the Data Management Group to interested agencies and to the public, and
(f) to further the improvement of transportation demand analysis, research, and forecasting in the Greater Toronto Area.

Although the administration of the group has changed and DMG is now a part of the University of Toronto Transportation Research Institute (UTTRI) under the Department of Civil and Mineral Engineering at the University of Toronto, the DMG continues to be guided by these objectives into this its 31st year of continuous operation.

Program approval and funding of the DMG is the collective responsibility of members of the Transportation Information Steering Committee (TISC) with the following membership:

City of Hamilton
City of Toronto
Metrolinx
Ministry of Transportation, Ontario
Regional Municipality of Durham
Regional Municipality of Halton
Regional Municipality of Peel
Regional Municipality of York
Toronto Transit Commission

Each participating agency appoints a member of their technical staff to the Transportation Research and Data Management Group (TRADMAG), which is a standing committee of TISC, and is responsible for coordinating the needs of the funding agencies and the activities of the research project.

This report provides a brief profile of the staff employed and a description of the activities undertaken by the DMG during the calendar year 2019. These are presented in the following sections:

1. Staff and Location.
2. Transportation Tomorrow Survey (TTS).
3. TTS Redesign Project (TTS 2.0).
4. Computer Resources and Technical Support.
5. Budget and Contributions.
6. Meetings.

STAFF AND LOCATION

Research Director

Eric J. Miller, Professor, Department of Civil & Mineral Engineering, University of Toronto

Associate Director

Khandker Nurul Habib, Professor, Department of Civil & Mineral Engineering, University of Toronto

Technical Staff

Reuben Briggs, B.A.Sc. (Civil Engineering), M.A.Sc. (Civil Engineering) University of Toronto, P.Eng.

Susanna Choy, B.A.Sc. (Industrial Engineering), M.Eng. (Civil Engineering) University of Toronto, P.Eng.

Asmus Georgi, Vor-Diplom (Geography), Diplom (Geography, minors in Chemistry and Transportation Planning & Engineering), Freie Universität & Technische Universität, Germany (since August 2017)

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TRANSPORTATION TOMORROW SURVEY (TTS)

Under the guidance of TISC, a series of urban travel surveys, Transportation Tomorrow Survey (TTS), have been conducted every five years since 1986. The last TTS was conducted in 2016 with 22 funding partners. The survey area spanned from Peterborough County in the east to Brant County in the west and Simcoe County in the north. Previous surveys since 1991 had been managed by the Data Management Group but due to the absence of a principal investigator from the University of Toronto in 2016, the DMG participated in the 2016 survey as an advisor to TISC and provided consulting and support services for the chosen vendor.

It is anticipated that DMG will play the same role for the 2021 TTS. In collaboration with other members of the technical advisory committee (TAC), DMG has generated cost estimates and risk analyses for the potential funding partners. The DMG was also involved in discussions to determine the possible addition of questions to the TTS survey and the expansion of the answer options available for current questions in order to improve data quality. As the first step of the vendor selection and procurement process, DMG initiated the preparation of the request for proposal document. This document describes the scope of the survey, the coverage area, detailed procedures involved in the survey, quality control measures, expected deliverables and timelines for major tasks.

TTS REDESIGN PROJECT (TTS 2.0)

The TTS Redesign Project is a continuation of a research and development project, Survey Methods Research (TTS 2.0), funded by the Ministry of Transportation Ontario (MTO) and other Ontario government agencies in collaboration with the Data Management Group, to investigate better and cost-effective ways to conduct future travel surveys. The TTS Redesign Project focuses on one of the main tools being developed by the TTS 2.0 team which is the survey design and execution platform, the TRavel and Activity Integrated Survey Instrument (TRAISI).

Following on from 2018 where DMG tested and provided feedback on the early version of TRAISI and offered advice and input for the TTS 2.0 reports, in 2019 DMG lent their expertise by continuing to test TRAISI. The DMG staff met with the team on regular basis to give advice, answer any questions and to ensure the project was progressing in the right direction. They advise the team on the requirements for the sample controller and a CATI version of the TRAISI software. They provided documentation from previous surveys to assist the development team in understanding more about the implementation of the tool in a survey environment. One graduate student, hired for the TTS2.0 project, focused on smartphone based data collection methodology. Data collected through the smart-phone app experiments were used for empirical investigation. The DMG staff provides regular and valuable comments, suggestions, and guidance on the data requirements for TTS survey, if a smart-phone app is used for the data collection.

INFORMATION PROCESSING

The term 'information processing' is used in this instance to describe a set of activities supporting the management, storage, and distribution of urban travel information. The principal components of this information are the results of the Transportation Tomorrow Surveys and a collection of all Cordon Count Surveys.

Transportation Tomorrow Surveys and iDRS

The DMG administers the data files on urban travel contained in the 1986, 1991, 1996, 2001, 2006, 2011 and 2016 Transportation Tomorrow Surveys (TTS) in the form of a set of relational databases with various methods of access. Direct access to the original files is restricted to DMG staff to ensure that information on a particular household cannot be identified. Currently, data files available to iDRS users contain the following information:

TTS Number of records

Year	Households	Persons	All Trips	Transit Detail
1986	61,453	171,086	370,248	56,615
1991	24,507	72,496	157,349	14,896
1996	115,193	312,781	657,971	702,95
2001	136,379	374,182	817,744	85,095
2006	149,631	401,653	864,348	87,244
2011	159,157	410,404	858,848	86,703
2016	162,708	395,885	798,093	91,437

The increasing size of the databases reflects not only growth in the area but also changes in the size of the area surveyed.

The first text-based data retrieval system (drs) was developed in the mid-1990s by the staff of DMG as the original method for external users to gain access to the data files and complete the data extraction themselves. This retrieval system was very effective when a modem was used as the principal method of remote access to the DMG's computer system. Over the years, as the demand for travel data grew and the Internet became the preferred method of remote access, a data retrieval system specifically designed for Internet access was developed (iDRS). All the features of drs were incorporated into the browser-based iDRS and the drs process was phased out.

The initial release of iDRS was restricted to use by the funding agencies. In 2002, access to iDRS was made available to any individual that requested access. The individual was required to sign an agreement form and system security was

maintained by giving each user a unique login and password. This procedure has the added benefit that agencies outside the Greater Toronto and Hamilton Area that participated in the Transportation Tomorrow Surveys could access their data without the need to set up their own database system.

In order to meet the changing needs of the data, the DMG developed a new version of iDRS. The software was rewritten to incorporate a new database management system; PostgreSQL, which was used as part of the TTS survey software. Several new functions such as additional filter criteria and the ability to store the query for future use have been added and the speed of extraction has increased dramatically.

A new authorization process has also been implemented together with the new software. The process has been automated so that any individual can request access by entering the name, affiliation, email address and contact number online. Once the information is submitted, it will be approved by the DMG staff and an email with the credentials will be sent to the new user.

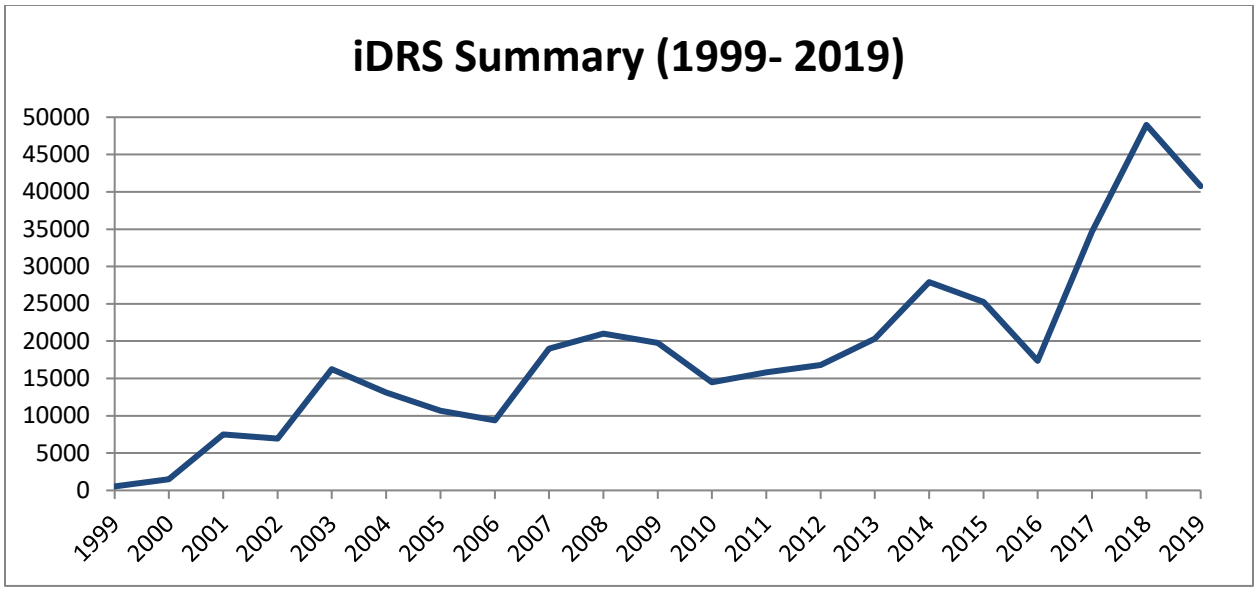
The official version of the new iDRS was released in 2016 but the DMG continues to fine-tune the new iDRS system based on the feedback of the users.

Summary of iDRS Data Requests

When the browser-based data extraction procedure (iDRS) was first released in 1999, the users were registered users of the DMG's computer system. The initial use of iDRS was encouraging. Subsequently in late 2000, the Steering Committee gave approval for use by anyone registering and providing information on their affiliation. The growth in use of TTS data is reflected in the growth of the use of iDRS for data extraction. The following chart shows the growth since iDRS was first introduced in 1999. The 'Number of Queries' reflects the number of times an output was generated during a session. iDRS usage peaked at the year after a new TTS dataset was released in 2002, 2007, 2014[1] and 2018[2]

[1] The interview phase of the 2011 TTS completed in December 2012 and the final data set was released in November 2013.

[2] The interview phase of the 2016 TTS was completed in December 2016 and the final data was released in October 2017.



After peaking in 2018, the number of queries completed in 2019 decreased but still remained at a very high level showing that the data tool is still very highly used.

The following table shows the monthly summaries for the year. The following table shows the monthly summaries since 2016.

	Year			
Month	2016	2017	2018	2019
January	235	2,194	3,079	3,778
February	426	2,179	4,126	4,098
March	369	4,724	5,479	4,296
April	177	2,115	4,080	2,946
May	1,745	4,517	7,466	4,209
June	1,928	2,259	4,944	3,575
July	2,049	2,493	5,405	3,554
August	1,736	2,391	3,139	3,205
September	2,361	3,689	3,196	2,461
October	2,299	3,172	2,759	3,360
November	2,382	2,889	3,148	3,149
December	1,670	2,059	2,149	2,143
Total	17,377	34,681	48,970	40,774

Affiliations of iDRS Users in 2019

The following is a list of 112 different agencies and groups that extracted data through iDRS in 2019.

407 ETR
ACCESS Planning
AECOM
Altus Group
Almec Foster Wheeler
Arup Group
BA Consulting Group Ltd
Bentley Systems
Brookfield Residential Properties
C.F Crozier & Associates Inc.
Canadian Centre for Policy Alternatives
Canadian Pacific Consulting Services
Candevcon Limited
CGH Transportation Inc.
CIMA Transportation Inc.
City of Brampton
City of Brantford
City of Burlington
City of Guelph
City of Hamilton
City of Kitchener
City of Markham
City of Mississauga
City of Peterborough
City of Toronto
City of Vancouver
City of Vaughan
Cole Engineering Group Ltd
County of Dufferin
County of Peterborough
County of Simcoe
County of Wellington
Dillon Consulting Ltd.
Distrikt Developments
EXP Services Inc.
Fehr & Peers
GHD Group
Goodmans LLP
Hatch Ltd.
HBA Specto Inc.
HDR Inc
IBI Group
Invest in Canada
Jacobs Engineering Group
JD Engineering
LEA Consulting Ltd.
Left Turn Right Turn Ltd.
McGIll University
McMaster University
Medi Terra Properties Corp.
Metrolinx
MHBC Planning Ltd
Ministry of Transportation, Ontario
Mohawk College
Nextrans Consulting Engineers
OCAD university
Office of the Auditor General of Ontario
Outfront Media Canada
Paradigm Transportation Solution Limited
Parsons Corporation
Pembina Institute
Peterborough & the Kawarthas Economic Development
PointA
Polytechnique Montreal
Queens University
R J Burnside & Associates Ltd.
Regional Municipality of Durham
Regional Municipality of Halton
Regional Municipality of Niagara
Regional Municipality of Peel
Regional Municipality of Waterloo
Regional Municipality of York
Ryerson University
Sidewalk Labs
Social Planning Toronto
St. Michael's Hospital
Stantec Consulting Inc.
Steer Group
Street Light Data Inc.
Sustainability Solutions Group
Tatham Engineering Ltd.
The Greater Toronto Airports Authority
The Municipal Infrastructure Group Ltd.
The Record
The Star
Toronto Regional Board of Trade

Toronto Transit Commission	Town of Caledon
Town of Halton Hills	Town of Milton
Town of Newmarket	Town of Oakville
Town of Orangeville	Town of Richmond Hill
Tranplan Associates	Transamo Ltd.
Trans-Plan Transportation Inc.	TriTAG Transport Action Group
Turkstr Mazza Associates	University of British Columbia
University of New Brunswick	University of Ottawa
University of Toronto	University of Waterloo
Urban Strategies Inc.	Urban Systems
Via Transportation Inc	Watson & Associates Economists Ltd.
WhatIf? Technologies Inc.	Wood Group
WSP Group Ltd.	York University

TTS Special Data Requests

The interactive procedures available with iDRS satisfy the majority of data needs. However, some data needs are too complex and require the intervention of an experienced analyst to formulate a custom query from the database. In addition, the DMG staff can often help define the most relevant data for the problem at hand. One of the typical data requests involves assigning the coordinates of households or trip ends to a specified spatial aggregation, different from the predefined traffic zone systems as these coordinates are not available to any non-DMG staff in order to protect the privacy of the survey respondents. Here is a list of agencies and details on some of the special data requests completed in 2019:

City of Toronto Cycling Infrastructure Group

> 2016 TTS trips made by seniors were assigned to a special spatial aggregation. In addition, various 2016 TTS data was aggregated to the City of Toronto's Districts for Vision Zero and Community Council reporting.

Metrolinx

> 2016 TTS population and place of work data at the Census dissemination area level for use in the investigation of the Ontario Line.

Regional Municipality of Halton

> Assignment of Halton region TTS data to a new zone system.

Regional Municipality of Waterloo

> Assignment of Waterloo region TTS data to a new zone system.

Toronto Board of Trade

> Presentation on the background and details of the TTS data and demonstration on the use of iDRS.

University of McGill

2016 TTS walk and cycle trips to and from North York were provided for an active transportation research project for Prof. Anna Kramer's student.

University of Toronto

2016 TTS households were assigned to the Toronto public and catholic high school boundary buffers for Prof. Steven Farber to investigate the role of public transit in school choice and after-school activity participation among Toronto high school students.

Trip day and trip week info from the 2001 and 2006 TTS surveys for Prof. Khandker Habib's student for use in an accessibility research study.

Disaggregate Data Access

There is an increasing number of transportation related projects that require access to disaggregate data for modelling work. With approval from TISC in 2017, DMG has begun testing a new data access protocol for the access of disaggregate data by researchers and consultants working on projects on behalf of DMG's funding partners which will allow DMG to maintain security over the disaggregate data.

Potential users are required to fill out a request form which outlines the specific data required, project and its sponsor, and the time frame for which access is required. If the request is approved, an account is set up and the users are given login instructions and a unique login and password to access their required datasets on a virtual machine. Datasets provided do not include any coordinates and all locations are coded to a higher-level geographic area i.e.: traffic zones, Census dissemination areas, planning districts etc.

The server is setup so the user can work on the datasets in the account via Remote Desktop Protocol (RDP). However, there is no internet access allowed and data cannot be directly copied off the server. Only aggregate data is allowed off the system and any data files required to be downloaded must be reviewed and approved by DMG personnel who will then allow download of the data from an FTP location. DMG has committed to review and forward requested data within one business day.

Below is a list of the users of disaggregate data access in 2019 via the RDP method:

User	Agency	Data required	Project
Arup	Metrolinx	TTS 2016	Transit Oriented Development Ridership Forecasting study
Arup	Metrolinx	TTS2016	Brampton Queen St-York Regional Hwy 7 BRT Planning Study

Arup	Metrolinx	TTS2016	Pearson Airport Area Transportation Study
Steer	Metrolinx	TTS 2016	Fare Integration Ridership Response Model
WSP	York Region	TTS 2016	York Regional Model
WSP	Halton Region	TTS 2016	Halton Regional Model
Dept. of Geography	University of Toronto	TTS 2016	Novel technologies and their effect on travel behaviour: Case of Ride Hailing
Dept. of Geography	University of Toronto	TTS 2016	Suburbanization of poverty and activity participation over time
Dept. of Geography	University of Toronto	TTS 2016	The role of public transit in school choice and after-school activity participation among Toronto high school students
Dept. of Medicine & St. Michael's Hospital	University of Toronto	TTS 2016	Identifying social and environmental factors impacting physical activities among dwellers of urban areas in Southern Ontario, and related health outcome such as obesity levels and Type 2 diabetes.

In addition to the RDP method, two desktop computers are designated for researchers from the University of Toronto[3] to access the disaggregate TTS data. These computers are located in locked offices within the DMG office complex. If the access request is approved, the researcher is provided office access (i.e., keys and security access code) and an account with unique login and password to log on to the specified space of the designated computer with the required data. Usage of the computers is monitored, and only aggregated data are allowed to be taken off.

Here is a list of the users of disaggregate data access in 2019 through the designated computers in the DMG office:

Project	Supervisor	Data required
Assessing the impact of trip chaining on individual greenhouse gas emissions in the GTHA	Prof. Marianne Hatzopoulou	2016 TTS
Regional traffic demand based on electric vehicle charging plan optimization	Prof. Marianne Hatzopoulou	2016 TTS
Health and climate benefits of electric vehicle deployment in the GTHA	Prof. Marianne Hatzopoulou	2016 TTS

[3] Or researchers visiting the University campus.

Transportation policies and air quality in the GTHA	Prof. Marianne Hatzopoulou	2016 TTS
Investigating the impact of automatic vehicle on vehicle ownership and unoccupied vehicle-kilometre travelled	Prof. Matthew Roorda	2016 TTS

Cordon Counts and CCDRS

The City of Toronto (then the Regional Municipality of Metropolitan Toronto) began collecting detailed information on the type and volume of traffic crossing selected points on the road system as early as 1975. The counting locations were selected such that screen lines or cordon lines could be defined and the counting program has continued on a regular basis since that time.

Subsequently, other Regions began similar programs. Given the number of regions with a similar program, they began coordinating their count programs and defining a common set of data standards. In 1998, the DMG collected these traffic counts in a common database structure and developed a Cordon Count Data Retrieval System (CCDRS). CCDRS is now widely used by a variety of public and private agencies.

In addition, participating agencies now use CCDRS as a tool in verifying their cordon count results. The approved procedure is to place new cordon count data directly into the CCDRS database with a disclaimer notice to all users that the new information is preliminary and allow the agencies to run queries on this preliminary database.

The last Cordon Count was undertaken by the participating regions in 2016 and the data released in 2017.

The DMG released a beta version of a new CCDRS in 2016. The final product is still a work in progress and is to include a graphic interface so the users can identify and select screen lines and count stations from a map. Statistics for usage of the new CCDRS are unavailable at this time.

It was decided that rather than conduct the Cordon Count program twice in a five-year period as was done previously, going forward the program would only be done once in a five-year period to coincide with the TTS year as the intermediate count has not been as valuable to the stakeholders. Therefore, the 2019 count program would not be taking place. However, in the meantime the committee will look into new methods for the future collection of Cordon Count data in order to improve data quality before the next cycle of the counting program.

Open Data

In March 2011, the first generation of Open Data Portal was launched by the Government of Canada. "Open Data is defined as structured data that is machine-readable, freely shared, used and built on without restrictions." The data must be available as a whole and at no more than a reasonable reproduction cost, preferably by downloading over the internet. It must also be available in a convenient and modifiable form and must be provided under terms that permit re-use and redistribution including the intermixing with other datasets. Everyone must be able to use, re-use and redistribute. There should be no discrimination against fields of endeavour or against persons or groups. For example, 'non-commercial' restrictions that would prevent 'commercial' use, or restrictions of use for certain purposes (e.g., only in education), are not allowed.

With the approval from TISC, the DMG started providing Open Data files from the TTS and Cordon Count data to the public in 2014. Unlike the online data retrieval systems, users can download the pre-generated text files from the DMG web site without registration.

The Open Data Portal at the DMG was updated to include the 2016 TTS data and the 2016 Cordon Count data bringing the total number of files available to 129 TTS data files and 222 Cordon Count data files. Each TTS data file contains household, person, and trip information for a specific survey year, geographic area, and spatial aggregation for different time periods. Each cordon count data file contains different types of vehicle and person counts for a specific year, geographic area, and time period. The files are in comma-delimited text format and readily import into Excel or other spreadsheet software. The DMG continues to update the Open Data Portal to include new TTS and Cordon Count data files as new dataset becomes available.

COMPUTER RESOURCES AND TECHNICAL SUPPORT

The DMG computer system is comprised of several servers located behind the DMG firewall for security reasons.

The DMG main server is a Dell R620 running Windows Server 2012 R2 with Hyper-V application. This application allows the DMG server to run multiple virtual machines, i.e., operating systems emulated within another operating system by imitating dedicated hardware. The following virtual machines are running on this server:

- Microsoft Exchange Server to handle daily DMG emails.
- Active directory server to facilitate the DMG domain.
- DMG website created in WordPress. Linux, Apache, MySQL, PHP and Lamp stack are also running on this machine.
- Data Retrieval System developed using MEAN stack, a free and open-source JavaScript software stack for building web applications running in Debian. The data are hosted in PostgreSQL which is an open-source relationship database management system.
- 2015 StudentMoveTO Data Retrieval Portal.
- A development and test server.
- Git system for version control and code repository.
- NGINX proxy server to handle web traffic. It also hosts the FTP website for file transfer with the funding agencies.

The other major server is a Dell R430 server running Windows Server 2012 R2 Datacenter, also with Hyper-V application. The virtual machines with the disaggregate TTS data for the consultants and researchers to use are running on this server. In order to support the increasing demand for this format of data, DMG configured additional virtual machines with extra storage spaces in 2019. There are currently 4 virtual machines hosted at the DMG. RStudio, Anaconda and Python are installed on these virtual machines together with basic software such as Office, Adobe Reader, Notepad, and 7-Zip etc. to facilitate modelling work.

EMME

The EMME software, which is used by the funding agencies for modelling, is run locally on agency personal computers with all related files stored locally. This results in a much faster operation. Each local machine requires access to an authentication key to operate the software. Rather than each agency purchasing a licence from INRO to use the software locally, DMG negotiated a concurrent licence for authentication of several machines operating at the same time. The DMG then dedicated a server to provide remote authentication to the participating partners.

In 2019, two additional EMME licences were purchased on behalf of the funding agencies, which brought the total number of size-15 licences (commercial and educational) hosted at the DMG to nineteen. The following is the list of EMME users in the year of 2019.

City of Brampton	City of Hamilton
City of Mississauga	City of Toronto
HDR Inc.	Metrolinx
Ministry of Transportation	Regional Municipality of Durham
Regional Municipality of Halton	Regional Municipality of Peel
Regional Municipality of York	Toronto Transit Commission
Travel Modelling Group	University of Toronto

There are also 60 size-1 educational EMME licences available for teaching purposes.

The DMG continues to maintain and improve the computer system to meet its funding agencies' changing needs.

BUDGET AND CONTRIBUTIONS

The following table presents the 2019 DMG budget and contributions by funding agencies. The DMG budget supported three full time staff members and the Director's stipend. It did not include the cost of the Emme software maintenance, which was proportionally contributed based on the number of licences allocated to each agency and a "flow-through" expenditure with an overhead of 2%.

2019 Budget	Amount
Salaries & Benefits	$382,700.00
Hardware & Software Upgrades	$ 7,000.00
Software License Support	$ 2,000.00
Miscellaneous	$ 1,000.00
Overhead @40%	$157,080.00
Total Budget	$549,780.00

2019 Contributions	Amount
Ministry of Transportation	$355,524.40
Metrolinx	$ 16,493.40
City of Toronto	$ 34,910.83
Toronto Transit Commission	$ 34,910.83
Regional Municipality of Durham	$ 16,508.87
Regional Municipality of York	$ 28,370.37
Regional Municipality of Peel	$ 35,318.62
Regional Municipality of Halton	$ 14,018.54
City of Hamilton	$ 13,724.13
Total Contributions	$549,780.00

MEETINGS

Two TISC meetings chaired by the Ministry of Transportation were held on June 25th and December 17th of 2019.

2021 TTS TAC kick-off meeting was held on September 27th, 2019. Two subsequent meetings were held on October 23rd and November 13th of 2019.