

Data Management Group

The Future of the Transportation Tomorrow Survey

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Halcrow Consulting Inc

Halcrow Consulting Inc

207 Queen's Quay West, Suite 550

PO Box 132

Toronto, ON M5J 1A7 Canada

Tel +1 (416) 363-8123 Fax +1 (416) 363-0341

www.halcrow.com

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Executive Summary

The value-for-money report

This report has been prepared at the request of the Data Management Group to address key issues associated with the continuation of the Transportation Tomorrow Survey (TTS) program including the value of this 20 year old program. It reviews the origins and rationale for the first TTS survey in 1986, including the pre-TTS planning context, reviews and assesses the uses to which the TTS data have been put by GTAHA transportation planners, and documents the attitudes of TTS users towards the data and the program. The report also discusses the strengths and weaknesses of the TTS methodology and addresses specific technical concerns, and discusses reasons for the continuation of the program and for continued financial support from the Province.

Summary of Findings and Conclusions

The first TTS survey and the TTS program responded to an agreed-to need for a large scale time series database to support transportation planning related activities by GTAHA transportation planning and transit agencies. Our findings suggest that the TTS has been successful in achieving its original objectives and has proven to be cost-effective. Since its inception in 1986, the TTS has gained widespread acceptance and has become the factual basis for many transportation planning activities.

If the TTS data collection program were to be discontinued, ongoing transport/transit planning activities across the GTAHA would be compromised. It would be difficult to replace the data collected in the TTS program and agencies would lose the historical time-series that has proven to be useful to planners. The pre-1986 experience suggests that without the TTS program, individual agencies would have to conduct travel habits surveys on an ad-hoc basis and datasets generated would be limited in scope or detail. The economies of scale and efficiencies that resulted from the TTS program would be lost and the individual surveys carried out by individual agencies would be more expensive on a per-response basis and would likely be more expensive in terms of the total costs.

The TTS gives Provincial and municipal planners and GTA transit agencies access to a GTAHA-wide database at low costs. These data are used for short-term planning and longer term planning and programming. The 75% contribution by the MTO is therefore justified and should be continued.

While the TTS data are generally accepted as accurate and reliable, a number of weaknesses were identified, including the under-reporting of discretionary travel and off-peak travel and more importantly, the under-representation of the 18-24 and other younger age cohorts. These deficiencies can be attributed to the current survey method, which relies upon a single informant contacted by landline telephone numbers. Although trip diaries may serve to address these issues, changes to survey instruments should not compromise the current sample size or survey detail.

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1 Study Background

1.1 *Introduction*

1.1.1 The TTS is a comprehensive data collection program managed by the Data Management Group at the University of Toronto. Halcrow Consulting Inc (HCI) was engaged by the Data Management Group in late May of 2008 to provide advice on the possible implementation of a 2011 TTS.

1.1.2 As noted in the Terms of Reference for this assignment, “[t]he decision to proceed with a 2011 Transportation Tomorrow Survey will be taken by the funding partners that are represented on a Transportation Information Steering Committee (TISC).” The HCI report is to also advise the TISC on “whether a travel survey of this magnitude is worth the money and whether the methods used can be adapted to solve some of the issues in previous surveys in a cost effective manner”.

1.1.3 The report is to address a number of issues including:

- the consequences of not conducting a 2011 TTS
- whether a survey of this magnitude is cost effective
- whether a 75% contribution by the MTO is justified
- what constraints should be considered before the instrument is changed, and
- whether the TTS is encouraging an appropriate mix of procedures for the development of short and long-term travel demand estimates to support transportation and transit planning across Greater Toronto Area and Hamilton (GTAH).

1.2 *Study Approach*

1.2.1 The purpose of the study is to assist the TISC in assessing the future of this important data collection program based on the applications of the TTS data over the last 20 years. To this end, HCI interviewed a wide range of TTS users starting with the original sponsors of the TTS program – the Toronto Transit Commission (TTC), the City of Toronto and the Region of Peel, and proceeded to interview other TTS users in the GTAH, including regional governments, local municipalities, and transit agencies and consultants, as well as a medical researcher.

1.2.2 The interviews were designed to document the influence and importance of the TTS data for the respondent’s organization/agency, and determine the impact of its possible discontinuation. TTS users such as planning staff at the various agencies were asked about

how their respective agencies, and their consultants, used the TTS data to support a range of planning activities including:

- a) short-term planning, such as parking studies, traffic impact assessments for development approvals and transit service planning activities.
- b) longer range planning studies including transportation master plans, environmental assessments for road and transit projects, and studies associated with the ongoing Metrolinx Regional Transportation Plan initiative.

For example, TTC Service Planning staff were asked to document the ways in which the TTC has employed TTS data for service and operational planning activities, the extent to which the availability of the TTS has allowed the TTC to reduce other data collection activities, and the associated costs and benefits of the TTS program for the TTC. Similarly, City of Toronto planners were asked to document how the availability of the TTS affected their transport planning activities and projects including modelling and the conduct of environmental assessment studies.

Interview subjects were asked questions about the consequences of not continuing with the TTS data collection program in 2011, in terms of planning activities that would be affected and the related costs, and to comment on the justification for the 75% contribution by the MTO to the funding of the TTS program.

There were also discussions about the strengths and weaknesses of the TTS and similar telephone origin-destination surveys carried out in Montréal and Ottawa, compared to smaller scale origin-destination surveys carried out by transportation agencies in Western Canada (Vancouver, Victoria and Edmonton) using a more costly “trip diary” approach. These discussions helped the study team to assess the potential benefits and costs of changing survey methods, in response to trends in cell phone use and practical and/or logistical issues of sampling certain groups, and changing the ways in which the information is collected, including the possibility of web-based data collection and other trip-diary formats.

1.3 Report Overview

1.3.1 This report is organized as follows:

- Chapter 2 is an overview of transportation data collection in the GTAH from the 1970s (before the first TTS survey) until 2006.
- Chapter 3 provides findings and conclusions with respect to the cost effectiveness of the TTS program, implications for a 2011 survey, and constraints to potential changes in the questionnaire, based on interviews and discussions with various TTS users.
- Chapter 4 discusses the consequences of not continuing the TTS data collection program in 2011.
- Chapter 5 examines the rationale for MTO’s 75% subsidy of the TTS survey and outlines reasons for the continuation of this support.
- Chapter 6 reviews the strengths and weaknesses of the TTS survey program up to 2006 including identified technical problems, outlines possible solutions, and recommends changes that should be considered for 2011.

2 Transportation Data Collection in the GTA/GGH

2.1 *Before the TTS*

2.1.1 In the 1970s the primary sources of transportation planning data and the only area-wide sources of travel habits data were the 1964 Metropolitan Toronto and Region Transportation Study (MTARTS) origin-destination survey and the Census Place of Work (POW) data. The 1964 MTARTS data had been collected to support model development and multi-modal transportation planning, while the Census POW data were first collected as part of the 1971 Census to assist Statistics Canada in defining the extent of Metropolitan labour sheds (and census metropolitan areas (CMAs) and census agglomerations (CAs). The POW data had proved useful to planners in understanding commuting patterns for Canada's major cities. However, the MTARTS data were already outdated and the POW data provided only limited information on travel patterns (home-work linkages) and did not provide important information on the timing of trips or the use of auto and transit modes, school-related travel and the other discretionary trip purposes. Given this unsatisfactory status quo, the MTO and the GTA planning agencies that had come together as the Toronto Area Database Review Steering Committee (TADRSC), agreed to take actions to address these issues.

2.1.2 In 1979, the TADRSC commissioned a study entitled "Toronto Area Transportation Data Study" by Acres Consulting Services¹. The report was to outline a program "to update the transportation planning database for a study area that included, Metropolitan Toronto, Hamilton-Wentworth, Halton, Peel, York and Durham Regions."

2.1.3 The various agencies that participated in the 1979 study recognized the need for up-to-date information to support a wide range of transportation planning related activities, ranging from long range strategic planning studies and facility needs studies to site planning and development approval studies. The agencies identified their specific needs and then rated each need in terms of relative importance. The consultant documented these needs and assessed the best and most cost effective ways to satisfy the priority planning requirements using existing datasets and special purpose surveys.

2.1.4 The Acres report identified several existing databases that might satisfy priority data gaps including the Census POW and related datasets and the TARMS external travel surveys. Databases with potential planning applications were also identified including the Ontario Recreation Survey for weekend travel forecasting purposes. Given the uncertainties surrounding the availability of the 1981 Census Place of Work (POW) data, because of the high costs of geocoding these data, and concerns about the suitability of potential datasets, the Acres report recommended three special purpose surveys to satisfy the priority planning needs of the participating agencies:

- a) Survey 1 would provide estimates of home based (HB) and non-home based (NHB) trip production and HB trip length frequency distributions (TLFDs) based on small scale telephone interviews.
- b) Survey 2 would estimate shopping trip attractions, TLFDs and mode choice for HB shopping trips, based on surveys of visitors to shopping centres, and;

¹ "Toronto Area Transportation Data Study." Acres Consulting Services Limited. March, 1979.

- c) Survey 3 was intended to collect detailed information on work trip distribution and mode choice for major employment areas including downtown Toronto and major suburban industrial and commercial areas. With Survey 3, employee travel survey forms would be distributed to all of the employees working for selected employers.

Table 1 summarizes the recommended surveys in terms of their objectives and methods, and provides the estimated costs for each survey. More details of the findings and recommendations of this 1979 study are provided in **Appendix A**.

Table 1: Toronto Area Transportation Data Study - Recommended Surveys

	Data Requirements	Where	How	Sample Design	Analysis Approach	Sample Size	Cost per Interview	Total Cost
Survey 1	HB Trip Production	Households	Personal/ telephone interview	Quota sample stratified by dwelling unit types (2 or 3) zonal socio-economic status level (5 classes) and location type (3)	Category analysis or regression analysis relating trip generation rate per unit (by type) to zone location and socio-economic status	1,500 to 2,250 households	\$15	\$22,500- \$33,750
	NHB Trip Generation			Fixed sample size (50) with each of 30 to 45 cells				
	HB Trip Length Frequency Distribution			Stratification based on analysis of MTARTS Durham, Peel, Halton and Hamilton-Wentworth data				
Survey 2	HBS Attraction	Store entrances/exits	Personal Interview	Stratified multi-stage systematic survey of shoppers	Weight up responses (allowing for multiple store visitation) to represent centre and area trip generation	5,000*	\$5	\$25,000
	HBS TLFD			Stratification by 2 classes of store (shop v. convenience), 5 location types and 3 time periods				
	HBS (Shopping) mode choice			100 interviews per sub-strata	Trip distribution via TLFD			
Survey 3A	HB Work mode choice (assumes existence of 1981 Census place of work data)	Place of work	Handback	Stratified multi-stage survey of employees by firm in selected high, medium and low density employment areas (CDs)	Analysis of existing datasets	10,000 to 25,000 (depends on use of existing data)	\$3	\$30,000- \$75,000
				Possibly can use available survey results in Centra Area, Flemingdon Park and Durham	Diversion curve or disaggregate analysis			
Survey 3B	HB Work mode choice	Place of work	Handback	Stratified multi-stage sample of employees by firm in all CDs	Analysis of existing datasets	50,000 to 65,000 (5%)	\$3	\$150,000 - \$185,000
	HB Work trip distribution (assumes 1981 Census place of work data unavailable)			Possibly can use available survey results in Centra Area, Flemingdon Park and Durham	Diversion curve or disaggregate analysis			

* assumes that 2 examples of each shopping centre area type are surveyed and that neighbourhood shopping centres are not surveyed on Saturday, i.e. 600 interviews in the CBD, 600 in each Regional and community shopping centre and strip retail area and 400 in each neighbourhood shopping centre

2.1.5 Following the release of the Acres report, some agencies undertook some of the recommended surveys to support their transport planning activities. This included the 1979 Metro Toronto travel survey (MTTS)² of 3,500 households and the 1980 Metro Toronto

² "Metro Toronto Travel Survey Phase 1" Boston Gilbert Henry Associates. January, 1980. and "Metro Toronto Travel Survey Phase 2" HGL Market Perspectives Inc. 1980

Employee Travel Survey (MTETS)³ of 30,000 employees, both of which were undertaken by consultants for the Metropolitan Toronto Planning Department, as well as the 1980-1981 Hamilton-Wentworth Employee Travel Survey of employees from 11 work zones, carried out by the Hamilton-Wentworth Planning and Development Department⁴. These smaller scale local surveys were undertaken at relatively low costs, approximately \$60,000 in 1979 or \$17 per completion for the MTTS, and approximately \$90,000 or \$3 per completion for the 1980 MTETS.

2.1.6 To put the 1979/80 costs into perspective, the MTTS would have cost \$172,656.25 or \$48.92 per completion in 2007, compared to about \$20 per completion for the 2006 TTS. The MTETS was an additional survey required because the MTTS did not include the residents of the suburban Regional Municipalities that were part of the Toronto commuter shed and it would have cost \$235,663.51 or \$7.86 per completion in 2007.

2.1.7 These surveys did not create a GTA-wide travel habits database or a time-series of comparable results that could be used to track changes in travel behaviour. Neither the MTTS nor the MTETS was repeated, partly due to incomplete results. The data collection program recommended in 1979 could not be used to establish a common basis for the planning of inter-regional transportation services.

2.2 *TTC Data Collection Prior to 1986*

2.2.1 The TTC had historically undertaken a wide range of surveys and counts to support their ongoing service planning activities. In the early 1980's, the TTC Operational Planning Department maintained a data collection or "checker" staff that exceeded 50 persons. The current Service Planning Department, which includes the former Service Planning and Operational Planning Departments, has fewer than 30 data collection staff. Prior to the TTS, the TTC data collection program included the TTC Subway system Origin-Destination Survey, which was carried in 1966, 1969, 1975, and 1978, as well as various special surveys of trip distribution patterns and access modes for commuter parking lots, etc.

2.2.2 Occasionally, the TTC undertook special purpose surveys to satisfy specific planning requirements, such as a mail-back survey of travel statistics to support a planned restructuring of bus services in North-East Scarborough. The "Scarborough Transit Services Improvement Study,"⁵ surveyed a random sample of 9,000 households within more than 40 traffic zones in the area north and east of Kennedy Subway Station. A personalized mail-back questionnaire was sent to the residents of each sample household and a total of 6,500 questionnaires were returned, after up to 3 postal follow-ups with households that had not responded to previous mailings. This survey, while providing useful information, had serious limitations because it did not collect information on individual car, transit or walk trips, and was relatively expensive.

³ "Metro Toronto Employee Travel Survey 1980" HGL Market Perspectives Inc. March, 1981.

⁴ "Employee Travel Survey Volume 1: Survey and Results" Hamilton-Wentworth Planning and Development Department. June, 1981. and "Employee Travel Survey Volume 2: Analysis and Conclusions" Hamilton-Wentworth Planning and Development Department. November, 1983.

⁵ "Scarborough Transit Services Improvement Study 1983 Report 1: survey design and execution". TTC Service Planning Department. April, 1984. and "Scarborough Transit Services Improvement Study 1983 Report 1: survey findings". TTC Service Planning Department. June, 1984.

- 2.2.3 Excluding staff time, this survey cost \$42,600 in 1983 (\$81,753.87 in 2007 dollars). The staff time was equivalent to 4 person months, which was worth approximately \$16,700 at the time or \$32,049.05 in 2007 dollars. Therefore the total cost was approximately \$59,300 or \$9.12 per completion (equivalent to \$113,802.93 and \$17.50 per completion in 2007, compared to \$20.00 per response for the much more detailed surveys undertaken as part of the 2006 TTS).

2.3 *The First TTS Survey*

- 2.3.1 In 1985, Metropolitan Toronto, Peel Region and the TTC began to explore the idea of creating a single GTA-wide database to replace the ad-hoc approach that had emerged during the early 1980s. New data were required to support transport modelling activities by provincial, regional and local governments, and to address the short-term transit service planning requirements of the TTC. The decision to adopt the proven Montreal survey methods for the original 1986 TTS reflected the recognition that there were great similarities between Montréal and Toronto in terms of transport and transit planning needs and that Montréal had developed considerable expertise in the carrying out large-scale travel surveys, something that they had done continuously since 1970.
- 2.3.2 Montréal's transit agency, the STM, formerly known as STCUM (la Société de Transport de la Communauté Urbaine de Montréal), provided a model for the TTC of how a large-scale household origin-destination survey could be used to understand transit use and transit's share of total travel and to better plan for transit service improvements. The potential to improve transit's competitiveness and bus service efficiency convinced the TTC to fund half of Metro Toronto's share of the cost of the 1986 TTS. It was recognized that the TTC's contribution could be easily justified if the TTC managed to save 1 or 2 buses by planning more effectively.
- 2.3.3 The 1986 TTS had a 4.2% sample size (86,000 households) in a study area now known as the GTA-H, which included , Metropolitan Toronto, Hamilton-Wentworth and the regional municipalities of Halton, Peel, York and Durham. The Data Management Group was established at the University of Toronto shortly after the completion of the 1986 survey with the responsibility of managing and distributing the 1986 TTS data.

2.4 *The TTS Program 1991 - 2006*

- 2.4.1 In 1991, the decision was made to undertake a second TTS to update the original 1986 survey. The 1991 survey focused primarily on those geographic areas that had experienced high growth since 1986 but the areas deemed relatively "stable" were surveyed using a small sample size (0.5%). The survey area was expanded to include a band approximately one municipality wide surrounding the outer boundary of the GTA-H to obtain more information on commuter travel to the GTA from these communities.
- 2.4.2 The 1996 TTS was a new survey rather than an update, and the survey area was expanded to include the regional municipalities of Niagara and Waterloo, the counties of Peterborough, Simcoe, Victoria and Wellington, the cities of Barrie, Guelph, and Peterborough and the Town of Orangeville. Approximately 115,000 interviews were completed, which represented a 5% sample of households across the larger study area.
- 2.4.3 The 2001 TTS collected data for approximately 137,000 households (5% sample) across a similar study area. The study area changed somewhat because the Regional Municipality of Waterloo chose not to participate while the City of Orillia and all of the County of Simcoe were included.
- 2.4.4 The 2006 TTS is generally similar to the 2001 survey and collected data for approximately 150,000 households across the Greater Golden Horseshoe (GGH), which encompasses a

larger area than the GTA. The survey area was expanded to include the Regional Municipality of Waterloo and the City of Brantford.

3 TTS User Opinions - Agency Survey Results

3.1 Overview

3.1.1 The agencies interviewed includes the regions of Peel, York, and Durham, the cities of Toronto and Mississauga and three major transit agencies, the TTC, GO Transit, and Metrolinx. Interviews were also conducted with other TTS users from the consulting industry and academia, e.g. AMT (Agence Métropolitaine de Transport), Madituc Research Group at the Ecole Polytechnique de Montréal. (to discuss common issues), and an academic researcher in the health sciences.

3.1.2 During the interviews with TTS users, discussions were based on key questions directed at addressing the priority issues outlined in Section 1.1.3, including:

- a) Document how/where your agency and your consultants have used the TTS data for various short-term and long-term planning activities.
- b) If the TTS data were not available in 2011 what would your agency do to support the ongoing short-term and long-term planning efforts?
- c) Is the TTS sample size (5%) required to support your work?
- d) Discuss the strengths and weaknesses of TTS and Montréal style origin-destination surveys with the smaller scale origin-destination surveys carried out by transportation agencies in B.C. (i.e. Vancouver and Victoria).

3.1.3 From responses to these questions and our own research, some key themes emerged that were common for the majority of the interviewed agencies. The key themes can be summarized as follows:

- a) The TTS is widely used for short and long-term planning activities including land use and transportation planning and related activities, policy evaluation and formulation, and the monitoring of travel behaviour patterns and trends. The TTS is the basis for travel demand modelling/forecasting associated with environmental assessment (EA) studies and the planning and evaluation of the elements of the Regional Transportation Plan for Metrolinx.
- b) Without the TTS, individual data collection programs in the form of fragmented local or agency surveys would have to be initiated, which would be impractical and inefficient, in the opinion of the respondents.
- c) The 5% sample size used for the TTS is seen as a minimum by all of the agencies and consultants interviewed.
- d) Emphasis was placed upon the comprehensiveness of the TTS in offering a unique GTA-wide perspective.
- e) The TTS is accepted as an accurate source of current travel behaviour data.

- f) While agencies acknowledged some of the deficiencies in TTS in relation to discretionary trips and non-vehicular modes, there was only limited support for more in-depth “trip diary” type surveys, such as those carried out in Western Canada.

Table 2 below summarizes the responses of the respective agencies interviewed.

Table 2: Summary of Themes Identified by Interviewed Agencies

Themes	Peel Region	York Region	Durham Region	City of Toronto	City of Mississauga	TTC	GO Transit	Metrolinx
Comprehensiveness of Survey: captures Regional Trends, offers a perspective that would not otherwise be available with smaller local surveys	√	√	√		√	√	√	
Accepted Standard: widespread acceptance for its validity, used as a measure/standard for other surveys	√	√	√	√	√	√	√	√
Travel Demand Modelling/Forecasting: helps to validate, calibrate and update models/surveys	√	√	√	√	√	√	√	√
Without the TTS, agencies would have to undertake own surveys, often impractical, costly, or not feasible.	√	√	√	√	√	√	√	
Policy Tool: analyze efficacy of existing policies and help direct future policies/plans. Also used to support policies/plans of regional and municipal governments, OP, TMP, TIS, etc	√	√	√	√	√			
Useful for land use and transportation planning and related activities	√	√	√	√	√	√	√	√
Useful for longer term projects such as EAs (the first two phases) and Metrolinx initiatives	√	√	√	√	√	√	√	√
Provides data to describe and monitor travel behaviour/pattern/trends.	√	√	√		√	√	√	
TTS 5% sample size as a minimum	√	√	√	√	√	√	√	√
Useful in OMB hearings		√						
Willing to adopt / interest in smaller scale O-D surveys				√				√
Unwilling to adopt / no interest in smaller scale O-D surveys			√		√		√	
Concerned about the state of transport modelling in the GTA		√						√
Need to look into other modes/ trip purposes: i.e. Trucks, bikes, pedestrians, ride-share discretionary trips, etc.	√	√	√	√	√			√

3.2 Major Findings

- 3.2.1 The TTS is widely used for short-term and long-term planning activities across the GTAH. The richness of the TTS database makes it useful to the various stakeholders for land use and transportation planning to support, explain, carry out and update their mandated activities.

The TTS plays an important role within the mandates of various planning agencies. The detail, diversity and ongoing updates of the TTS data enable planners to use the survey results to evaluate and assess the effectiveness of past and/or current initiatives. More specifically, instead of just providing a specific travel statistic for a particular point in time, the historical TTS database is a powerful analytical tool to track changes in the components of trip-making and travel dynamics at microscopic, macroscopic or inter-regional levels (various traffic zone aggregations). The data are also available on a totally disaggregate basis (providing geo-codes for individual trip origins, destinations and transit access points) for the study of walk access to transit, transit bus route corridors (e.g. within 500 m of specific routes) and other research exercises.

In general terms, the TTS data are used to monitor and, through models, predict changes in travel behaviour and related measures, including travel by mode and time period, and vehicle ownership, and to help agencies to assess the impact that these changes will have on transportation systems and infrastructure requirements. A wide range of examples of the uses of the TTS were identified as part of this study. Some of these examples of the use of the TTS for planning applications are outlined in the following paragraphs.

- The City of Toronto extracted TTS data (population, employment, and trips within each transit station catchment area to estimate transit market shares and assess the success of its transit-supportive land use policies. The city also relies on the TTS to update their travel forecasting model (GTA Model) to support their ongoing transportation planning activities.
- With the release of each TTS, the Staff from various departments at the City of Mississauga review the data for trends and changes in travel habits that can be used to develop and update strategies and plans. The Mississauga Transit Marketing Strategy and the Mississauga Transportation Strategy Update can be found in **Appendix C** and **Appendix D** respectively.
- York Region has used the TTS to monitor trends in travel patterns and modal splits to assess the impacts on travel behaviour resulting from YRT and VIVA transit service improvements. By monitoring changes in travel behaviour, the Region has been able to evaluate the efficacy of current policies and actions. Traffic impact studies submitted for review by various consultants often make use TTS data to estimate trip distribution and modal split so as to inform planning decisions.
- The Region of Peel currently uses the TTS to plan, prioritize and stage capital projects as well as to provide data to support official plans, transportation master plans, traffic impact studies, and various other transportation-related studies. The TTS also provides the rational used to generate Development Charge revenues in Peel Region.
- For longer term planning projects, the TTS is commonly used in travel demand modelling/forecasting to develop, validate, calibrate, and update travel demand models and the trip generation, trip distribution, modal split and assignment sub-models. For example, the TTS has been used to develop a four stage travel demand model for Phases 1 and 2 of the EA process in Durham Region (need and justification and evaluation of alternatives to the undertaking) and was fundamental to the development of a GTAH model for MTO, which is currently being used for the Metrolinx Regional Transportation Plan exercise. TTS results have also been used to update a GTA model maintained by the City of Mississauga and the TTS data are also

the basis for the York Region Model that is used to forecast future changes in travel demands by mode and future transportation infrastructure needs.

- For the TTC, the TTS survey functions as a basis for resource allocation and as a tool for evaluating current and future routes and improvements. The TTC actively uses the TTS data to plan routes, allocate bus services, and evaluate the performance of existing and proposed new routes/services (buses, LRT, subway). The TTS allows for impact assessment based on changes in weighted travel times, composed of walk, wait, in-vehicle time adjusted to reflect their relative perceived values so as to minimize ridership loss, maximize ridership gains in a cost-effective manner. It was noted that the TTC had been able to cut 9% of its service a few years ago but incurred only a 3% ridership loss because the service reductions were made where most riders would be able to shift to alternative services with minimal inconvenience. The TTC has also used the TTS data to evaluate potential RT projects, in conjunction with MADITUC software, and to estimate potential greenhouse gas (GHG) savings that could be achieved as a result of the implementation of specific transit service changes. A copy of a 1999 TTC study titled “Optimising Transit Service Decisions Based on Ridership” can be found in **Appendix B**. The TTS has replaced a wide range of other TTC surveys outlined in **Section 2.2**.
- The TTS has played a supplementary role in the longer term planning initiatives of GO Transit. GO Transit uses cordon counts for short term plans but uses the TTS for long term initiatives like needs identification and new BRT and rail services plan based on origin-destination data. For travel demand forecasting in support of longer-range network/system planning studies, GO uses total work trips and downtown trips by GO rail captured by the TTS survey.

3.2.2 Great value is placed on the comprehensiveness of the TTS in offering a GTA-wide perspective. The TTS encompasses the entire GTA and is unique in its ability to capture the majority of inter-regional travel trends. For transit planning agencies like TTC, GO Transit, and Metrolinx, this is especially important because increasingly dispersed and complex commute patterns have significant impacts on transit demand. For example, GO Transit uses the cross-boundary commuting travel data extracted from the TTS database for inter-regional service planning for the Niagara region, Hamilton and Barrie areas.

3.2.3 TTS data have also been used to support medical research such as a major study on diabetes carried out for the Institute of Clinical Evaluative Sciences (ICES) in 2007. This study, entitled, “Neighbourhood environments and resources for healthy living - A focus on diabetes in Toronto” was the first Canadian study of its kind and is published as part of the ECES Atlas series. This particular Atlas, which includes a number of exhibits that were based on TTS data, examined “the role neighbourhoods play in the diabetes epidemic” by documenting the results of a three-year comprehensive study of 140 Toronto neighbourhoods. TTS data were used to assess the impact of factors such as car ownership and use, transit use and opportunities for physical activity (trips made by walking and biking) on the incidence of Type 2 diabetes. **Appendix E** contains exhibits extracted from this study that were based on TTS data.

3.2.4 TTS data are generally accepted as valid and accurate travel habits data across the GTA. The TTS is the largest survey of its kind in North America with widespread acknowledgement of its validity. It is released on a quinquennial basis coinciding with the Canadian Census and is perceived by many as the common source of travel habits data for the Greater Toronto Area and beyond.

The TTS is considered to be the benchmark against which other travel data can be compared and/or validated, especially when agencies undertake their own special purpose data collection programs. For example, the TTS has been used to confirm the validity of the results of City of Toronto household surveys for St. Clair Streetcar, Kingston Road, North York City Centre, Scarborough City Centre, the Waterfront, and the Kings.

The TTS is also accepted by bodies such as the Ontario Municipal Board and the Courts as being accurate and reliable. As planning processes become subject to increasing expectations of transparency and validity, the TTS offers public and private sector users a defensible source of travel behaviour facts (e.g. trip distribution patterns and transit modal shares).⁶

It should be noted that while the TTS is recognized as being accurate for work and school related trip making (the repetitive non-discretionary travel that defines peak transportation demands), users of the data recognize that the survey method tends to under-estimate discretionary travel such as trips made for shopping, personal business or recreation, and non-home based travel, such as shopping trips made on the way home from work.

3.2.5 There are concerns about the quality of data for communities outside of the GTA, such as the Region of Waterloo and the City of Guelph. Waterloo planning staff informed HCI that the 2006 TTS data substantially understates local transit ridership but no specific documentation was provided. Based on our earlier experience using the 1996 TTS data for Waterloo Region, it appears that a large number of non-resident university/college students are not included in the TTS sample. This type of problem may also affect TTS results in other communities which attract large numbers of non-resident students.

3.2.6 The 5% sample size used for the TTS is seen as a minimum. None of the agencies or individuals contacted as part of this study supported the idea of any reduction in the size of the TTS sample. The typical response was that the 1991 experience (where a .5% sample was applied to so-called stable areas) had proven that a smaller sample size was not sufficiently accurate to support planning activities at a sub-area level (e.g. for area or corridor studies). Little use has been made of the 1991 dataset for this reason. For example, the City of Mississauga has concerns about the ability to accurately track changes in modal split, etc, based on their experience with the 1991 sample. The City of Toronto sees the 5% sample size as a minimum required to support ongoing planning work and transit modelling work in conjunction with the TTC and sometimes sees the need to under-take supplementary household surveys with larger sample sizes. Metrolinx advised that they will be conducting analyses at various geographic levels and would be concerned that a smaller sample size would be inadequate.

3.2.7 There was no support for replacing the TTS with a smaller sample “trip diary” survey, which is designed to collect more complete information on daily travel. Some respondents were concerned about the ability of the TTS to capture good data on discretionary trip purposes, alternative work arrangements etc. While there was some interest in smaller scale, trip diary type surveys, no one was willing to give up the advantages of the larger sample size offered by the TTS for more complete data on discretionary and off-peak travel.

3.2.8 Concerns were raised about the state of transport modelling in the GTA and a small number of respondents indicated that they were concerned that the TTS has not led to the development of improved transport planning models or better insights into the implications

⁶ Appendix F illustrates how TTS data can be used to identify trip origins for employment areas.

of trends, (e.g. trends in female participation in labour force and the related car ownership or behaviour change over time). Respondents also expressed the need to improve the understanding of other modes like trucks, bicycles, pedestrians, ride-share as well as discretionary trip purposes. However, no specific ideas or proposals were offered to address these deficiencies. .

3.3 Conclusions

- 3.3.1 The TTS data collection program has fulfilled its mandate. It provides GTAH transportation agencies with the travel habits data required to understand how growth and change are influencing travel patterns and peak period transportation demands. The TTS has supported the continued development and updating of the transportation planning models used by both public and private sector stakeholders to forecast future demands. These data also provide important region-wide socio-economic and travel data used to track changes in travel by mode and to measure achievement of objectives. As noted in **Section 3.2**, the TTS is used by transportation and transit planning agencies across the GTAH and is increasingly used by agencies for the larger GGH area.
- 3.3.2 The TTS data is accepted as being accurate and reliable by GTA agencies and consultants for their respective mandates, which tend to focus on AM peak period road and transit demands that are primarily defined by travel to and from work and school. However, these same agencies recognize that the TTS tends to under-estimate off-peak and total daily trip making because the surveys are undertaken by telephones generally relying on a single household member to report on the trip making of all family and/or household members. This is a concern to some agencies interested in studying off-peak travel and emerging behaviours such as “work from home” and “bicycling to work”.
- 3.3.3 The TTS sample has generally been consistent at approximately 5% of the total households in each of the municipalities included in the survey area. The sole exception was 1991, when stable areas were surveyed at a .5% sample of households. All of the agencies surveyed agreed that the 5% sample size is adequate to meet their needs, although Durham Region expressed concerns that the current sample resulted in small numbers of observations within their smaller rural municipalities. The respondents representing transportation planning and transit agencies and consultants agreed strongly that reductions in sample size would result in greater sampling errors and compromise the precision and reliability of the future survey results, as was the case with the 1991 TTS.
- 3.3.4 There are some concerns about the accuracy of TTS data for some communities outside of the GTA, such as the Region and Waterloo and the City of Guelph, where transit trip making is reported to be substantially understated. These aforementioned issues should be addressed in the design of the 2011 TTS data collection program (as discussed in Chapter 6, which considers a number of technical issues that have emerged during the course of the TTS program).
- 3.3.5 There are also some concerns about the failure to improve the quality of the transportation models that are being used by GTAH planning agencies to support ongoing long range planning activities.

3.4 Implications for 2011

- 3.4.1 Within the GTAH area, continued development has led to increasing congestion, dispersed travel patterns and longer travel times. Transportation planning has become more complex with travel within and between the rapidly urbanizing suburban regions accounting for most

of the growth in travel. Therefore, planners and decision makers will continue to require data that describes travel at the GTA and GGH levels.

- 3.4.2 Given the continued decentralization of population and employment centres and road capacity constraints, there is an increased focus on transit solutions in the GTA and GGH, including various forms of rapid transit (BRT, LRT, and subway extensions) and the continued development of conventional bus services. Suburban growth will continue to require the building of new roads, including highways. A comprehensive database on travel by mode will be required to assist transportation and transit agencies in assessing existing facilities and services and future plans and policies.

4 Consequences of Not Conducting a 2011 TTS

4.1 *Context*

- 4.1.1 The TTS program was developed by GTA area transport planning and transit agencies in response to data gaps that their independent data collection activities could not address. The program has been successful in that it appears to have achieved the original objectives and is used by all of the agencies and municipal agencies within the GTA that have been part of the program since 1996.
- 4.1.2 Without the type and quality of travel habits data provided by the TTS, or a similar GGH-wide data collection program, future transportation plans and policies and related the decision making processes, will be jeopardized. This is the consensus opinion of the TTS users who were interviewed.

4.2 *Implications of Not Proceeding with a 2011 TTS Program*

- 4.2.1 In the absence of a provincially supported TTS data collection program, the GTA (and GGH) municipalities and agencies would have to rely on independent data collection activities that would produce less useful information and be much less cost-effective, recognizing the economies of scale that the TTS has achieved.
- 4.2.2 If the TTS program did not continue in 2011, municipal planning agencies would probably update the 2006 TTS results in the short-term, using regional and/or local datasets (i.e. cordon counts, transit ridership counts, traffic counts and special purpose small scale O-D surveys, etc.). However, based on earlier experience, by 2016 GTA planning departments would likely revert to the pre-1986 situation with the larger agencies undertaking special purpose O-D surveys to support specific studies and smaller towns or cities foregoing travel habits data collection altogether. The integrated, GTA and GGH-wide database created by the TTS program would be lost and so would be efficiencies gained by the combined actions of the MTO and the GTA municipal planning agencies working through the Data Management Group.

The high costs of undertaking independent surveys to collect travel habits data are demonstrated by the pre-TTS experience outlined in **Sections 2.1** and **2.2**. The 1979 MTTS would have cost \$172,656.25 or \$48.92 per completion in 2007. In order to collect sufficient data to understand commuting travel (in terms of travel times, modes etc.) for all persons working in Toronto, including non-residents, the City of Toronto spent a further \$90,000 in

1980 (or \$235,663.51 in 2007 dollars) to assemble data for 30,000 workers employed in major employment concentrations.

In contrast, the TTS survey cost approximately \$20 per completion for 2006, comparable to the budgeted costs for the O-D survey being carried out in the fall of 2008 for the Greater Montréal area. This employee O-D survey data collected in 1980 as part of the MTETS was made unnecessary because of the availability of a GTA-wide household survey that offers cross-boundary travel data.

- 4.2.3 In a large integrated urban area like the GTAH, a complete picture of the GTAH is important to assess the evolution of travel behaviour and the implications of these trends for the transit of future transit services. Both Metrolinx and the TTC have acknowledged that the continued availability of TTS data is fundamental to their ongoing planning, decision making and monitoring.

5 MTO Contribution

5.1 *Highlights*

- 5.1.1 The original TTS would not have been feasible without the financial support of the MTO which covered 75% of the total costs. Revenue sources in Metropolitan Toronto were limited to the property tax base and Provincial transfers, and major transportation data collection programs were not supported through most of the 1970s, until 1979 and 1980, as documented in **Section 2.2**. By 1985, it was clear to planning agencies in the GTA that the solutions proposed in 1979 had not resulted in an integrated time-series data base. They agreed that new data were required and the GTAH municipalities approached the MTO to discuss the possibility of undertaking a GTA wide Origin-Destination Survey in 1986, modelled after the successful Montréal survey program. MTO senior staff saw the advantages of such a program to the Province and supported the initiative.
- 5.1.2 The 75% MTO contribution was consistent with provincial policy at the time because the Province had a major interest in ensuring that major capital expenditures for transit were carefully planned. This required accurate and up-to-date information. MTO had already been subsidizing the special purpose surveys undertaken by Metropolitan Toronto, Hamilton and other cities, so the support of the TTS was not a policy change but a better and more cost-effective way to collect information that MTO and the various GTA agencies required. Therefore, the MTO subsidy was easily justified.
- 5.1.3 A change in Provincial government in 1995 led to the downloading of transit capital and operating expenditures to municipal governments and their transit agencies and the loss of the 75% capital subsidy. However, Provincial contributions to the TTS program (from the MTO) remained at 75% level, despite the policy change. This was and is a reflection of the importance of the survey to the ongoing planning of provincial, regional and local transportation infrastructure and services across the GGH area.

5.2 *Current/Future Justification*

- 5.2.1 The release of the Provincial Policy Statement and the Places to Grow Act in 2005 points to the importance that the Province places on encouraging sustainable development in the GTA

and GGH. Transportation and transit planning are central to the planning of the GGH area as evidenced by more recent initiatives such as the provincial “Move Ontario 2020 Plan” and the soon to be released Metrolinx “Regional Transportation Plan”. These activities underscore the importance of planning for and investing in transportation infrastructure on a GTA-wide basis.

- 5.2.2 The TTS is a source of travel-related and socio-economic parameters that has been widely used for various planning purposes throughout the GTA. All of the agencies that were interviewed, including long time TTS users such as the TTC, GO Transit, the City of Toronto and the Regional Municipalities of Peel, York and Durham, and new users, such as Metrolinx, perceive the TTS data as increasingly important to their activities. According to Metrolinx, TTS data are essential to the development/refinement of the Regional Transportation Plan in the future.
- 5.2.3 It is our opinion that an area-wide data collection program would not be feasible without substantial funding by a provincial government agency, such as the MTO. Municipal finances, which rely on the property tax base, are limited and generally do not increase in line with other municipal operating expenditures, especially during period of slow economic growth. Without Provincial funding, it will be difficult to maintain area-wide coverage of the TTS program, as it has been throughout the 1986 to 2006 period, outside of the larger cities and regional municipalities because the data collected are not required by smaller communities.

6 The Future of the TTS Program: Strengths and Weaknesses, Technical Challenges and Recommendations

6.1 *Strengths, Weaknesses and Technical Challenges*

- 6.1.1 The TTS has been utilized widely due to its relative consistency, continuity and comprehensive scope. It supports the ongoing monitoring of travel trends, short term transit service planning using state of the art methods (the totally disaggregate approach), as well as model development and calibration by GTA and GGH planning agencies and their consultants. Therefore, there is almost universal support for the continuation of the program, so as to maintain the time series, consistency and continuity, even if it means foregoing improvements or changes in data collection.
- 6.1.2 However, there are some technical problems with the TTS program that will need to be addressed, because some of them will also affect both the future quality of the data and its continuity. These problems include:
- a) the under-reporting of discretionary and off peak trips and, therefore, total daily trips is recognized as a weakness of the current telephone survey method.
 - b) the quality of data pertaining to the 18-24 age group, which has been increasingly under-represented since 1996 to the point where the 15 to 44 age group were under-represented in 2006 .

- c) concerns about the quality of the data related to transit trip making in communities outside of the GTA that attract large numbers of post-secondary students as temporary residents.

6.2 *Discussion of the Problems and Possible Solutions*

6.2.1 Under-representation of discretionary and off-peak travel including those trips that are not destined for school or work and those trips that do not originate at home, is largely the result of the TTS reliance on a single informant for most households in the sample. As early as 1985, there was recognition for the fact that a single informant cannot be expected to know about the activities and trips made by other persons living in the household. Therefore, where the original informant could not report on details of someone's trip, a call back would be arranged. However, the large majority of surveys are completed based on information from a single informant.

In order to gauge the level and impact of this under-reporting, as well as to collect additional data that could not be collected as part of the TTS due to time constraints in telephone interviewing, a Trip Diary Survey (TDS) was conducted in 1987 for a sub-set of the respondents to the 1986 TTS.⁷

The results of the TDS confirmed that non-discretionary work and school trips and AM peak period travel were very accurately reported in the TTS. However, discretionary travel including NHB trips and shopping/personal business and other travel were under-reported to varying degrees. A comparison of the 1987 TDS results and the 1986 TTS results showed that the TTS reported only half the NHB trips that were reported in the TDS. Trips were compared by purpose and by mode to calculate ratios in **Table 3**. The results also suggested that home-based auto trips were under-represented by about 20% while HB transit trips were low by approximately 10%.

Table 3: Relative Trip Rates (TDS/TTS) by Trip Purpose and Trip Mode (Calculated Using Sample Weighting Factors)

Trip Purpose	TDS Trip Rate/TTS Trip Rate
Home-based work	1.01
Home-based school	1.05
Home-based other	1.14
Non-home based	1.98
Trip Mode	
Auto	1.19
Transit	1.1
Walk	1.14
Total	1.18

Note: HBW and HBS trip rates are only for those respondents whose employment and student status were coded consistently in the two surveys. HB other and NHB trip rates were derived for everyone who reported trips in both surveys.

The under-representation of discretionary and off-peak trips has been recognized by most of the respondents interviewed, but they did not raise this as a major issue and favoured maintaining continuity with the existing historical database rather than resolving this issue through significant changes to the survey methods that would impact data continuity (see

⁷ "Trip Diary Survey Analysis" Tranplan Associates. January, 1990.

Table 2 in Section 3.2). There was little or no interest in replacing the TTS with some form of trip diary survey (such as those undertaken in Western Canada, e.g. Vancouver and Victoria).^{8 9}

To date, no formal attempt has been made to update the 1987 Trip Diary Survey and to update users' understanding of the under-statement of discretionary and off-peak trips. Given the interest in obtaining more detailed data on non-discretionary trip making and trips by active modes etc., we feel that it is time for the Data Management Group to seriously consider a repeat of a diary type survey as part of the 2011 program, rather than a follow-up trip diary survey a year later, and with broader goals and objectives. These could involve an "activity" rather than "trip" based questionnaire, to support tour based or activity based modelling.

6.2.2 In terms of representation of the sample population, the 18-24 age cohort has been consistently under-represented since 1996. This under-estimation was not present in the 1986 survey nor was it reported in the 1991 survey, but was clearly identified in the 1996 TTS Validation Report. From 1996 to 2006, the problem appears to have worsened. Similar problems have been experienced in Montréal.

The 2006 TTS population estimates for ages 15-44 (males and females) were substantially lower than the Census estimates, but were higher than the census estimates for the 50 plus age groups. Various causes may have led to this problem. The sample lists used for the 2006 TTS include only those persons living in households with a listed telephone number. The use of cell phones as substitutes for landlines has meant that younger persons would not appear on the sample lists used and this probably accounts for the under-representation of younger persons, including the 18 to 24 age cohort, and for the over representation of persons over age 50. Other explanatory factors could include the more active lifestyles of young persons living on their own (and not being home to answer the phone) and the use of answering machines to screen unwanted calls. An additional survey related factor relates to changes in the advance mail notification that has been a feature of the TTS since 1986.

Earlier TTS surveys benefited from a personalized advance letter that was sent to all sample households prior to the initial phone call. This important measure distinguished the TTS phone call from other "market research" and "sales" calls and was a major factor in the high TTS response rates. In fact, more than 60% of eligible households have responded to the TTS surveys since 1986. It has not been possible to send personal letters to persons living in apartments and town-houses since 2001, due to a CRTC (Canadian Radio-television and Telecommunications Commission) ruling which prevented phone companies from supplying

⁸ In western Canada, travel surveys are undertaken to provide a synopsis of travel characteristics and identify emerging trends but the primary objective of these surveys is to support model development activities. The agencies involved are very concerned about obtaining a complete description of travel behaviour including off-peak trips by all modes. Whereas the TTS only records walk trips to and from work and school, the surveys carried out for the greater Vancouver and Victoria areas attempt to record walk trips for all trip purposes. However, they do not report on the detailed itineraries of transit users, as is the case in Toronto and Montreal. In Victoria and Vancouver, self-administered trip diary surveys are conducted using mail-back and web-based formats, with the respondents choosing their preferred mode, after having been recruited by telephone. These types of surveys are better at capturing discretionary travel and modes with smaller modal shares, but due to the higher costs per survey, the sample sizes are considerably smaller. For example, the most recent GVTA 2004 trip diary survey collected information on 24-hour weekday travel characteristics from a 0.53% random sample of the total 913,600 households in Lower Mainland.

⁹ "Recent Trends and Characteristics: Analysis of the 2004 Greater Vancouver Trip Diary Survey" Strategic Planning and Policy. June 7, 2005.

address information that was not included in their published phone books. The result of this change is that TTS interviewers are making cold calls that are much more likely to be ignored, even if messages are left in the voicemail describing the survey and asking for a call back to complete the interview. The solution to this problem will require an overhaul of the TTS sample frame so that the sample lists include all households and not just those with a landline.

- 6.2.3 Post-secondary students are also under-represented in the TTS sample lists for places like the City of Waterloo, which has a large student population that comes from outside the area, most of whom are not likely to live in local homes with landlines. Within the Census, most of these students are reported to be living with their parents in places like Toronto, instead of living in the communities where they live during the school year. Therefore, the Census does not provide any guidance on how large the problem is and what to do about it. Similar problems can be expected for cities like Guelph (Guelph University) and St. Catherine's (Brock University). A solution to this problem that has been used successfully in Waterloo and BC communities involves the use of supplementary sample lists, developed with the universities/colleges and local community officials who are familiar with and have access to information regarding student lodgings.

6.3 Recommendations

- 6.3.1 The under-representation of discretionary and off-peak trip making is a disadvantage of the TTS method. However, the advantages of the telephone survey method outweigh the disadvantages. There are other methods to estimate the extent and nature of this under-reporting and can be used to support research that is not fully supported by the TTS. Therefore, it is recommended that a travel diary survey be carried out in conjunction with the 2011 TTS. This would be applied to a sub-sample of individuals surveyed by the TTS who could be asked to participate in a more in-depth survey involving a paper diary or an online survey, much like the trip diary survey carried out in B.C. This detailed survey could be designed to better satisfy the requirements of modellers using disaggregate methods as well as the growing concerns about walking, biking, work at home, and off-peak travel behaviour.
- 6.3.2 The proposed supplementary travel survey should be designed to support state of the art modelling. "Given the shift towards 24 hour "activity based" or "tour based" models, rather than AM peak period trip based models, the current TTS survey design is far from ideal. This is because the TTS and similar surveys track trips rather than activities and tend to miss a high proportion of discretionary and off-peak travel. An activity based survey, using a diary format which encourages more complete reporting of activities and related travel, would support successful activity based modelling and the extensive research required to develop useful tour-based planning models that address 24 hour travel.¹⁰
- 6.3.3 Given the need for continuity and consistency, major changes to the survey methods should not be made to the TTS telephone survey methods for 2011 and future surveys. There are good reasons to believe that the telephone survey approach will continue to work relatively well assuming that appropriate changes are made to the TTS sample frame to address the under-representation of persons aged 15-44. As noted above, this will involve the use of new sample frames (lists) based on residential households, rather than telephone numbers. This

¹⁰ HCI's experience with available tour-based models during traffic and revenue studies for toll roads in Montréal and rapid transit facilities in Sydney, Australia suggests that they are inferior to traditional trip based models and could not be used with confidence.

will represent a return to the methods used for the 1979 Metro Toronto Travel Survey, which used data on residential households as the sampling frame (a source that provided complete mailing addresses for each potential sample household) and identified telephone numbers for the selected households using available telephone directories. However, in order to address the cell phone issue, it will be necessary to contact those households without landlines by mail to encourage participation, possibly by offering them an internet option.

- 6.3.4 The problems that appear to be associated with post-secondary students being under-represented in the TTS sample lists for places like the City of Waterloo will require further research involving the local communities and the relevant post secondary institutions that can provide contact information, if they can be convinced that this is both legitimate and useful. Our preliminary hypothesis is that a solution to this problem will require the development of supplementary lists, working with the universities, colleges and local community officials who are familiar with and have access to information regarding student lodgings. Since all students are assigned a university e-mail address, this may well be the best way to access the students who do not with their families within the community. However, research will be required to confirm that this is indeed the cause of the under-reporting of local transit trips and to identify the best ways to identify students living in the community while the TTS survey is underway.

Appendix A - "Toronto Area Transportation Data Study." Acres Consulting Services Limited. 1979.

Appendix B - TTC Use of TTS data and Madituc for Service Planning – William R. Dawson Paper

Appendix C - City of Mississauga briefing

Appendix D - Mississauga Transit briefing

Appendix E - Diabetes research

Appendix F - Traffic impact inputs (Cole Engineering Summary).