TRANSPORTATION TOMORROW SURVEY
1996

DESIGN AND CONDUCT OF THE SURVEY

FIRST REPORT OF THE 1996 SERIES

TRANSPORTATION TOMORROW SURVEY

1996

A Telephone Interview Survey on
Household Travel Behaviour in
Greater Toronto and the Surrounding Areas
Conducted in the Fall of 1995 and the Fall of 1996

DESIGN AND CONDUCT OF THE SURVEY

Prepared for the
Toronto Area Transportation Planning
Data Collection Steering Committee

by the

Data Management Group
University of Toronto
Joint Program in Transportation

December 1997

Participating Agencies:
Ministry of Transportation, Ontario • GO Transit • Municipality of Metropolitan Toronto
Toronto Transit Commission • Regional Municipality of Durham
Regional Municipality of Halton • Regional Municipality of Hamilton-Wentworth
Regional Municipality of Waterloo • Regional Municipality of Niagara
Regional Municipality of Peel • Regional Municipality of York • Town of Orangeville
Peterborough County • Simcoe County • Victoria County • Wellington County
City of Barrie • City of Guelph • City of Peterborough

Acknowledgments

Nineteen agencies were represented on the Technical Steering Committee that planned and directed the 1996 survey. The people who served on the technical committee were:

Tom AppaRao and Vello Soots, Chair	Ministry of Transportation
Arthur Gerlewych, Secretary	Ministry of Transportation
James Wong	Ministry of Transportation
Rick Newlove	City of Barrie
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John Barnes	Regional Municipality of York
Bernard Farrol	Toronto Transit Commission
Doug Munro	Toronto Transit Commission
Jack Tupling	Town of Orangeville

The advance letter and other publicity material were designed and prepared by a sub-committee chaired by John Barnes of the Regional Municipality of York.

The survey was managed by the Data Management Group at the University of Toronto. The management team consisted of:

Prof. Gerry Steuart	Director
Jerry Ng	Project Manager
Peter Dalton	General Manager

Administrative assistance was provided by Lorine Jung.

The hiring, training and supervision of interviewers were performed by a team of 6 people reporting to the General Manager:

Sharon Bawden	Team Leader
Jill Brownlee	Team Leader
Ian Fisher	Chief Supervisor
Claude Lurette	Operations Supervisor
Denise Osland	Team Leader
Ralph Seidermann	Team Leader

Cory Porter, of ADI Ltd., assisted with the initial recruitment and traning of interview staff.

Wayne Nichol, of the Toronto Transit Commission, and Daniel Badoe, of the Data Management Group, provided daily assistance in reviewing the logic and consistency of all the transit route information collected.

The Direct Data Entry and Sample Control Software were developed by Paul Sargeant of the BA Consulting Group. The geocoding software was developed by Jerry Ng.

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This report was prepared for the Toronto Area Transportation Planning Data Collection Steering Committee by the Data Management Group at the University of Toronto. The principal authors are Peter Dalton and Jerry Ng. The report was assembled and edited by Suzette Shiu. The authors would like to express their appreciation to the members of the Survey Technical Committee for their review and comments. The views and opinions contained in the report are those of the authors and do not necessarily reflect the positions of either the participating agencies or the Data Management Group.

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1. Introduction and Background

The 1996 Transportation Tomorrow Survey (TTS) is the third in a series of area-wide travel surveys conducted in Toronto and the surrounding regions. The previous surveys were in the fall of 1986 and the fall of 1991. In the current survey, the Regional Municipality of Waterloo was surveyed in October and November of 1995 and the rest of the TTS was surveyed between September and December of 1996. A total of 115,000 households were successfully interviewed. The survey area, which was significantly larger than the previous surveys, included the Regional Municipalities of Niagara and Waterloo, the Cities of Barrie, Guelph and Peterborough, the Town of Orangeville, the County of Victoria and partial coverage of the Counties of Peterborough, Simcoe and Wellington. Parts of Dufferin and Northumberland Counties were included although those agencies did not participate in funding the survey. These areas were in addition to the six Regional Municipalities (Metropolitan Toronto, Durham, Halton, Hamilton-Wentworth, Peel and York) that make up the Greater Toronto Area (GTA) and which were surveyed in both 1986 and 1991.

The survey was undertaken on behalf of the Toronto Area Transportation Planning Data Collection Steering Committee (TATPDCSC) which was formed in 1977 to coordinate data collection activities between agencies. The membership of the committee consisted of representatives from the Ministry of Transportation of Ontario, the six Regional Municipalities in the GTA, the Toronto Transit Commission and GO Transit. A larger technical committee, that included representatives from the other agencies, was formed for the purpose of conducting the 1996 survey. The survey was jointly funded by all the participating agencies.

The 1986 survey was the first comprehensive area-wide survey conducted in the Greater Toronto Area since 1964. The participating agencies have made extensive use of the 1986 TTS data. More than $7 billion was committed to future transportation projects, the need for which was indicated by the survey. The 1991 survey was a smaller scale update focusing primarily on those areas that had experienced above average population growth since the 1986 survey. However, comparison of the 1986 and 1991 survey results revealed that significant changes in travel behaviour were not restricted to the high growth areas. The 1996 survey is a full scale repeat of the 1986 survey with expanded geographic coverage. All three surveys were timed to coincide with the Canada Census.

2. Planning and Design

Planning for the 1996 survey started in the fall of 1994. An organizational structure was put in place that reflected the cooperative nature of the project. The Data Management Group at the University of Toronto was requested to prepare a proposal including budget estimates. The Data Management Group managed the 1991 survey and is the principal custodian of the data from all three surveys. The Ministry of Transportation initiated discussions with the agencies of the areas adjacent to the six regional municipalities surveyed in 1986 and 1991, inviting them to participate in the 1996 survey. The Regional Municipality of Waterloo requested that their region be surveyed in the fall of 1995 in order to provide timely input to a Regional Transportation Study that was already underway.

The survey questionnaire used in 1991 was reviewed and three additional questions were proposed for inclusion in the person data section. Those questions were:

1. Possession of a transit pass
2. Occupation
3. Whether they worked at home (only asked of people employed outside their home who did not make a trip to work)

These three questions were tested as part of the Waterloo component of the survey and were retained for the main part of the survey. The content of the rest of questionnaire was the same as in 1991 except for some minor revisions to the dwelling unit and trip purpose categories.

The Waterloo component of the survey was conducted using vacant office space provided in the head office of the Regional Municipality. The relative small scale of the Waterloo component of the survey provided an excellent opportunity to test new survey procedures and computer software revisions in a less demanding environment than the main survey. Significant changes were subsequently made to the sample control software to improve its performance.

Dwelling unit counts from the 1996 Canada Census have been used as control totals in expanding the survey data to represent the total population of the survey area. Preliminary expansion of the Waterloo data, prior to the availability of the Census data, was performed using dwelling unit estimates supplied by the Regional Municipality. The data from both parts of the survey were subsequently integrated into a single database containing the expansion factors based on the 1996 Census.

3. Survey Methodology

The same methodology was used in all three surveys. A random selection of households within the survey area was drawn from Bell Canada residential phone listings. Each of the selected households was sent an advance letter explaining the nature of the survey, why it was being done, who the sponsoring agencies were and advising the residents to expect a phone call from a trained interviewer. Interviews were conducted between 5 and 10 p.m. on weekdays and between 10 a.m. and 5 p.m. on Saturdays. Up to eight attempts were made to contact each household. In most interviews a single member of the household, the respondent, was asked to provide the person and trip information for all members of the household. Other members of the household were contacted if necessary to get complete information. Travel information was collected for the week day immediately prior to the day of the interview. Some interviews conducted on Saturdays were for trips made the previous Thursday in order to limit the over representation of Friday trips.

Significant advances have been made in the software and computer technology used to conduct travel surveys of this type. The 1986 TTS was the first large scale survey in Ontario to use automated geocoding. Geocoding refers to the use of grid coordinates to identify geographic locations instead of coding to a pre-defined zone system. The advantages of geocoding include the flexibility to subsequently assign the data to any zone system, greater accuracy in measuring travel distances and the ability to use automated look-up functions based on standard reference mapping.

Direct Data Entry (DDE) computer software was introduced as part of the 1991 survey. The DDE software prompts the interviewer with the appropriate script and enables the interview data to be recorded in the computer as the interview is in progress. In 1986 the interviewers used pencil and paper to record the responses. The advantages of DDE include a flexible interview script, based on the response to previous questions, better quality control through on-line logic and spelling checks, and elimination of data entry as a separate process.

The major advance in the 1996 survey was the in the use of a local area network to speed up the transfer of data to a central file server and to improve the management control. The 1991 survey used “stand alone” PCs.

4. Quality control

Good quality control over the data being collected was given a high priority throughout the conduct of the survey. The measures used to ensure accuracy and completeness included:

1. Adequate training and testing of interviewers prior to the conduct of live interviews
2. Visual and aural monitoring by supervisory staff of interviews in progress

3. Spelling and logic checks built into the Data Entry software
4. Visual review of printouts for all completed interviews
5. Daily monitoring of interview performance statistics
6. Call backs to obtain missing information or to verify inconsistencies
7. Logic checks built into the geocoding software
8. Quality control audit of selected households

The results of the survey have been validated through comparisons made with the 1986 and 1991 surveys data and with independent sources, including the Canada Census, Cordon Counts, transit ridership data and post secondary school enrollment. Basic demographic information is in close agreement with the census. Peak period trips by all modes appear to be accurately reported as are trips associated with work and school trips. There is strong evidence that off-peak discretionary trips, mainly made by automobile, have been under reported. Transit trips appear to be accurately reported with the exception of off-peak use of streetcars in the downtown of Toronto. Total daily streetcar use is under reported by one third. These results are consistent with the findings from the validation of the 1986 and 1991 surveys. Other checks performed on the data for the three surveys revealed a high degree of consistency in trip length distribution, mode split as it relates to socio-demographic factors and many other travel behaviour characteristics.

5. Survey Statistics

	1986 TTS	1991 TTS	1996 TTS
Number of households in the survey area	1.47 Million	1.71 Million	2.32 Million
Target sample	5%	High growth 4.5% Low growth 0.5%	5%
Completed sample	4.2%	1.4%	5.0%
Sample used (approximate number of letters mailed)	102,606	34,167	158,753
Valid contacts	83,764	27,813	139,952
Refusal rate (of valid contacts)	25.9%	11.4%	21.8%
Completion rate (of sample used)	60%	72%	70%
Final Database			
Household records	61,453	24,507	115,193
Person records	171,086	72,496	312,781
Trip records	313,633	142,453	587,676
Transit records	56,615	14,896	70,295
Mean household size (expanded data)	2.77 persons	2.77 persons	2.71 persons
Trips per person 11 or older	2.35	2.54	2.48
Interview stations	86	33	120
Interviewers & Supervisors recruited	390	75	300
Coding staff	n/a	6	17

The above interview station and staffing statistics exclude the Waterloo component of the 1996 survey.

6. Survey Cost

The budget established for the survey, including development, report production and analysis was $2.374 million. A cost saving of approximately $75,000 was realized by using the Government of Ontario phone system and inter-city communications network. Staff supervision and computer equipment costs were also

below budget. The savings on these items were used to finance additional post survey analysis and applications. The following table provides a breakdown of actual expenditures

Development and Testing	$ 232,000
Conduct of the survey	$ 1,197,000
Analysis and Reports	$ 309,000
Management and Coordination	$ 636,000
Total Expenses	**$ 2,374,000**

The next table gives a breakdown of the direct costs associated with the conduct of the survey and compares them with the costs of the 1986 and 1991 surveys. Inflation factors of 40% and 10% have been used to adjust the 1986 and 1991 costs to 1996 values. The 1986 survey had a very different management organization from the 1991 and 1996 surveys. It should be noted that the 1986 survey costs do not include any allowance for the substantial amount of time that agency staff spent managing and directing the survey.

Interviewing costs per interview were higher in both 1991 and 1996 than in 1986 largely due to the premium wage rates paid to attract good interview staff, the result of a strong recommendation that came out of the 1986 survey. The higher interview costs are more than off set by savings in post interview processing.

The 1996 survey benefited from the continuity of development since 1986 as well as the staging of the Waterloo component and the conduct of the 1995 Ottawa survey. Some cost savings also resulted from the overall size of the survey and the economies of scale. These factors need to be taken into account when the cost of future surveys as do the savings resulting from the use of the Government phone system and the provision of office space by the sponsoring agencies.

Cost Comparison (1996 $)

	1986 TTS Costs		1991 TTS Costs		1996 TTS Costs	
	Total	Per Completed Interview	Total	Per Completed Interview	Total	Per Completed Interview
Variable Costs (Directly related to the number of interviews conducted)						
Interviewing	$ 445,000	$ 7.24	$ 229,000	$ 9.34	$ 886,700	$ 7.70
Coding	$ 466,000	$ 7.58	$ 55,000	$ 2.24	$ 132,200	$ 1.15
Miscellaneous	$ 158,000	$ 2.57	$ 59,000	$ 2.41	$ 177,300	$ 1.54
Total variable Cost	**$ 1,069,000**	**$17.40**	**$ 343,000**	**$ 14.00**	**$1,196,200**	**$ 10.38**
Fixed Costs (Not directly related to the number of interviews conducted)						
Pilot Survey & Pretests	$ 52,000	$ 0.85	$ 17,000	$ 0.69	$ 85,600	$ 0.74
Management	$ 123,000	$ 2.00	$ 177,000	$ 7.22	$ 416,800	$ 3.62
Other Costs	$ 91,000	$ 1.48	$ 4,000	$ 0.16	$ 219,500	$ 1.91
Total Fixed Costs	$ 266,000	$ 4.33	$ 198,000	$ 8.08	$ 721,900	$ 6.27
Total Cost (Excluding analysis and reports)	**$ 1,335,000**	**$21.72**	**$ 541,000**	**$22.07**	**$1,918,600**	**$16.65**

7. Conclusions and Recommendations

The desired target of a 5% sample was achieved on schedule and within the approved budget. Early indications are that the quality of the data is excellent for a wide range of applications including the planning of transportation facilities to meet peak period demands, the analysis of home to work and home to school travel linkages, and the analysis of travel behaviour as it relates to household socio-economic and demographic characteristics. The most serious deficiency is a significant under reporting of off-peak discretionary travel by automobile. This under reporting is common to all three TTS and is likely a result of the survey methodology which relies on a single individual being able to recall and report on the travel movements of all members of a household without having kept a written diary.

The continuity of development since 1986 has resulted in survey procedures and computer software technology which is highly effective and efficient at collecting large amounts of travel behaviour data for use in transportation planning. The provision of the survey site facility by one of the sponsoring agencies, as was done in both Waterloo and Toronto, contributed significantly to overall survey management and administration efficiency.

It is recommended that the 1996 TTS be used as the model for the conduct of a similar scale urban travel survey in the year 2006. A smaller scale survey, focusing primarily on global trends, trip generation rates and mode choice behaviour, is recommended for the year 2001. A number of possible improvements in the survey procedure have been identified but the benefits from implementing them are likely to be small relative to the other advances that have been made since 1986. It is recommended that envelopes bearing the official provincial government logo be used for the mailing of the advance letter to each household.

The most serious problem encountered during the conduct of the main Toronto component of the 1996 survey, was the inability to recruit an adequate number of staff with the experience and ability to perform supervisory functions. The problem would have been more serious had it not been for the availability of some staff from the conduct of the Waterloo and Ottawa surveys the previous year The supervisory problem needs to be addressed if another survey of the same magnitude is to be performed in the future. The recommended solution is to have a staged approach, as was done with Waterloo, but on a larger scale. Including all the areas external to the GTA in the initial stage would be a convenient size and would preserve the time series integrity of the data for the GTA. The same survey site should be used for both stages in order to increase the likelihood of staff retention.

1. Introduction

The Transportation Tomorrow Survey (TTS) is a comprehensive travel survey conducted in the Greater Toronto Area (GTA) once every five years. The TTS is a joint undertaking by the agencies represented on the Toronto Area Transportation Planning Data Collection Steering Committee (TATPDCSC). The Committee was established in 1977 for the purposes of setting common transportation data collection standards and for coordinating data collection and dissemination between the member agencies. Membership of the committee includes Metropolitan Toronto, the Regional Municipalities of Durham, York, Peel, Halton and Hamilton-Wentworth, the Toronto Transit Commission, GO Transit and the Ontario Ministry of Transportation.

The first TTS, conducted in 1986, obtained completed interviews for a 4.2% random sample of all households in the GTA. After the completion of the 1986 survey, the Data Management Group was formed at the University of Toronto to manage and distribute the 1986 TTS data. The Data Management Group was also requested to manage the second TTS undertaken in 1991. The 1991 survey was a smaller update of the 1986 survey focusing primarily on those geographic areas that had experienced high growth since 1986. The survey area was expanded slightly to include a band approximately one municipality deep surrounding the outer boundary of the GTA for the purpose of obtaining more complete travel information in the fringe areas of the GTA.

The 1996 TTS is a new survey, not an update. Agencies outside the GTA were invited to participate in the 1996 survey if they so wished. The survey area was expanded to include the Regional Municipalities of Niagara and Waterloo, the Counties of Wellington, Simcoe and Victoria and Peterborough, the Cities of Guelph, Barrie and Peterborough and the Town of Orangeville. Interviews were completed for a 5% random selection of households throughout the survey area. A technical sub-committee of TATPDCSC was established that included representation from all the participating agencies. The Data Management Group was responsible for all aspects of the management of the survey.

The 1996 TTS, with approximately 115,000 completed household interviews, is one of the largest travel surveys ever undertaken anywhere. The approach taken represents a continuation of the experience and development from the 1986 and 1991 surveys. The telephone survey methodology, on-line Direct Data Entry (DDE) and automated geocoding of all geographic information were adopted as the proven most cost effective and reliable means of collecting large quantities of travel data. The most significant change in the data collection process was the use a networked computer system for improved efficiency and quality control. The 1991 TTS used DDE software but on stand alone computers. Diskettes were used after each interview session to transfer the data to the sample control computer and to obtain new sample for the next session.

2. Planning and Organization

The selection of the Data Management Group to manage the 1996 survey ensured continuity from the initial planning and design of the survey through to the dissemination of the final database and subsequent analysis of results. The selection also took advantage of the experience gained from the 1986 and 1991 surveys, ensuring consistency in methodology and results.

2.1 Organization

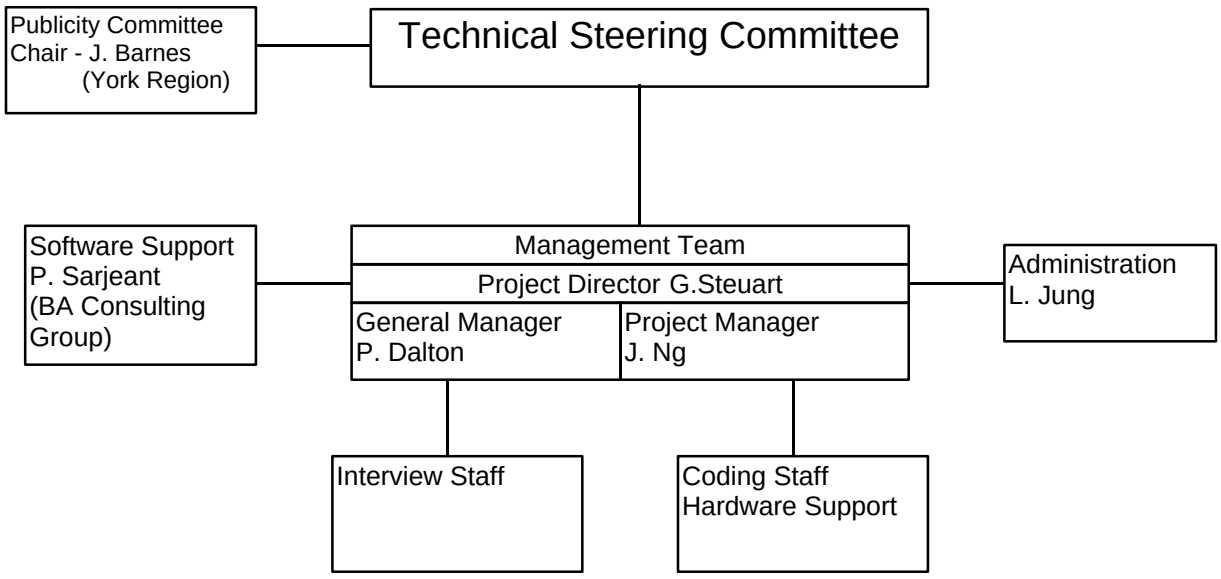
Exhibit 2.1.1 shows the reporting relationships adopted for the survey. The Technical Steering Committee consisted of a representative from each of the participating agencies. It met once every two to three months to receive progress reports from the Project Director, Gerald Steuart, and to make, or confirm, decisions on critical items.

The Data Management Group appointed a Project Manager, Jerry Ng, and a General Manager, Peter Dalton, who, together with the Project Director, formed the Management Team. The responsibilities of the Project Manager included the design of the initial component of the survey in the Regional Municipality of Waterloo, computer hardware and the coding of the survey data. The General Manager was responsible for the conduct of the interviewing in the main survey. All three team members were involved in the conduct of the 1986 and 1991 surveys. The Management Team met on an informal basis about once a week, to discuss all aspects of the design and conduct of the survey.

A special sub-committee was established to design and coordinate the distribution of publicity material including press releases and the notification of local officials within the survey area. This committee was chaired by John Barnes, of the Regional Municipality of York, and reported to the Technical Steering Committee. Membership consisted of one representative from the Ministry of Transportation Communications Branch (John Shragge), the survey chief supervisor (Ian Fisher) and a representative of the non-GTA agencies on the Steering Committee (Richard Newlove of the City of Barrie).

Paul Sarjeant, of BA Consulting Group, was retained to write the Direct Data Entry and Sample Control Software. Mr. Sarjeant developed the software used in the 1991 survey. He also provided technical support for the operation of the computer network. The fileserver used for the main survey was purchased by BA Consulting Group who then rented it to the Data Management Group for the duration of the survey.

Exhibit 2.1.1 1996 TTS Organization Chart



2.2 Survey Design

The success and cost effectiveness of the 1986 and 1991 surveys, together with the need for a consistent time series, resulted in the same survey methodology being adopted for the 1996 survey. The basic methodology consisted of an advance letter mailed to each of the selected households followed, about a week later, by a telephone interview to collect demographic data and travel information for the previous week day for each member of the household. A universal coordinate system was used to record geographic information to allow assignment to any zone system.

The computer software developed for the 1991 survey was used as a base for the 1996 survey but substantial rewriting of all three components (data entry, sample control and geocoding) were required to take advantage of the network capability and to accommodate other improvements identified since the 1991 survey.

Representatives from the Regional Municipality of Waterloo requested that their region be surveyed in the fall of 1995 in order to provide timely input to their transportation master plan. The conduct of the Waterloo component a year in advance of the rest of the survey provided a valuable opportunity to test and refine the computer software in an environment where software performance was not critical due to the smaller scale of the survey. The survey also benefited from the use of similar software for the 1995 TRANS survey in Ottawa and Hull. Significant improvements in software performance were achieved as a result of both the Ottawa and Waterloo surveys.

Two small scale pretests were carried out prior to the Waterloo component of the survey to test changes made to the data entry software.

Exhibit 2.2.1 provides a summary of key events leading up to the completion of the 1996 TTS.

Exhibit 2.2.1 Schedule of Key Events

1977	Formation of the Toronto Area Transportation Planning Data Collection Steering Committee (TATPDCSC)
Fall 1986	Conduct of the 1986 TTS (61,708 households interviewed)
August 1988	Release of the 1986 TTS database (Version 2.0)
August 1988	Data Management Group formed at the University of Toronto
December 1989	Data Management Group appointed to manage the 1991 TTS
Fall 1991	Conduct of the 1991 TTS (24,507 households interviewed)
June 1992	Release of the 1991 TTS database (Version 2.1)
January 1995	Data Management Group appointed to manage the 1996 TTS
March 1995	BA Consulting Group retained to update the Direct Data Entry and Sample Control software
June 1995	First meeting of Survey Technical Committee
June 1995	Pretest of Direct Data Entry Software (15 Interviews)
August 1995	Pilot of TRANS survey in Ottawa (402 Interviews)
Sept-Dec 1995	TRANS survey in Ottawa (21,707 households interviewed)
Sept. 18/19 1995	Second pretest for Waterloo survey (14 live & 50 simulated interviews)
Oct./Nov. 1995	Conduct of the Waterloo component of the 1996 TTS (7,556 interviews completed)
March 1996	590 Jarvis Street, Toronto, selected as the survey site.
May 1996	National census (Statistics Canada)
July 1996	Installation and testing of phones, computer systems and software
August 1996	Initial recruitment and training of interview staff
Sep-Dec 1996	Conduct of the main portion of the 1996 TTS (108,850 households interviewed)

2.3 Survey Content

All participants agreed that a fundamental requirement was consistency with the 1986 and 1991 survey data. This requirement dictated the survey methodology (telephone interview), a core block of questions that had to be asked, and most of the definitions used. Other than the scale of the survey, the most significant change, relative to the 1991 survey, was the adaptation of the Direct Data Entry and Sample Control Software to take advantage of the efficiencies and management capabilities offered by the networked computer system. Changes in survey content were minor in comparison.

Three questions were added to the person section of the 1991 survey instrument. Those questions were:

1. Possession of a transit pass
2. Occupation
3. Whether or not the person worked at home on the trip day (only asked if a person was employed full time outside the home but did not make a trip to work on the survey trip day).

The question about occupation proved to be the most difficult to implement requiring the pretesting of several options. Three different methods of recording the response to the question "What is your occupation?" were identified:

1. to have the interviewer enter the response in full for subsequent categorization during coding;
2. to have the interviewer categorize the response immediately from a short list of options displayed on the data entry screen;
3. to have the interviewer read a list of occupational categories for the respondent to choose from.

Option 1 was pretested but resulted in a wide variety of responses including mixed descriptions of type of work, level of responsibility and employment segment. Statistics Canada has compiled a list of over 2000 job codes using a similar survey methodology but even with that list as a reference database it was found to be impossible to categorize the responses in a consistent and meaningful manner.

Option 2 was subsequently pretested and adopted. The categories of occupation were chosen as being likely to have meaningful differences in socio-economic characteristics and travel behaviour as well as being easily distinguishable. The four categories were:

- General Office
- Manufacturing and Construction
- Sales & Service
- Professional/Management

Option 3 was not tested due to the expectation that it would be time consuming. This method, however, was adopted for use in the Ottawa survey.

Two changes were made to the response categories of the existing questions contained in the 1991 survey:

1. Townhouse was added as a new category of dwelling unit.
2. Shopping was added as a separate category under trip purpose. In 1991 shopping trips were recorder as part of the "other" category.

The resulting survey consisted of the following questions:

2.3.1 Household Data

- Home Location
- Type of dwelling unit
- Number of persons

- Number of vehicles available for personal use

2.3.2 Person Data

- Gender
- Age
- Possession of a driver's license
- Possession of a transit pass
- Employment status
- Occupation
- Usual work location
- Availability of free parking at place of work
- Status as a student
- Usual school location
- Origin of first trip

2.3.3 Trip Data (Only collected for persons 11 and older)

- Location of destination
- Purpose
- Start time
- Method of travel

2.3.4 For Trips made by Public Transit

- Method of access
- Sequence of transit routes (maximum of 5)
- Method of egress
- Boarding station (when a car is used for access to a rail route)
- Egress station (when a car is used for egress from a rail route)

Details of all the response categories and definitions are contained in both the Interview Manual (Working Paper #1) and the Data Guide.

2.4 Waterloo Survey

Staff from the Regional Municipality of Waterloo requested that their Region be surveyed in the fall of 1995 to provide results in time for input for their Regional Transportation plan. The Waterloo survey also served as a pilot for the main part of the survey enabling the computer software and hardware to be tested in a less demanding environment. The management organization was the same as that for the main survey. Mr. Ian Fisher was retained as chief supervisor of the interview staff with the expectation that he would have the primary responsibility for training the interview staff for the main survey. Mr. Fisher was the chief supervisor in both the 1986 and 1991 TTS and also assisted with the training of interview staff for the Ottawa survey.

The Region of Waterloo provided office space for the conduct of the survey at their Regional office in downtown Kitchener. Office furniture and the phone system were also provided by the Region as part of the same agreement. Equipment that had to be purchased included computer hardware, software and telephone headsets, most of which were retained for use in the main part of the survey.

Revisions to the software from the 1991 survey commenced in April 1995 in conjunction with the development of similar software for use in the 1995 TRANS survey in Ottawa. Two small scale pretests were conducted in Toronto in July and August to test the operation of the software and the content of the survey with particular references to the changes made in the software.

The survey site was available near the end of September and was equipped to accommodate a maximum of 22 interviewers working at the same time. The computer equipment consisted of 16 interviewing stations, six coding stations, three monitoring stations, one sample control computer and one file-server. The coding stations were also set up to for use as interview stations if required.

The 5% sample requirement translated into a target of 7,500 completed interviews. A 9% sample of residential phone listings randomly distributed across the Region was purchased from Bell Canada in two stages. The first listing, obtained in August, excluded households in the City of Waterloo.

The second listing, for the City of Waterloo, was obtained in mid October. The reason for the two stage approach was to obtain a better representation of the student population at the University of Waterloo by drawing the sample for that area after the start of the school year.

The survey commenced on Wednesday October 11, 1995 and ended on Thursday December 7, 1995. A total of 35 interviewers, three interview supervisors and three geocoders were recruited and trained. A total of 7,820 interviews were completed successfully of which 264 were subsequently discarded as being incomplete or outside the Regional Municipality. An interim database was created using expansion factors based on dwelling unit data supplied by the Regional Municipality. After the conduct of the main survey in 1996 the two databases were combined and new expansion factors were calculated using 1996 Census data.

2.5 Interview Premises

The Management Team identified the potential for cost reduction by having the funding agencies provide the office space, furniture and office support services for the conduct of the survey. The Waterloo survey served as a good model in this regard. The arrangement was also beneficial in allowing the project Management Team to concentrate their efforts on the actual conduct of the survey and proved more flexible with respect to timing. Several of the agencies had vacant office space that they were prepared to make available to the survey in return for a reduction in their share of the total survey cost.

Agencies that were prepared to make space available included the Corporation of Metropolitan Toronto, the Regional Municipalities of Durham and Halton, the City of Barrie and the Ministry of Transportation in Downsview. The Management Team recommended against the suggestion that it might be possible to make shared use of office space and computer equipment with other staff and functions unrelated to the survey. Previous experience indicated that a survey of this magnitude required specialized software and dedicated computer equipment in operation 24 hours a day. The interview stations must be accessible at all times, not just during interviewing hours.

Consideration was given to splitting the survey between two or more sites. Although attractive in terms of having access to a larger labour market, the Management Team recommended against that option because of the organizational and supervisory problems it would create in setting up and managing several sites simultaneously. The requirement was therefore to have a single location with exclusive use of approximately 12,000 square feet.

Serious consideration was given to potential sites outside the Toronto area largely because of the very positive experience in recruiting and training quality interviewers for the Waterloo survey. The potential labour market represented by the City of Barrie, however, was considered to be too small to be able to recruit the number of interviewers and coders required for a survey of this size.

A downtown site within Metro Toronto was considered to be much preferable to a suburban location such as the Ministry of Transportation office in Downsview. The recruitment of mature, reliable interviewers had proven much easier in the 1991 survey, done at the University of Toronto, than in the 1986 survey carried out at a suburban location. The availability of high quality late night transit service with secure access proved to be very important.

The site finally selected was in the building belonging to Metropolitan Toronto at 590 Jarvis Street. The survey site occupied the whole of the third floor consisting of 15,000 square feet of mostly open office space. The office was a few minutes walk, on major thoroughfares, from subway stations on both subway lines and provided free parking. The parking was a benefit primarily to the Management Team, only about 5% of the interview and coding staff made use of it. Metropolitan Toronto provided the necessary desks, tables and chairs to furnish the space and rented partitions for the interviewing stations, which were primarily for sound attenuation.

The survey management staff were able to occupy part of the space in early July with the remainder becoming available in early September. The space was vacated in mid January on completion of the coding and coding related telephone call backs.

2.6 Sample Design

The target for the survey design was to achieve completed interviews for a 5% random selection of households throughout the survey area. The listing of households included in the survey was obtained from Infodirect, a subsidiary of Bell Canada. The sample frame consisted of listed residential phone numbers within the boundaries of the survey area defined as accurately as possible by postal codes. Households without phones, or with unlisted phone numbers, were excluded from the sample frame while households with multiple listed phone numbers were represented more than once. The extent to which these differences in the sample frame affect the results of the survey is not known. The 1986 and 1991 surveys produced no evidence of significant bias that could be attributed to this factor.

One concern was to obtain a proper representation of post secondary students in the sample. According to Infodirect, their computer files were updated with new phone listings once a month with the updated sample frame being available at the beginning of the week that follows the first Tuesday of the month. An initial order was placed for the purchase of three phone list sample selections. The first list, used for staff training, was purchased in July. The second list, consisting of the entire sample for the GTA was drawn prior to the start of the survey to be consistent with the 1986 and 1991 TTS. Phone listings for students moving into college residences were not likely to become part of the sample frame until October. The sample selection for the external areas (the third list) was delayed until the second week of October to get a better representation of the student population. A supplementary order was subsequently placed in order to correct for under reporting in certain areas.

2.7 Sample Selection

The survey was divided into three areas for the purpose of drawing the sample.

2.7.1 Area #1 GTA

All postal codes beginning with the characters

M (Metro Toronto)			L1	L5	L6	L7	L8			

Forward Sortation Areas

L0A	L0B	L0C	L0E	L0G	L0H	L0J	L0P			
L3P	L3R	L3S	L3T	L3X	L3Y					
L4A	L4B	L4C	L4E	L4G	L4H	L4J	L4K	L4L		
L4P	L4S	L4T	L4V	L4W	L4X	L4Y	L4Z			
L9A	L9B	L9C	L9G	L9H	L9J	L9K	L9L	L9N	L9P	L9T

Local Delivery Units

L0N 1A0	ALTON	L0N 1C0	CALEDON VILLAGE

L0N 1E0	CALEDON EAST	L0N 1K0	INGLEWOOD
L0N 1P0	PALGRAVE	L0R 1A0	ALBERTON
L0R 1C0	BINBROOK	L0R 1H0	CARLISLE
L0R 1H1	CARLISLE	L0R 1H2	CARLISLE
L0R 1H3	CARLISLE	L0R 1J0	COPETOWN
L0R 1K0	FREELTON	L0R 1P0	HANNON
L0R 1R0	JERSEYVILLE	L0R 1T0	LYNDEN
L0R 1V0	MILLGROVE	L0R 1W0	MOUNT HOPE
L0R 1X0	ROCKTON	L0R 1Z0	SHEFFIELD
L0R 2B0	TROY		
L0R 2H0	WATERDOWN	L0R 2H1	WATERDOWN
L0R 2H2	WATERDOWN	L0R 2H3	WATERDOWN
L0R 2H4	WATERDOWN	L0R 2H5	WATERDOWN
L0R 2H6	WATERDOWN	L0R 2H7	WATERDOWN
L0R 2K0	WEST FLAMBOROUGH	L0R 2M0	WATERDOWN

2.7.2 Area #2 (External to the GTA)

All postal codes beginning with the characters

L2

Forward Sortation Areas

K9H K9J K9K K9L K9V

L0S

L3B L3C L3K L3M L3Z

L4M L4N

L9R L9V L9W L9X

N1C N1E N1G N1H N1J N1K N1L N1M

N3L

Local Delivery Units

K0L 1B0	BAILIEBORO	K0L 2G0	KEENE
K0L 1H0	BRIDGENORTH	K0L 2H0	LAKEFIELD
K0L 1R0	CURVE LAKE	K0L 2V0	NORWOOD
K0L 1S0	DOURO	K0L 2W0	OMEMEE
K0L 1T0	ENNISMORE	K0L 2X0	REABORO
K0L 1V0	FRAZERVILLE	K0L 3A0	WARSAW
K0L 2B0	INDIAN RIVER	K0L 3B0	WESTWOOD
K0L 2C0	JUNIPER ISLAND	K0L 3G0	YOUNGS POINT
K0L 2E0	KAWARTHA PARK		

K0L 3H0	CENTURY VILLAGE LANG
K0M 1A0	BOBCAYGEON
K0M 1B0	BOLSOVER
K0M 1C0	BURNT RIVER
K0M 1E0	CAMBRAY
K0M 1G0	CAMERON
K0M 1K0	COBOCONK
K0M 1L0	DUNSFORD
K0M 1N0	FENELON FALLS
K0M 2A0	KINMOUNT
K0M 2B0	KIRKFIELD
K0M 2C0	LITTLE BRITAIN
K0M 2J0	MANILLA
K0M 2L0	NORLAND
K0M 2M0	OAKWOOD
K0M 2T0	WOODVILLE
L0A 1A0	BETHANY
L0A 1K0	PONTYPOOL
L0B 1K0	JANETVILLE
L0K 1A0	BEAVERTON
L0A 1CO	CAVAN
L0A 1G0	MILLBROOK
L0L 1C0	BELL EWART
L0L 1K0	CHURCHILL
L0L 1L0	COOKSTOWN
L0L 1N0	EGBERT
L0L 1P0	ELMVALE
L0L 1R0	GILFORD
L0L 1V0	HILLSDALE
L0L 1W0	LEFROY
L0L 1X0	MIDHURST
L0L 1Y0	MINESING
L0L 2K0	PHELPSTON
L0L 2M0	STROUD
L0L 2N0	THORNTON
L0M 1B0	ANGUS
L0M 1C0	BORDEN
L0M 1G0	CREEMORE
L0M 1H0	DUNTROON
L0M 1J0	EVERETT
L0M 1K0	GLENCAIRN
L0M 1L0	GLEN HURON
L0M 1M0	LISLE
L0M 1N0	NEW LOWELL
L0M 1P0	NOTTAWA
L0M 1S0	STAYNER
L0M 1T0	UTOPIA
L0R 1B0	BEAMSVILLE
L0R 1B1	BEAMSVILLE
L0R 1B2	BEAMSVILLE
L0R 1B3	BEAMSVILLE
L0R 1B4	BEAMSVILLE
L0R 1B5	BEAMSVILLE
L0R 1B6	BEAMSVILLE
L0R 1B7	BEAMSVILLE
L0R 1B8	BEAMSVILLE
L0R 1E0	CAISTOR CENTRE
L0R 1M0	GRASSIE
L0R 1Y0	ST ANNS
L0R 2A0	SMITHVILLE
L0R 2J0	WELLANDPORT
L0R 1G0	CAMPDEN
L0R 1S0	JORDAN STATION
L0R 2C0	VINELAND
L0R 2E0	VINELAND STATION
L0R 2N0	BEAMSVILLE
N0B 1B0	ARISS
N0B 1C0	ARKELL
N0B 1H0	BALLINAFAD
N0B 1J0	BELWOOD
N0B 1P0	EDEN MILLS
N0B 1S0	ELORA

N0B 1T0	ERIN	N0B 2K0	ROCKWOOD
N0B 1Z0	HILLSBURGH	N0B 2K9	ROCKWOOD
N0B 2C0	MORRISTON	N0C 1M0	SINGHAMPTON
N0B 2J0	PUSLINCH		

2.7.3 Area #3 (Northumberland)

Forward Sortation Areas

L1A

Local Delivery Units

K0K 1C0	BALTIMORE
K0K 2E0	GORES LANDING
K0K 2H0	HARWOOD
L0A 1B0	CAMPBELLCROFT

The County of Northumberland was not one of the agencies participating in the survey but was included primarily to provide more complete information on trips to and from the GTA (Durham Region). The area was surveyed in the last week of interviewer training prior to the start of the survey proper.

2.7.4 Sample Selection 1.

This selection, used for staff training, was drawn the week of July 8th after the June updates of phone listings had been completed. There were two parts to the sample selection:

Part A - A random selection of 8,000 households drawn from the combined sample frame for Areas 1 & 2.

Part B - A random selection of 1 in 12 households from the sample frame for Area 3.

2.7.5 Sample Selection 2.

This selection was drawn the week of August 12th (after the July updates were complete). The sample consisted of a random selection of 1 in 12 households from the sample frame for Area 1 after removal of households contained in the first sample selection.

2.7.6 Sample Selection 3.

This selection was drawn the week of October 7th (after the September updates were complete). The sample consisted of a random selection of 1 in 12 households from the sample frame for Area 2 after removal of households contained in the first sample selection.

The use of more sample than was expected for training purposes and a lower than expected response rate in some areas, most notably parts of Niagara Region, resulted in the need to obtain additional sample during the course of the survey. An additional random selection of 10,000 households in the GTA and 5,000 households outside the GTA were obtained at the end of November.

2.8 Mailing Plan

On receipt of each sample selection a random number was assigned to each household record. The records were then sorted by the random number and assigned to mailing blocks. An electronic copy of the address information was provided to a commercial mailing house (Westminster International) who was contracted to mail the advance letter to each household. An initial mailing plan, shown in Exhibit 2.8.1, was prepared through discussion with the mailing house. The plan called for the mailing blocks to be grouped into four

waves that would be sent to the mailing house one at a time. The mailing house prepared all of the mailings in one wave at the same time, holding the individual blocks until the actual mailing date requested. The mailings qualified for bulk postage rates representing a saving of more than 40% relative to first class postage.

The mailing plan was modified according to circumstances and special requirements as the survey progressed. The first few mailing blocks in Wave 3 contained a high proportion of sample from sample selection 3 in order to achieve a uniform percentage coverage throughout the survey area well before the end of the survey. The later blocks in Wave 3 were randomly distributed across the entire survey area. Wave 4 was reduced to a single mailing block of approximately 15,000 households pre-selected predominantly from areas that had experienced a below average response rate prior to the mailing date.

The information supplied by Infodirect for each household in the sample list consisted of:

- Name
- Street Address
- Municipality
- Postal code
- Phone number

CRTC regulations, introduced in 1991, restricted Infodirect from supplying information that is not contained in the telephone directory. Apartment numbers are generally not included in directory listings for Metropolitan Toronto and some surrounding areas. Unlike the sample obtained for the 1986 and 1991 surveys there was also no flag to distinguish between single and multiple dwelling units. It was not possible to identify households with incomplete address information due to missing apartment numbers. These letters were therefore mailed with the others with the hope that most would be delivered despite the missing information.

Exhibit 2.8.1 Mailing Plan

Drop #	No. of letters	Area	Mailing Date	First Interview
		Wave 1 (Training)		
1	2500	Survey area	July 31	August 6
2	5000	Survey area	August 13	August 19
3	500	Northumberland	August 20	August 27
		Wave 2 (GTA)		
4	5000	GTA	August 28	September 4
5	10000	GTA	September 5	September 12
6	10000	GTA	September 13	September 20
7	12000	GTA	September 23	September 30
8	12000	GTA	September 30	October 8
9	12000	GTA	October 9	October 16
		Wave 3 (Entire survey area)		
10	12000	Survey area	October 16	October 23
11	12000	Survey area	October 23	October 30
12	12000	Survey area	October 30	November 6
13	12000	Survey area	November 6	November 13
14	12000	Survey area	November 13	November 20
		Wave 4 (Entire survey area - sampling rates adjusted to reflect completions)		
15	12000	Survey area	November 20	November 27
16	12000	Survey area	November 26	December 3
17	12000	Survey area	December 2	December 7

2.9 Sample Control

Prior to each wave being sent to the mailing house each record was given a permanent 6 digit identification number and was assigned to one of 50 coding areas based on the postal code in the address. The coding areas were defined to have approximately equal population. The records were then added to the sample queue on the central file-server. The sample control software allocated records in the sample queue to individual interview stations. The software always allocated the first unused record in the sample that met the following criteria:

- the mailing block containing the record was active,
- the Forward Sortation Area containing the household was active, and
- the coding area number lay within a specified range for the interview station requiring sample.

Management control features designed into the sample control software permitted the following functions to be performed as needed:

- the activation of a new mailing block
- setting the queue length for each interview station
- activation/de-activation of unused sample for any FSA
- setting the range of coding area numbers that could be assigned to each interview station

Changing the work station allocation or FSA activation did not affect records that had already been assigned to a work station regardless of whether or not an interview had been attempted.

Sample control consisted of daily monitoring of completion statistics to determine:

- any changes required in the mailing schedule
- the appropriate time to activate a new mailing block
- the allocation of coding areas to interview stations
- the appropriate allocation of interview staff to interview stations
- the de-activation of FSAs that had achieved their completion targets

As a general rule a new mailing block would not be activated until the previous blocks were exhausted for all geographic areas. Some re-allocation of interview staff and/or coding areas were frequently necessary to maintain full productivity.

2.10 Publicity

The primary item of publicity was the advance letter sent to the households in the selected sample. Other items included a bilingual press release and letters to local government and public service officials.

2.10.1 Letter to Local Officials

Exhibit 2.10.1 is a copy of the letter sent by the General Manager advising local officials of the conduct of the survey. Two weeks prior to the start of the survey this notification letter was sent to a list of people supplied by each of the funding agencies. The lists were generally made up of the following officials:

- Federal and Provincial Members of Parliament
- Regional Chairpersons
- Mayors, Reeves and County Wardens
- Local Councillors
- Police Departments
- Chambers of Commerce

2.10.2 Press Release

A press release package was sent to all newspapers, television and radio stations in the survey area. Packages for the news media within the GTA were planned to go out in mid August but due to delays in production did not get sent out until the first week of September. Packages to the media outside the GTA were sent out in early October prior to the start of interviewing in those areas. A copy of the press release package is contained in the appendix.

2.10.3 Advance Letter

The advance letter sent to all selected households was regarded as a critical item in the conduct of the survey to encourage a high response rate and minimize the time interviewers needed to spend explaining reasons for the survey. The letter was prepared by the chairman of the Publicity Committee. A copy of the advance letter is contained in the appendix.

For the 1986 and 1991 surveys, a different version of the advance letter was prepared for each of the participating regions. The body of the text was the same but the signature was that of the respective Regional Chairperson in addition to the signature of the Minister of Transportation. For the 1996 survey it was decide to have one letter signed by all the senior elected officials representing the 16 participating agencies. The use of a single letter reduced printing costs and simplified the mailing procedures. It was also felt that having all 16 signatures on one letter would emphasize the cooperative nature of the project. The Ministry of Transportation elected to de-emphasize their role in the survey preferring to stress the lead taken by the Regions and Municipalities. The Minister of Transportation did not sign the advance letter nor did any representative of the Toronto Transit Commission or GO Transit.

Two hundred thousand copies of the letter were printed based on a completion target of 110,000 and an expected overall completion rate of more than 60%. Five hundred copies of the letter were printed with just the General Manager's signature. These were used for the mailing to the households in Northumberland County.

2.10.4 Envelopes

The selection of an appropriate envelope to mail the advance letters in proved to be an unexpectedly difficult task. Three options were considered:

1. Using envelopes supplied by the 16 local agencies, each with its own official insignia.
2. Using official Ministry of Transportation envelopes in all areas.
3. Designing a special insignia to be printed on plain envelopes.

The Management Team was of the opinion that it was desirable to use official envelopes to give the survey visual legitimacy and to reduce the probability of the letters being thrown away as junk mail. The use of a different envelope in each area, however, would have added significantly to the complexity and cost of mailing. In addition to extra handling costs a large portion of each mailing would not have qualified for bulk postage rates. There was also a significant risk that some households would receive their letters in the wrong envelopes causing negative publicity.

The Management Team recommended the use of Ministry of Transportation envelopes but Ministry staff rejected that proposal as being inconsistent with the idea of promoting the survey as a Regional and Municipal initiative. It was therefore necessary to design a special envelope for use in the survey. The Transportation Tomorrow Survey letterhead was modified and used as a logo on the envelope. The word "Survey" was removed and the survey site location used as the return address.

Exhibit 2.10.1 Letter to Officials

This letter is being sent to municipal councils, members of parliament, police and senior government officials to inform you that a major **travel survey** will be conducted in your community between mid-August and mid-December. We would appreciate your assistance in ensuring that all members of your organization that deal directly with the public are aware that this survey is underway.

The survey will consist of telephone interviews with a randomly selected sample of households in Toronto and the surrounding areas. The Government agencies sponsoring the survey are Metropolitan Toronto and the Regional Municipalities of Durham, Halton, Hamilton-Wentworth, Niagara, Peel and York, the Counties of Peterborough, Simcoe, Victoria and Wellington, the Towns and Cities of Barrie, Guelph, Orangeville and Peterborough, the Ministry of Transportation, GO Transit and the Toronto Transit Commission. Some local communities adjacent to the above areas will also be included. The Regional Municipality of Waterloo was surveyed last year.

The County of Northumberland is not included in the main survey but will be used for the training of interviewers. The data collected during the training program will be made available to the county at no cost. Approximately 300 interviews will be carried out during the week beginning August 26, 1996.

The survey's purpose is to collect information on the travel habits of residents and provide a data base for long-range planning and improvement of road and transit facilities. Similar surveys were conducted in 1986 and 1991. In addition to trip information for each household member (i.e. trip origin, destination, time, purpose, means of travel) survey participants will be asked about age, sex, employment status, size of household and number of motor vehicles.

All information collected will be kept in the strictest confidence and cannot be traced to an individual household. Only combined results for an entire area will be examined to determine travel patterns for specific communities.

Enclosed is a sample of the notification letter which will be sent to each household chosen for telephone interviews. Separate press kits have been prepared to notify the general public through regular television and cable channels as well as local and regional newspapers.

If you have any questions about the survey, please contact myself at (416) 397-9657 or the Ministry of Transportation Corporate Policy Communications Branch at (416) 235-4102.

Sincerely,

Peter Dalton
General Manager

3. Software Development

3.1 System Design

The overall data flow design was to move household sample through the system from one stage to another without duplication, other than for backup purposes. This allowed management personnel to use the sample control system to trace a household from the original Bell sample file down to the final completion table.

Household sample could be added to the sample queue of a particular interview station anytime. Vice versa, household sample could also be deleted at any stage upon request.

There were four stages in the data flow system, namely, the sample queue stage, the interview stage, the review and edit stage and the geocode stage.

- At the sample queue stage, all the selected sample were stored in one file which was sorted by the randomly assigned household numbers and grouped into mailing blocks. Once a mailing block was activated, all the sample records belonging to that block were then moved into a master sample queue ready for assignment onto one of 120 interview station sample queues. Interview station sample queues were in fact separate files managed by different sub-directories on the file server. The assignment was controlled by the Sample Control System (SCS) program.
- At the interview stage, the Direct Data Entry (DDE) program drew new sample from a designated sample queue on the file server and downloaded the records onto the local computers for interviewing. Completed surveys from individual interview stations were passed back onto the file server into one of 4 review and edit files, one file for each of the 4 interview teams. Incomplete sample (i.e., not yet contacted, call back required, etc.) remained on the local interview stations for follow up work.
- At the review stage, review and edits were done by edit teams and supervisors. The editors reviewed the completed interviews on paper print-outs and made corrections directly on the computer files through the DDE program. When reviews were finished, the survey records from the 4 review and edit files were then grouped into 2 files, one file for successful interviews and one file for all rejected interviews (i.e., refusals, invalid contacts, etc.).
- The geocode stage started by taking the successful interviews and extracting out the location information by household to create a set of temporary files. A batch geocode program processed the temporary files and appended the batched records to 50 geocode area files for interactive geocoding. The geocode area files were downloaded onto the local coding stations on demand and backed up onto the file server upon completion.

For more information on the design specifications of the survey, please refer to the third report of the 1996 Working Paper Series, Design Specifications.

3.2 Operating System

One of the major recommendations from the 1991 survey was the use of a local area network for conducting future large scale surveys. In 1991, much of the day to day problems were associated with the handling of floppy disks, which were used to transfer sample records, and the resultant delays in updating the sample control computer with the completed surveys. The problems were expected to worsen with the much larger 1996 sample. A network system directly connecting the sample control computer with the interviewing and geocoding stations would virtually eliminate both problems.

In order to build on the experience gained from the 1991 survey it was decided to use a PC based system instead of an UNIX based system. All the software developed for the 1991 survey was PC based. Furthermore, the cost of purchasing, supporting and eventually reselling the PC equipment after the survey was completed made it more attractive than UNIX equipment. To minimize the required configuration, it was decided to operate in DOS rather than in Windows. Novell NetWare 4.1 was selected because of its reputation as a reliable and stable operating environment.

As with the 1991 survey, the major software components for the 1996 survey were the Direct Data Entry (DDE) software, the Sample Control System (SCS) and the Geocoding program. All three software components were developed in FoxPro Version 2.6. FoxPro was selected over other database management programs because it allowed building on the programs developed for the 1991 survey, its superior operating speed and network compatibility.

3.3 Direct Data Entry

The general operation of the DDE software did not change from the version developed in 1991. The software has an internal sample control module which controls when and which household to contact from the pool of sample allotted to the interview station. There were four working screens in which data were collected, namely, the household, person, trip and a dedicated transit data screen. Information collected over the telephone was entered directly into the prescribed fields. To assist the interviewer, pop-up listings of municipalities, streets, schools and transit routes were available to record information quickly and accurately. Furthermore, there were logic and consistency checks as the information was recorded. At the end of an interview, an overall check was performed to ensure data completeness.

All instructions on the use of the program, valid data codes, survey questions and read-out messages were built into the DDE. Although the program has a prescribed sequence in which data were expected to be collected, the interviewer could override the sequence in response to the interview situation. The DDE has two operating options, a normal interviewing mode and a supervisor edit mode. In other words, the DDE was useful for both collecting survey information as well as for supervisors to review and make corrections to the data.

The most significant difference from the 1991 version of the DDE was that the new version took advantage of the network environment. As well as backing up local files after every completed interview onto the network server, new sample could be added to the interview station anytime without interrupting the interview session. In the event of a computer hardware malfunction, all station files including sample and recorded information can be replicated on another computer quite quickly. Furthermore, even though the DDE was designed to work with a file server, it could operate as a stand-alone unit and there was always sufficient sample at the local interview station for two or three days of work in the case of a general network failure. Although it was not implemented, the new DDE also had an option to switch scripts (survey questions and messages) between English and French. Other languages could be built in if necessary.

For more information on the design and operation of the DDE, refer to the first and fourth reports of the 1996 TTS Working Paper Series, entitled Interview Manual and Software Documentation, respectively.

3.4 Sample Control System

The Sample Control System (SCS) was completely redeveloped for the 1996 survey. In 1991, interviews were carried out on stand alone computers instead of on a local area network (LAN). This was because of the lack of experience on LANs and the fact that the DDE itself was a new technology for travel surveys. For the 1996 survey, a Novell NetWare system allowed the SCS to work directly with the DDE to control how and when new sample was added to interview stations and to return the completed survey back to the central computer for post-survey processing.

Some components of the sample control were built into the Direct Data Entry software. Whenever an interviewer logged on to start an interview session the DDE picked up any new sample that had been allocated to that work station on the fileserver. After each completed interview the DDE made a backup copy of the local files on the fileserver. On completion of an interview session newly completed or rejected interviews were copied to the completion files on the fileserver and were then deleted from the local files.

Other components of the sample control process were performed by a batch process that was usually run once a day on completion of interviewing. The batch process performed the following functions:

- retrieve the new interview records from the completion files for each work station
- validation checks on the new records
- compile completion statistics for each work station and each interviewer
- produce a print out of each completed interview to a file

- update the sample queue for each work station with the required number of new records from the active sample queue
- re-allocate interview records identified as requiring a non-English call back to the appropriate work station queue for the identified language.

In addition to the batch process the SCS has a number of management functions that can be executed at any time. These functions include:

- updating the current list of interviewer names and login ID codes
- setting the queue length for each work station
- setting the allocation of work stations to teams
- setting the allocation of which geographic areas can be assigned to which interview stations
- activating new mailing blocks
- turning individual forward sortation areas on or off
- generating reports

The reports that can be generated include:

- a daily performance report giving completion and performance statistics for each interviewer
- a work station report summarizing the status of the active sample on each interview station
- a survey status report summarizing the completion statistics by forward sortation area relative to the calculated completion target
- a listing of the households identified as needing a daytime call back

For more information on the sample control software refer to Working Paper # 3, Design Specifications, and Working Paper # 4, Software Documentation.

3.5 Geocoding Program

In both the 1986 and 1991 surveys the surveyed information was divided into different files for coding. A household file which contained home addresses, a trip file which contained trip destinations, and in 1991 a person file which contained usual places of work and school. This set-up limited the coder to work on one item at a time. In 1996, the geocoding program was modified to group location information by household, allowing the coder to review all activities associated with a household at one time. Geocoding was performed on one household at a time. In addition to more accurate coding, call backs to a household to resolve problems were also more organized.

The routines used for the actual geocoding were very similar to those in the 1991 version. There was a batch module to pre-process the coding files and an interactive module for the coder to manually resolve the unsuccessfully batched records. Look-ups were done by specifying a street address, street intersection, monument name or place name. The major improvements over previous versions were the addition of the sounds-like and the full-text search routines. The sounds-like feature helped the coder to resolve spelling mistakes and illogical selection of street addresses. The full-text search was useful in browsing through the huge monument file. Although coding was done on local computers, the local area network enhanced the back-up and sharing of coding files.

For a detail description of the coding software, refer to the second report of the 1996 TTS Working Paper Series, entitled Coding Manual.

3.5.1 Coding Reference Database

The coding reference database was much more extensive than the one used in the 1991 survey due to the larger survey area. In light of the additional area coverage and changes within the GTA, it was decided to

rebuild the reference database rather than to update the one used in the 1991 survey. The coding reference database consisted of a parcel dot file, an address range file, an ELC or emergency location code file, an intersection file, a monument or landmark file and two place name files. The total disk storage was about 110 megabytes.

a. Street Address Files

Street addresses were geocoded to either an exact parcel dot coordinate or to a street block centroid coordinate depending on the availability of data. The new address database was created by combining geographic information system (GIS) files from different participating agencies. The reasons for not using Statistics Canada's Street Network File (SNF) are:

- At the time of the survey, the SNF available from Statistics Canada was a 1991 release. The total purchase price for all available coverage of the survey area was approximately $23,000. To order a special early update of 1996 information would require approximately another $10,000.
- The entire survey area did not have SNF coverage. Supplemental data would still be required.

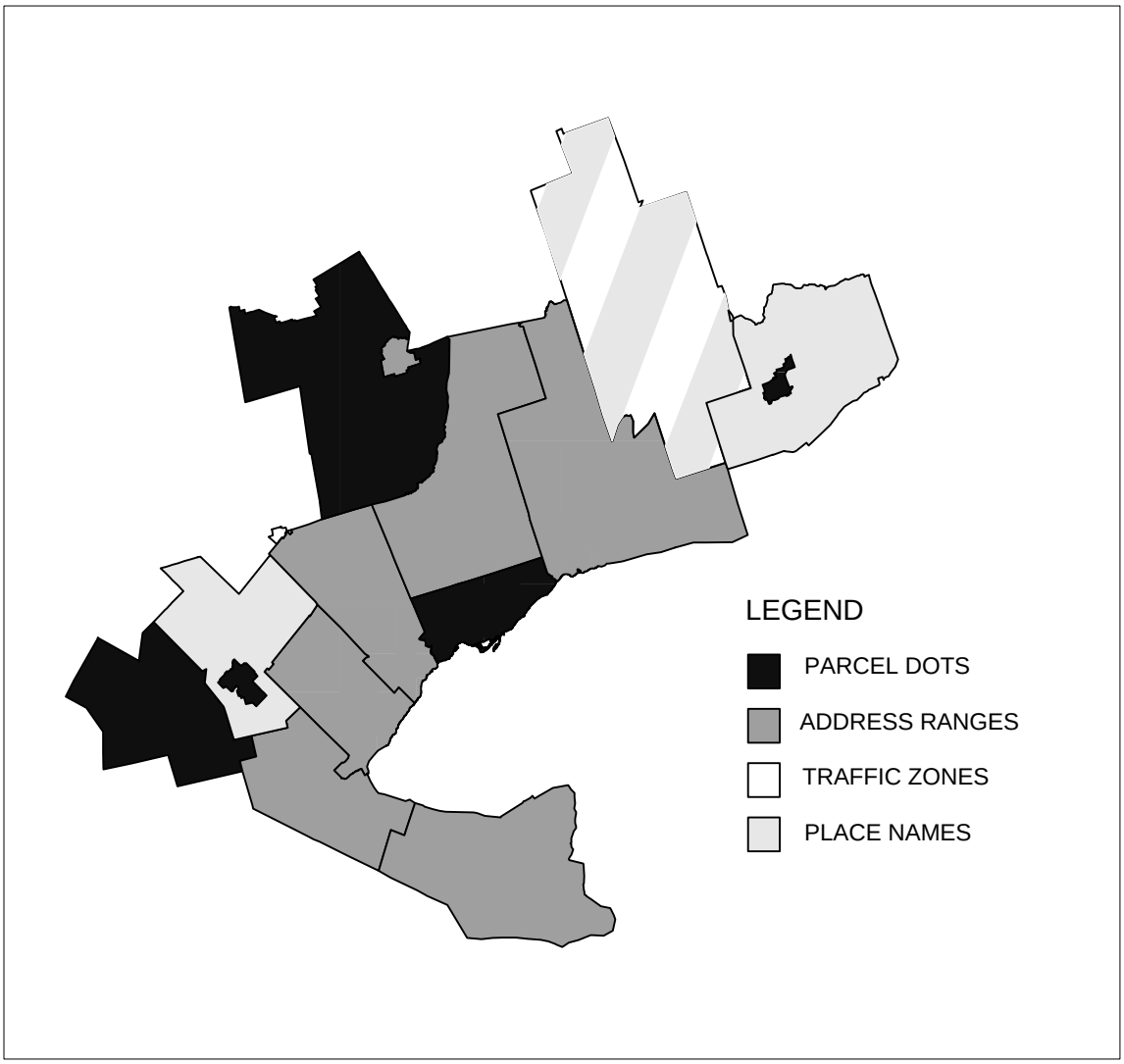
To create the address coding file, participating agencies provided their most up-to-date street network files. Exhibit 3.5.1 summarizes the different standards used by the various agencies.

Exhibit 3.5.1 GIS Files from Participating Agencies

Agency	Data Type	File Format	Last Update	Datum
Metro Toronto	Parcel dots	MapInfo	1996	NAD 27
Durham Region	Address ranges	SNF	1991	NAD 27
York Region	Address ranges	SNF	1991	NAD 27
Peel Region	Address ranges	ArcInfo	1996	NAD 27
Halton Region	Address ranges	ArcInfo	1996	NAD 83
Hamilton-Wentworth	Address ranges	MapInfo	1996	NAD 83
Peterborough City	Parcel dots	dBase	1993	NAD 27
Peterborough County	-	-	-	-
Victoria County	-	-	-	-
Simcoe County	Parcel dots	AutoCad	1996	NAD 83
Barrie City	Address ranges	AutoCad	1996	NAD 83
Orangeville Town	-	-	-	-
Wellington County	-	-	-	-
Guelph City	Parcel dots	MapInfo	1994	NAD 83
Waterloo Region	Parcel dots	MapInfo	1994	NAD 83
Niagara Region	Address ranges	SNF	1991	NAD 27

For areas which did not have GIS files, street address was coded to traffic zones or place names, whichever one provided the greater detail. Wellington and Peterborough Counties were coded to place names, the Town of Orangeville was coded to traffic zones and Victoria County was coded to a combination of traffic zones in urban areas and place names in rural areas. Areas that were developed after 1991 in York Region have been coded to traffic zones since address ranges for those areas were not available. Exhibit 3.5.2 illustrates the street address coding standard used in the survey.

Exhibit 3.5.2 Street Address Coding Guideline



Without a standard file format, such as the SNF, for the entire survey area, the combined street address reference file required immense effort to generate. In addition to converting the different file formats (i.e., AutoCad, MapInfo, dBase and ArcInfo) to FoxPro (format for the geocoding software) the combined database also had two compatibility problems:

- The GIS files were maintained on either the NAD 27 datum or the NAD 83 datum, therefore the geocode coordinates for the street addresses were not compatible. The offsets varied from a few meters to a couple hundred meters.
- Since agencies maintained their own street networks, incompatibilities were noted at jurisdictional borders even when they were using the same datum for digitization. Offsets were generally less than 50 meters.

Instead of arbitrarily choosing one datum and converting all the GIS files to the selected datum, the individual files were left unchanged prior to combining. The decision to keep the combined database with the variations of datum references was based on:

- The lack of a reliable and tested datum conversion program at the time of the survey.

- After the conversion, much work would still be required to align streets along jurisdictional borders to ensure consistency across the entire survey area. This would require choosing an acceptable yet arbitrary reference point for the realignment.
- By not modifying the reference files, individual agencies can use their own GIS to analyze the geocoded survey data without changing their internal files.
- Instead of aligning the street centre lines, efforts were made to correct only those geocode coordinates along the borders and to align the traffic zone boundaries. Since the survey data is usually used at the traffic zone level, this was a much more effective alternative.

b. ELC File

The ELC, or emergency location code, file was used only for coding Waterloo Region during the pilot survey. The file was useful for coding households in rural areas which sometimes do not have full street addresses. Every ELC was assigned a geocoded coordinate. In the main 1996 survey, ELC was not used because of the lack of available information instead rural areas were coded by place names or lot and concession numbers.

c. Intersection File

An intersection is defined as the centre point where two or more streets meet. Intersections are identified by locating all the common nodes in a street network. Since most participating agencies maintain GIS files, creating the intersection file was a relatively simple task.

d. Monument File

To identify a particular location, it is common to use a monument name instead of a street address. A monument may be a building or landmark, such as the CN Tower or the Eaton Centre. The monument file was created by combining information from various sources. Some agencies such as Metro Toronto, Hamilton-Wentworth and Waterloo Region maintained detail monument listing with full names and street addresses. Other agencies created their monument listing from internal sources specifically for the survey. During the survey, more records were added by the coding team by locating major shopping malls, schools and colleges, tourist attraction areas, etc. through street maps, the Board of Education and telephone books. Other sources used during the survey included a 1996 Canadian phone listing CD and a series of Might directories.

The monument file did not make use of assessment records. This was because the registered owner's name in the assessment may not be the common name of the property and the file was too large for practical use. Agencies were encouraged to contact their local 911 program department for assistance. However, in most cases the 911 programs were either not fully in place or unwilling to release information to the survey.

e. Place Name Files

The level of geocoding accuracy varied throughout the survey area. The goal was to geocode to as much detail as possible. Street address and monument location were preferred over street intersection and traffic zones. However, in rural areas where the survey data is expected to be used at an aggregated level and when GIS data was not available, geocoding was performed at the place name level.

A geocoded place name file from Statistics Canada was divided into two files. The first listing included places within the survey area in which exact geocodes were required (i.e., must be coded to traffic zone and below). The second listing included places within the survey area where place name coding was acceptable, namely Peterborough, Wellington and part of Victoria counties, and other Ontario locations outside of the survey area.

4. Equipment

The decision to operate the 1996 survey on personal computers was based on the speed of look-ups, the lower development costs, better staff support and the expected lower overall equipment cost after resells.

4.1 Computer Network

Software development started in March 1995. A prototype DDE program was tested in June which determined the minimum configuration to be a 486SX-25MHz computer with 4MB of RAM and 100MB of hard disk storage. Although it was not possible to thoroughly test the geocoding program (the reference database was not ready), a 486DX-50MHz computer with 4MB of RAM and 200MB of hard disk storage was expected to be sufficient.

Since the configuration was relatively basic, it was decided to purchase reliable used computers instead of buying new computers which would probably have higher configurations than required. Furthermore, to minimize support problems, it was better to buy brand name computers with similar configurations (i.e., make and model) than to purchase a variety of clone computers. Brand name computers tend to have better resell values and similar models imply exchangeable components. Colour monitors were not required but were purchased because of expected resell values. The option to lease all the computer equipment was rejected in order to gain better control on computer support (i.e., shorter turn-around time on malfunctioning units) and more flexibility in timing the purchasing and reselling of equipment. The cost of leasing equipment over a 6 months period was not much different from buying and reselling the equipment.

In preparation for the pilot survey in Waterloo Region the following computers were purchased in the fall of 1995.

- 14 IBM PS/1 486SX - 25 and33 MHz; 4MB RAM; 130MB hard disk
- 4 IBM PS/1 486DX2 - 50MHz; 4MB RAM, 350MB hard disk
- 2 IBM ValuePoint 486DX4 - 100MHz; 8 / 16MB RAM; 750MB / 1GB hard disk
- 8 Clone 486DX2 - 66 MHz; 4MB RAM, 800MB hard disk

The 8 clone computers were purchased new because of a shortage in low-end used IBM equipment. The clone computers were sold immediately after the pilot survey and the IBM computers were kept for the main 1996 survey. Of the two DX4-100MHz computers, one was used as the sample control unit and the other as a file server. Other equipment purchased for the pilot survey included a Novell NetWare Version 4.1 50-user license, two 10BaseT 16-port network hubs, 26 Kingston combo network interface cards (NIC) for the interview and geocode stations, two 3Com Coaxial NICs for the file server and sample control units and an external 700MB tape backup unit for off-site backup.

During the Waterloo Region pilot survey it was realized that aside from improvements needed to speed up the Sample Control System, a much faster file server was needed to handle the 1996 main survey. The average load on the network in the pilot survey was less than 20 users. The main survey would increase the load to about 120 users. A Compaq 166MHz Pentium file server with 32MB RAM and a 4GB mirrored hard disk was leased for the main survey. The file server also came with a built-in EISA NIC and a 5-user Novell NetWare license pre-installed.

Computer prices continued to drop between the pilot and the main survey. Without changing the budget, the following higher configuration used computers were purchased in the summer of 1996:

- 48 DELL DX-33MHz; 4MB RAM; 130 to 270MB hard disk
- 31 DELL DX2-50MHz; 4MB RAM; 130 to 270MB hard disk
- 30 IBM Aptiva DX2-66MHz; 8MB RAM; 540MB hard disk

The IBM computers had a 3-month warranty and the Dell computers had a 2-month warranty with a guaranteed buyback option from the supplier.

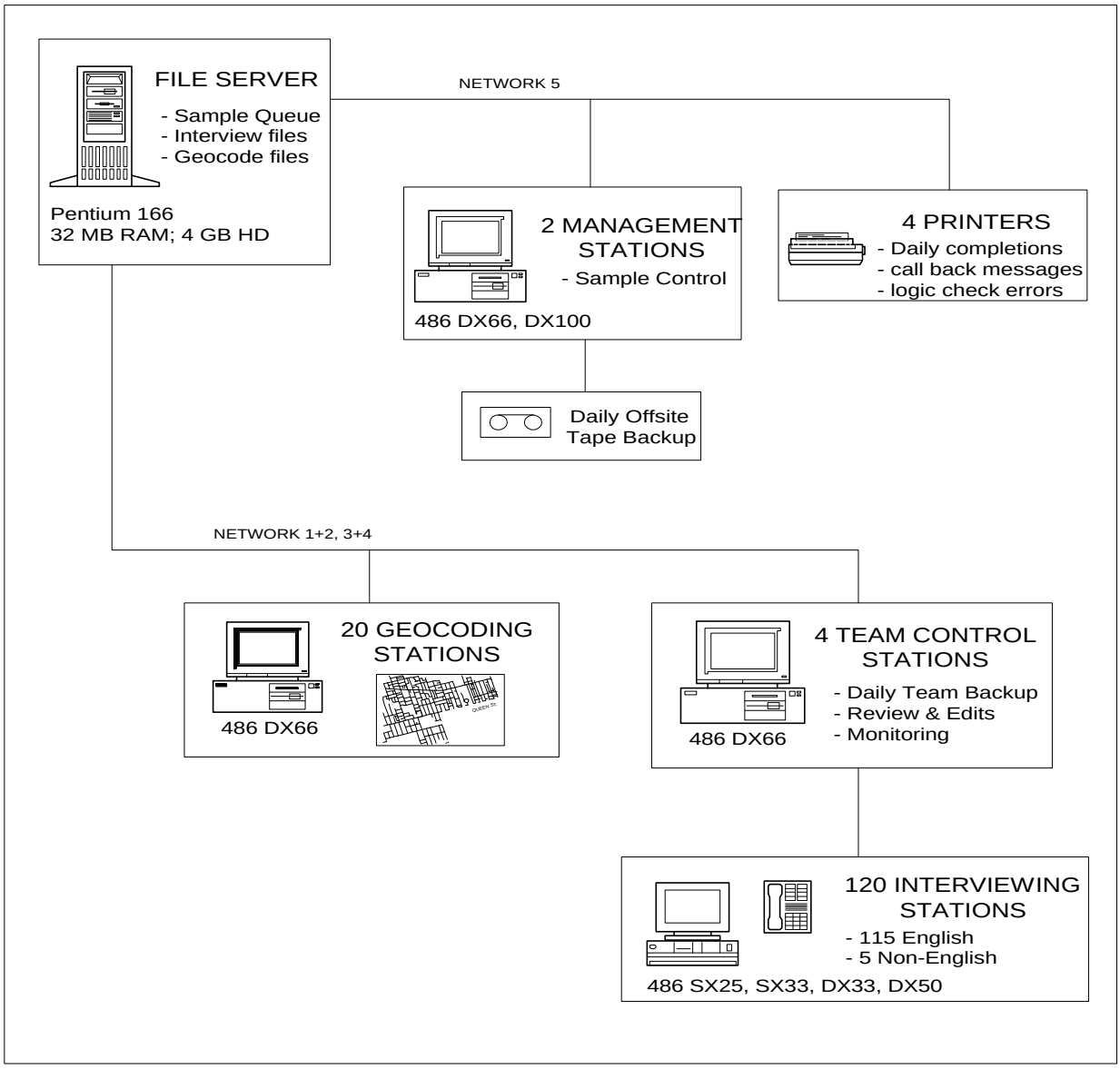
The Dell computers and the IBM PS/1 computers from the pilot survey were used for interviewing. The 30 IBM Aptiva computers were used for geocoding, monitoring and post-interview review and edit corrections. Purchasing used brand name systems proved to be cost effective in the survey. Of the 129 systems at the survey site, only 4 system failures were experienced.

To connect the additional computers onto the local area network, a second 50-user Novell NetWare license was purchased bringing the total number of allowable instantaneous connections to 105. Additional network equipment include 105 IBM 10BaseT NICs and two 8-port and five 16-port Kingston network hubs. During the survey, it was discovered that when active connections reached beyond the 105 limit, Novell NetWare allows the additional connections to download files but not to upload files. This feature in fact made network management rather difficult because a connection did not guarantee total access to the file server. A special 20-user license was leased for the last two months of the survey to resolve this problem.

In the pilot survey, file sharing was accomplished through a single network. For safety and speed reasons, the main survey file server supported five physical networks. One network was for management computers and print servers which supported four dot-matrix printers. The remaining four networks were divided into two groups. One group supported interview teams 1 and 2 and the other group supported interview teams 3 and 4 and the geocoding stations. Aside from speedy network access, the group set-up allow easy switching of stations from one network onto another of the same group in case of a network failure. This set-up was accomplished by adding four more EISA 3Com NICs to the file server and cabling 10Base2 backbones with 10BaseT connections between network hubs and work stations. Exhibit 4.1.1 illustrates the computer set-up for the main survey.

Reselling the computers proved to be much easier than anticipated. The selling plan was to keep the two IBM DX4-100 systems for post-survey work and to sell all other computers at the end of the survey. Any unsold Dell computers would be shipped back to the supplier at an agreed buyback price. In fact, aside from several malfunctioning systems, all the computers were sold within 3 weeks through word of mouth from staff at the survey site and participating agencies. The computers were priced just below market values.

Exhibit 4.1.1 Computer System



4.2 Telephones

Two separate telephone systems were installed for the conduct of the survey. The first system was for the use of management staff and was installed at the beginning of July. The system consisted of five lines for regular phones and two for fax and modem use. The phone lines were connected to Metropolitan Toronto's Centrex phone system.

A separate phone system, consisting of 131 phone lines, was installed for the interview and coding operations. These lines were connected to the Government of Ontario Centrex phone system at Queen's Park providing access to the Ontario Communications Network (OCN) belonging to the Provincial Government. Use of the Queen's Park phone system and the OCN resulted in an estimated cost saving in

long distance calling charges of at least $50,000. No conflict arose with the existing use of the OCN since nearly all of the interviewing was done outside of normal office hours.

Special equipment was rented to permit supervisors to monitor the interviewing calls without the alerting the interviewer being monitored. Two types of monitoring units were available, one capable of monitoring any one of 10 lines and the other up to 30 lines. Four of each were rented. The 10 line units were used in the training area with a maximum of eight lines connected to each. The remaining interview stations were connected in groups of 24 using the 30 line units. The eight monitoring stations were each equipped with two phones, one for making outgoing calls and the other for monitoring. Both the monitoring equipment and the phones were rented from Remark Telecom in Oakville.

Software was installed on the monitoring station computers to allow the supervisor to visually monitor an interviewer's computer screen at the same time as listening to the interview over the phone. The monitoring software was found to have some limitations in terms of being able to select from a full list of interview stations. As an alternative measure some of the phones were replaced with cordless phones which permitted the supervisor to move around the room in order to perform visual and audio monitoring at the same time.

Telephone headsets were provided for all the interview and monitoring stations. Twenty-five sets were available from the Waterloo component of the survey and 18 were purchased from the Ottawa survey. Eighty-five were purchased from NCI Resale in Markham with a buyback agreement at the end of the survey. All the headsets were equipped with a separate battery operated amplifier unit with volume control, mute button and a switch to change between headset and handset use. The headsets all had over the head bands. Most were monaural (single ear piece).

5. Conduct of the Survey

5.1 Interview Staffing

The number of interview staff required, together with the need to recruit and train them in a short time, was unquestionably the most challenging aspect of the survey. Initial planning required recruiting of enough interviewers to have 120 on the phone each night. A goal was set to have between 60 and 80 interviewers trained before September 4th, the scheduled start date of the survey. The remaining staff and replacements would be hired and trained during the first month of the survey.

The organization of the interview staff evolved as the survey progressed. The original plan was to have a chief supervisor, responsible for hiring and training, and two team leaders to supervise the interviewing. On completion of the training a third team would be formed with either the chief supervisor or one of the newly trained recruits as the team leader. The chief supervisor (Mr. Ian Fisher) and one of the designated team leaders (Mr. Claude Lurette) were recruited in July 1996. Mr. Lurette was a senior supervisor in the 1995 Ottawa survey. The site manager from the Ottawa survey (Ms Cory Porter) was also recruited for a two week period in August to assist in the initial hiring and training. One supervisor from the Waterloo component of the survey (Ms Denise Osland) and one from the Ottawa survey (Mr. Ralph Seidemann) were also recruited prior to the start of training.

The interview staff were recruited by means of a help wanted advertisement in a local newspaper (the Toronto Star). The training of interviewers began on August 7th with the advertisement appearing in the paper at the end of the previous week. The immediate response to the first appearance of the advertisement required three people working continuously to answer the phone and schedule interviews. Interviews were conducted at 20 minute intervals by each of the three senior supervisors (Messrs. Fisher and Lurette, and Ms Porter). The primary criteria for staff selection were keyboarding skills and a good telephone manner.

Previous tele-marketing or market research experience was considered an asset but not essential. Persons who met the minimum criteria were invited to be trained.

Enough people were recruited from the initial advertisement to fill the training schedule for the three week period prior to the official start of the survey. No new staff were hired for training during the first week of the survey in order to allow management staff time to prepare and to concentrate on supervision for the first few days. Hiring and training resumed the second week of the survey.

During the first three weeks of the survey it was necessary for all the staff with previous experience to assist in the training of new staff in addition to supervising the staff already recruited. A number of the earliest recruits were given supervisory roles on a trial basis. Their responsibilities were primarily to monitor the interviewers conducting the survey and those being trained.

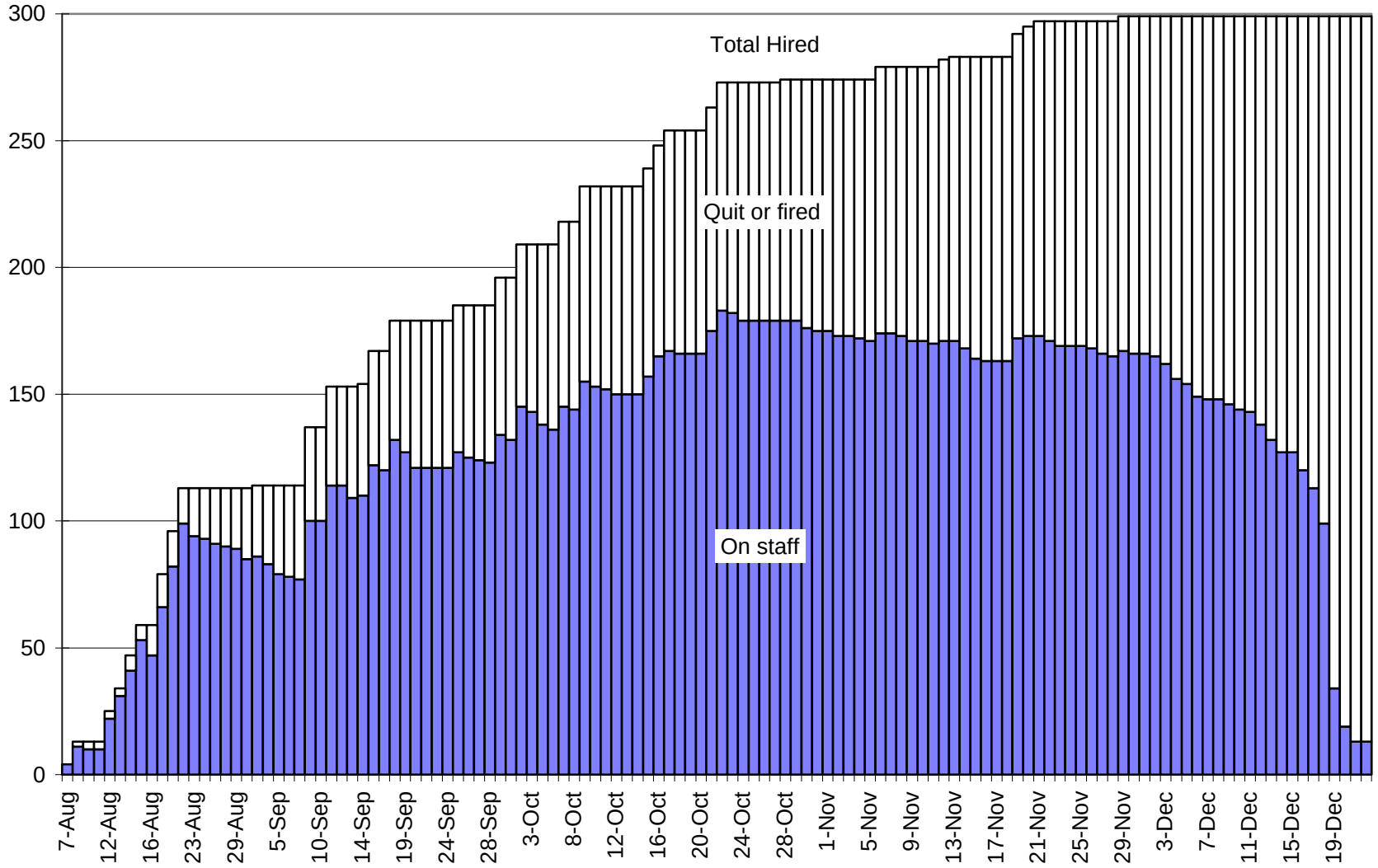
Responsibilities shifted as the operation grew in size and the number of new people being hired diminished. A revised management organization was created in response to the changing requirements and available staff resources. Under the new organization the following staff reported to the General Manager:

- Three team leaders (Sharon Bawden, Denise Osland and Ralph Seidemann) were given full responsibility for the day to day management of their own group of staff.
- Mr. Lurette became operations manager responsible for coordination between the teams, general administration and supervision of a group of staff responsible for those aspects of the survey not assigned to the teams. Those responsibilities included daytime call backs, answering machine call ins and call backs requested by the coding team. The operations manager also monitored the operations of the teams for consistency and quality control.
- Mr. Fisher remained as Chief Supervisor responsible for hiring and training of interview staff as well as any retraining or dismissal that was necessary. An assistant (Jill Brownlee) was appointed to manage the day to day operations of the training group in a similar capacity to the other team leaders. New staff stayed with the training group for one to two weeks before being assigned to one of the other teams.

In late October a fourth team was formed with Ms Brownlee as team leader. New staff were distributed between all teams immediately following the initial training session. Higher than expected staff turn-over resulted in the need to continue the training of new staff until the 3rd week of November. In total, 300 interviewers and interview supervisors were recruited. Exhibit 5.1.1 shows the number of interviewers and interview supervisors on staff throughout the survey. A major disappointment was the number of staff who received training in August but who quit, either before or during the first week of the survey, despite verbal assurances that they intended to stay for the duration of the survey.

The team leaders selected supervisors and interview editors from their pool of staff. Supervision and monitoring of interview staff was usually done on a rotating basis with supervisors required to spend at least two sessions a week doing interviews.

Exhibit 5.1.1 Interview Staff



5.2 Training

The initial training program consisted of three evening sessions for each new group of interviewers. In previous surveys the training groups were limited to three to five people but, due to the size of the 1996 survey, the groups in the initial start up period comprised up to twenty people. Three groups a week were trained starting on Monday, Tuesday and Wednesday evenings.

The first evening of training consisted of a detailed demonstration of the software by the Chief Supervisor, or one of the senior staff with experience from previous surveys. The demonstration, with appropriate time for questions and answers took 2 to 3 hours. Working in pairs, the trainees spent the remainder of the evening familiarizing themselves with the software.

On the second evening the candidates practiced interviewing each other. Supervisors were available to answer questions and provide guidance. A review meeting was held towards the end of the evening to provide a recap about certain aspects of the software and to allow questions.

On the third evening the recruits continued to practice interviewing while the supervisors went around testing each person in turn. When it was felt that a new recruit was ready to start conducting live interviews they were transferred to a "live" work station in the training area. Interviewers were expected to be ready for live interviewing after the three nights of training. Most of those who were not ready were let go. A few were given extra time to learn.

The interviewing stations being used by new recruits were monitored more closely than the stations assigned to the other teams. New recruits worked in the training area until the chief supervisor was satisfied that they were ready to be assigned to one of the other teams.

During the training period from August 7th to the start of the survey on September 4th the interviewers were given training sample. The training sample consisted of a random selection of households from across the survey area. None of the interviewers were aware that they were not conducting final interviews. The only difference from the main survey was that the results, with the exception of the interviews done in Northumberland County, were not kept as part of the final database. No training sample was used once the main part of the survey got under way. All live interviews were kept as part of the main database.

5.3 Rates of Pay

Interviewers were paid $9 per hour for the first pay period while they were being trained. After the first pay period they were paid between $10 and $13.25 an hour depending on their performance. The performance of all interviewers was reviewed weekly to determine appropriate merit increases. Daily and weekly performance statistics were calculated for each interviewer taking into account 3 measures:

1. Productivity. Both the number of phone calls placed and the number of interviews completed per paid hour of interviewing time.

2. Trip Rate. The average number of trips recorded per person in the households for which interviews were completed..

3. Refusals. The proportion of households contacted where the respondent refused to participate in the survey.

Although performance statistics were used as the primary factor in setting rates of pay other factors were also taken into consideration. These factors included the number of post interview call backs required, the general accuracy of their work, willingness and cooperation.

Saturday to Friday was chosen as the pay period permitting the performance reviews to take place on Saturday in time for the payroll to be processed over the weekend. The merit increases were applied to the pay period that justified them so that interviewers received immediate reward for good work and improvements in performance. Pay cheques were dated for the following Friday and were generally distributed during or after the Thursday night shift.

Staff were given a different rate of pay for non-interviewing time including supervisory duty and visual editing of interviews. Supervisory staff were not necessarily paid more for supervising and monitoring than they were for conducting interviews. The average rates of pay per hour, including incentive bonuses, were:

Trainee interviewer	$9.00
Interviewer	$11.25
Supervisor	$11.99
Team leader	$16.04
Coder	$11.15

5.4 Hours of Work

Initially interview staff were required to work a four hour shift for each interview session but were given some latitude as to when it started and finished. On weeknights the hours had to be between 5:30 p.m. and 10 p.m. and on Saturdays between 10 a.m. and 4 p.m. The staggering of hours was done primarily to make the sign in and logon procedure less hectic. Staff were subsequently encouraged to work longer hours if they wished within the same time windows. In the initial design of the survey it was hoped that it would not be necessary to interview on Mondays but it quickly became apparent that it was necessary to have a six day a week operation in order to meet the completion target.

5.5 Incentive Bonuses

Initially a bonus of $1.50 was paid for each hour of interviewing in excess of 14 hours in one pay period. The purpose of the bonus was to encourage regular turn out thereby reducing the total number of interviewers that need to be recruited. The bonus rate was later changed from $1.50 to 20% of the interviewer's base interview pay rate in order to provide added incentive to the better interviewers. Supervisory and other non-interview time did not qualify for the bonus. No bonuses were paid during the initial training period in August. The number of qualifying hours was reduced to 10 for short work weeks due to public holidays.

Interviewers assigned to make non-English call backs on a regular basis were paid a premium of about $1.00 an hour extra. As a general rule, non-English call backs were not included in the performance statistics used for pay review.

5.6 Quality Control

Quality control of the information being collected was assured by the following procedures.

1. Logic checks performed by the DDE software.
2. Monitoring of interviews while in progress.
3. Daily monitoring of interview performance statistics
4. Visual review of all completed interviews
5. Call backs
6. Feedback from the coding process
7. Rotation of interviewers between work stations
8. Random quality control audits

5.6.1 Logic Checks

The DDE software controls the flow of the interview, preventing the interviewer from moving on until a valid response has been entered for each question. At the completion of an interview, the software performs a second series of checks on the consistency and completeness of the information. A list of errors and warning messages appears on the screen prompting the interviewer to go back and make corrections immediately while the respondent is still on the phone. Any errors that are not corrected will appear on the print out of the interview for visual review by a supervisor. Details of the error checks are contained in TTS Working Paper #4, Software Documentation.

5.6.2 Monitoring

All interview stations were equipped for monitoring, both aurally and visually, by a supervisor. Newly trained interviewers were monitored more frequently than seasoned interviewers. Monitoring was mostly done by the team leaders and their senior supervisors. The supervisors comments were recorded in writing. Minor problems were brought to the attention of the interviewer immediately, particularly if corrections to a just completed interview were required. More serious problems were reported to the team leader for appropriate corrective action. Items of particular concern were the interviewer's telephone manner and their ability to question respondents to ensure completeness and accuracy of information. Interviewers were warned not to lead respondents in their answers, not to make assumptions, and not to readily accept refusals. The Chief Supervisor made a point of monitoring problem staff before taking corrective action such as re-assignment, re-training or dismissal.

5.6.3 Performance Statistics

The sample control software was used to print comprehensive statistics on interviews conducted by each interviewer, both daily and weekly. Team leaders, and management staff, could also display or print a historical record of any interviewer's weekly performance statistics. In addition to setting rates of pay, the performance reports served to identify other problems, such as below average trip rates and higher than average refusal rates, so that corrective measures could be taken. A sample report is shown in Exhibit 5.6.1.

5.6.4 Visual Review

After each interview session all of the completed interviews were printed out. The software used to print the interviews performed the same logic checks as the DDE software, flagging errors with appropriate messages. A supervisor visually reviewed every interview looking at the error messages and also at the consistency and logic behind the information collected and the manner in which descriptive information, such as trip destinations, was recorded. The printouts were sorted by interviewer within each team and the printing was done overnight so that the visual review could be completed before the next interview session. Problems and corrective actions were noted on the printouts.

A separate visual review was done for transit related errors. The printouts for households within Metro and the immediate surrounding areas were reviewed by a staff person from the TTC. Other areas were reviewed by a staff person from the Data Management Group. Most problems resulted from missing route descriptions in the look-up database or routes that did not connect. The sample control software was designed to prevent a household to be passed on for geocoding until a valid code had been assigned to every transit route used. Most problems were fixed by using the DDE software to amend the route description. In other cases, new route descriptions were added to the look-up database. Problems requiring call backs were noted on the printout. The review of transit problems was generally done prior to printouts being reviewed by a supervisor.

5.6.5 Call Backs

Printouts requiring call backs were given back to the interviewer who did the interview before the next interview session. Interviewers were notified, either by the notes on the printout or verbally by the team leader, of areas where improvements to their work could be made. The interviewers were required to make the call backs prior to starting new interviews. Corrected information was written on the printouts which were then given back to a supervisor. Supervisory staff then made the corrections to the database using the DDE software.

If the original interviewer was not available to work the next session, the printouts were held until the following day. If the call backs had not been made within two days then a supervisor would make the call back. Call backs made by the supervisor provided an opportunity for the supervisor to check on the quality of the interviewer's work by speaking directly with the interview respondent.

5.6.6 Feedback from the Coding Process

Once all the visual edits, call backs and corrections had been made for a given interview date the data for those households were moved to the coding database for geocoding. A series of computerized logic checks was performed on each household to ensure that the information being passed on was complete. Incomplete interviews, and those containing identifiable errors such as missing transit route codes, were kept in the review database and reprinted for further checking.

If the geographic information in the coding database proved to be insufficient or ambiguous, the coders would flag the record for a new printout to be generated. These printouts were given to a group of interviewers assigned the task of making geocoding call backs. The corrected printouts were given back to the geocoders for entry into the geocoding database. Software was also developed to enable the interviewer to make the changes on-line while making the call back.

Problems encountered in the geocoding process were monitored continuously and reported to the team leaders so that corrective action could be taken with respect to future interviews. The survey procedures were set up with the expectation that the geocoding would take place within 3 days of the interview. Delays in the review and edit process, together with the sheer volume of information being processed, resulted in a time delay of one week to 10 days.

5.6.7 Rotation of Interviewers

A point was made of not allowing any one interviewer to use the same interview station all the time. Rotating the interviewers around meant that scheduled call backs would be made by a different interviewer. Interviewers were instructed to report to their supervisors any problems in the way previously collected information had been recorded. A particular concern was interviewers scheduling call backs for households instead of accepting a refusal.

Exhibit 5.6.1 Performance Report

Team 3 Cumulative Statistics for the Week 20-Dec

ID	Total Pers	Total Trips	Total Time	B Cal Bak	C Ans Mch	D Lin Bsy	E No Ans	F Frn Lng	G Int Int	V Inv Num	W 8x Uns	X Out Srv	Y Int Ref	R Cmp Rev	Z Suc Cmp	Total Cntct	Cntct Rate	Comp Rate	Trip Rate	Hhld Size	Refl Rate	Perf Score
118GW	206	440	21	48	76	8	124	29		34	9	6	49		82	465	22.1	3.9	2.1	2.5	0.37	7.04
240SG	147	234	13.5	12	5	1	43	1		11		3	15		59	150	11.1	4.4	1.6	2.5	0.20	6.27
265HB	209	522	20	44	68	8	199	2		16	17	2	35		80	471	23.6	4.0	2.5	2.6	0.30	8.08
270SG	107	188	14.5	23	78	9	55	3		20	5	6	41		44	284	19.6	3.0	1.8	2.4	0.48	4.78
299YX	87	149	7.25	7	17	6	38	2		4	5	1	16		33	129	17.8	4.6	1.7	2.6	0.33	6.91
306SK	92	230	11.25	29	46	4	77	1		18	20	2	20		43	260	23.1	3.8	2.5	2.1	0.32	7.77
307CC	149	370	23	26	41	6	116	2		4	11	1	8		70	285	12.4	3.0	2.5	2.1	0.10	6.49
316SM	115	188	15	4	70	2	39	14		3	5	7	22	1	53	220	14.7	3.6	1.6	2.2	0.30	5.44
318DG	20	59	2.75	7	11		9		1		1		4		8	41	14.9	2.9	3.0	2.5	0.33	6.28
325BD	128	348	15	31	10	2	40	4		3			8		57	155	10.3	3.8	2.7	2.2	0.12	7.34
332MB	199	476	20.25	42	115	3	64	1		15	3	4	25		83	355	17.5	4.1	2.4	2.4	0.23	7.65
335SG	126	234	12	11	28	5	93	2		13	2		3		54	211	17.6	4.5	1.9	2.3	0.05	8.15
342MB	55	110	6	10	40		57	2		3	7		7		26	152	25.3	4.3	2.0	2.1	0.21	8.40
345TH	104	219	19	38	38	1	154			17	10		12		47	317	16.7	2.5	2.1	2.2	0.20	5.42
352SM	75	140	10.5	23	12	2	68	5				4	32		24	170	16.2	2.3	1.9	3.1	0.57	3.30
354SR	31	63	4.75	10	7		60	1			7		5		17	107	22.5	3.6	2.0	1.8	0.23	7.18
356AB	65	156	8	18	15	1	46	2		9	9		15		27	142	17.8	3.4	2.4	2.4	0.36	6.33
357LS	39	92	4	7	13		5			1		2	5		18	51	12.8	4.5	2.4	2.2	0.22	7.56
359CR	191	299	16.25	24	45	1	38	11		9		6	42		72	248	15.3	4.4	1.6	2.7	0.37	6.10
369MP	38	74	5.25	11	19	3	10	3		1	1	1	7		14	70	13.3	2.7	1.9	2.7	0.33	4.50
370SH	30	70	6.75	20	21	3	61	2		4			7		15	133	19.7	2.2	2.3	2.0	0.32	5.31
Team1	3527	7051	424.5	898	1590	85	1820	145	4	169	221	79	445	1	1417	6874	16.2	3.34	2.00	2.49	0.24	6.07
Team2	3748	8103	322	819	1110	79	1300	78	2	339	131	74	389	1	1296	5618	17.4	4.03	2.16	2.89	0.23	7.26
Team3	**2249**	**4736**	**262.5**	**464**	**805**	**70**	**1444**	**90**	**1**	**188**	**115**	**45**	**390**	**1**	**941**	**4554**	**17.3**	**3.59**	**2.11**	**2.39**	**0.29**	**6.41**
Team4	3358	7266	351.75	734	1120	73	1608	45	2	152	215	60	529	4	1307	5849	16.6	3.73	2.16	2.56	0.29	6.58
TOTAL	14572	30064	1424	3081	4790	320	6711	365	17	879	716	265	1958	7	5558	24667	17.3	3.91	2.06	2.62	0.26	6.85

5.6.8 Random Quality Checks

The Operations Manager conducted a separate quality assurance program in addition to the regular monitoring. The quality assurance program commenced in mid October and consisted of the following elements:

Monitoring

Visual and aural monitoring was done on a regular basis for all of the teams. Monitoring was done by completing a hard copy of the survey and noting any discrepancies between the information given by the respondent and the data recorded by the interviewer.

A total of 25 complete interviews were monitored per week. If there were major discrepancies, the interviewer was alerted immediately to call the household back and get the proper information. The interviewers were instructed to make minor corrections after completion of the interview using the information recorded by the person doing the monitoring. A subsequent visual check of the nightly completion report was done to ensure that the revised information had been entered correctly and the necessary call backs made.

Visual Check of Nightly Completions

Each day the printed interview reports for ten interviewers, chosen at random, were reviewed to ensure that a thorough job of visual editing had been done. The reports selected were from the previous week after the visual review, call backs and edit revisions had been made. Any discrepancies or deficiencies were brought to the attention of the Team Leader.

Visual Check of Completions Passed on to Geocoding

Each week 50 households were selected at random to verify that the electronic editing had been completed as per the data collected from the interviewer call back. These households were pulled from the geocoding database and re-printed after all the normal edit corrections had been made. A visual check was made comparing the contents of the household record submitted for geocoding with the original print that including the comments from the visual review and any subsequent call backs. Discrepancies were noted and brought to the attention of the team leader.

5.7 Answering Machines

Approximately 1 in 4 phone calls resulted in contact with an answering machine, a much higher proportion than in previous surveys. The DDE software provided the script for a message to be left on any answering machine encountered. The script identified the survey and requested that a member of the household call the survey office. A local phone number was given for households in the Toronto calling area and a 1-800 number for long distance calls. These two phone numbers were used solely for calls from households with answering machines. The DDE software would also schedule the next call to give time for someone to respond. The delay in scheduling the next call was initially set at 3 days plus 1 hour which resulted in an unexpectedly large backlog of scheduled call backs waiting to be made. The delay period was subsequently changed to 1 day plus an hour and finally to 2 days plus an hour.

The procedure for handling incoming phone calls, in response to the answering machine message, was to manually record the callers name, their home phone number and the phone number they were calling from if different. The person taking the phone call would determine which work station the household record had been assigned to and call the respondent back from that station in order to complete the interview. If the required work station was already in use, a written message was handed to the interviewer at the work station instructing him or her to make the call back as soon as possible.

The call in phones were staffed from 10 a.m. to 10 p.m. each day. The volume of calls required a team of three people during evening interview hours, two to answer the phones and one to deliver messages to the interviewers.

5.8 Strikes

The conduct of the survey was affected by two strikes, one at General Motors and the other a day of protest against the Provincial Government.

The areas most affected by the General Motors strike were Oshawa and St. Catharines. Survey staff immediately stopped assigning households in Oshawa and Whitby to the interview queue. A concentrated effort was made to complete the households already assigned to work stations before the announced strike date. No immediate action was necessary with respect to St. Catharines since interviewing outside the GTA had not yet begun. Fortunately the strike occurred at the time the next wave of advance mailings was being prepared. The mailing block was split into two parts with households in Durham, Peterborough and St. Catharines excluded from the first half. A deadline was set by which interviewing would have to resume regardless of the strike in order to reach the completion targets. The households that would normally have been in the first half of the mailing wave were included in the next two mailing blocks. Interviewing resumed a few days after the plants returned to full operation.

The Day of Protest occurred in Toronto on Friday, October 25. Most government offices were affected and all TTC services were shut down. The survey continued but with a greatly reduced staff complement since most interviewers relied on the TTC for transportation. Normal interviewing was conducted on Friday. Interviews on Saturday were conducted for Thursday's trips. On Monday, interviews were completed for Friday's trips, with no interviewing of households within Metropolitan Toronto. The shift size had to be reduced due to the limited number of work stations with active sample outside Metro.

5.9 Non-English Call Backs

The data entry software allowed the interviewers to schedule a call back to be made in a language other than English. The languages that could be specified were Cantonese, Italian, Portuguese, French and Other. The selection of languages was based on the frequency with which they had been used in the 1986 and 1991 TTS. The sample control software re-assigned households requiring non-English language call backs to a specific work station where an interviewer was able to select households for which a call back had been requested in a specific language. Initially all non-English interviews were assigned to one work station. Additional stations were added, and the languages assigned to each changed, based on the accumulated queue length. For most of the survey two stations were used exclusively for call backs made in Cantonese, one to a combination of Italian, French and Portuguese and two to the other category. Households in the other category, where the required language was not identified, were contacted by an experienced interviewer who would attempt to conduct the survey in English, preferably with another member of the household from the one which was originally contacted. The interviewers conducting non-English interviews did their own on-line translation to and from the standard English script. There was no monitoring of non-English interviews.

5.10 Software Changes

A number of changes were made to the software during the course of the survey. Minor revisions were made to the DDE, primarily in the logic checks, and to the reports. The creation of a fourth interview team required some revisions to the Sample Control Software.

As the number of households in the review databases increased, the performance of the DDE software used to perform edit corrections suffered. The problem was alleviated by giving the person doing the edit corrections exclusive access to the files. Exclusive access, however, resulted in some scheduling problems because of the number of hours required for one person to make all of the changes required for one team.

6. Completion Statistics

Exhibit 6.0.1 gives a summary of the completion statistics. The statistics include the interviews done in Northumberland County but do not include the Regional Municipality of Waterloo surveyed in the fall of 1995. Exhibit 6.0.2 provides a summary by geographic area. The target values shown are based on the sample obtained from Tele-Direct which may not agree with the Canada Census data obtained later for the purpose of data expansion. Additional records were discarded after the survey prior to the data being integrated with the 1995 Waterloo data.

The refusal rate, at 21.8% of valid contacts, was higher than for the 1991 TTS (11.3%) but compared favourably with other surveys. It is well within the generally accepted limit of 30%. As expected, on the basis of previous surveys, refusal rates tended to be higher in the urban centres of Toronto and Hamilton than in the rural areas. A surprise was the high refusal rate in Niagara Region (27%) which necessitated the purchase of additional sample in order to obtain the required number of completions.

Exhibit 6.0.3 shows the number of completions by trip day of the week. Trip data for Fridays were collected on both Saturday and Monday except for three Saturdays when Thursday trip data were collected to limit the over representation of Friday trips. Mondays trips were slightly under represented due to public holidays and the starting of the survey on a Wednesday.

Exhibit 6.0.4 shows the number of interviews completed by day. Measured over the entire survey, interview productivity, at 3.7 completed interviews per paid hour of interview staff time, was comparable to the 1991 survey. Savings in time due to improved software design were offset by a slightly longer questionnaire (3 new questions) and the wasted time due to a higher refusal rate and the large number of answering machines encountered.

Exhibit 6.0.1 Completion Statistics

Original Sample		178,511	
Not used	13,590		(FSAs over represented)
Incomplete	6,168		
Sample used		158,753	
Phone out of service	4,524		
Invalid	7,838		
8 attempts	6,439		
Valid contacts		139,952	88%
Refusals	30,523		21.8% of valid contacts
Completed Interviews		109,429	68.9% of sample used
Rejected in review		849	
Pre-geocode database			Mean
Households		108,580	
Persons		295,475	2.72
Trips		630,702	2.13
Transit records		69,312	

Phone calls		
Out of service	4,527	1%
Invalid	9,279	2%
Line Busy	5,487	1%
No answer	80,271	20%
Ans. machine	90,315	22%
Call back		
English	68,270	17%
Non-English	6,742	2%
Interrupted	464	0%
Refused	31,260	8%
Complete	109,204	27%
Total	405,819	

Exhibit 6.0.2 Completions by Geographic Area

	Target A	Complete B	Rejected C	Refused D	% Complete of target B/A	Completion Rate B/(B+C)	Refusal Rate D/(B+D)
Toronto	21810	21218	11253	6097	97%	65%	22%
Scarborough	9222	9306	4070	2460	101%	70%	21%
North York	7969	7772	3815	2347	98%	67%	23%
Etobicoke	6948	6626	3266	2142	95%	67%	24%
Durham	7469	7526	3312	2191	101%	69%	23%
York	9480	9396	3700	2245	99%	72%	19%
Peel	13299	13261	5043	3096	100%	72%	19%
Halton	6062	5924	2539	1663	98%	70%	22%
Ham-Went	9210	9177	4368	2873	100%	68%	24%
GTA	91469	90206	41366	25114	99%	69%	22%
Niagara	7465	7696	4067	2868	103%	65%	27%
Guelph	2004	2141	694	477	107%	76%	18%
Barrie	1528	1591	583	381	104%	73%	19%
Peterborough(City)	1806	1778	760	484	98%	70%	21%
Orange. & Well.	1156	1169	458	298	101%	72%	20%
Simcoe	1785	1762	729	367	99%	71%	17%
Peter. & Vic. Cnts	1982	1911	1303	526	96%	59%	22%
Northumberland	273	327	126	87	120%	72%	21%
Non-GTA	17999	18375	8720	5488	102%	68%	23%
Total	109468	108581	50086	30602	99%	68%	22%

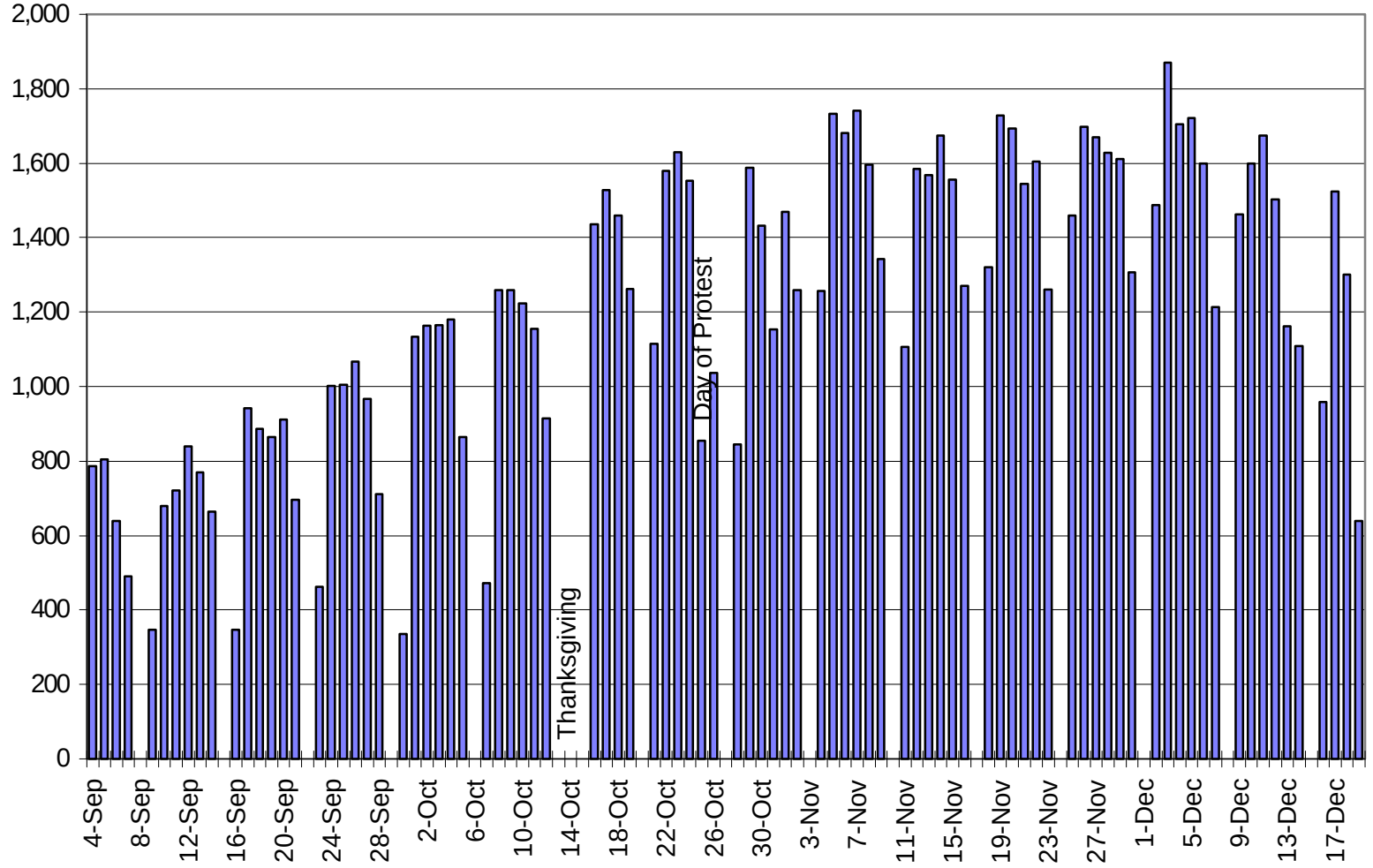
Notes:

1. Rejected includes refused
2. Target values estimated on the basis of listed residential phone numbers. The targets for Peterborough and Victoria counties have been reduced by 15% to account for invalid seasonal residences included in the Bell sample.
3. Allocation to geographic areas is approximate based on Forward Sortation Area (Not full postal code)

Exhibit 6.0.3 Completions by Trip Day

Trip Day		**Trip rate**
Monday	18.4%	2.08
Tuesday	19.9%	2.10
Wednesday	19.0%	2.12
Thursday	19.8%	2.14
Friday	22.8%	2.20

Exhibit 6.0.4 Completed Interviews by Day



7. Coding

7.1 Staffing and Training

Based on a ratio of 1 coder to 6 interviewers, approximately 20 coders were needed to keep pace with interviewers at full interviewing strength. Since interviewers were brought into the survey in phases, the hiring of coders had to follow similar phases by anticipating the interview staff roster. The staffing difficulties faced by the interviewing team made the hiring and training of coders equally difficult.

Coding positions were advertised through Ryerson University and University of Toronto's employment placement centers with emphasis on computer and geography knowledge. Approximately 40 applicants were interviewed by the coding supervisor of which 16 were retained. Nearly all of the coding staff have university educations and about half have a civil engineering background. There were three training sessions, one in late August, one in early October and one in late October. Training took 3 to 4 full days and coders were trained to use the geocoding program and various reference materials such as telephone books, phone CD, city directories, maps, etc. Because coding was the last part of the survey process, extra effort was placed in stressing accuracy of information. The pay rate started at $10 per hour and increased regularly according to individual performance and length of time with the survey. The highest paid coder who also assisted in setting up the geocode reference database and some administrative work received up to $13.50 per hour. The turn-over rate for coders was relative low, at 12%. Most of the staff stayed throughout the survey which minimized the trouble of hiring and training.

7.2 Coding Activity

Geocoding started one week after interviewing began. The coding plan was to geocode survey records within 3 days of the interview. The shorter the turn-around time the better it is for call backs if households had to be contacted again to clarify information. However, the review and edit stage at times took longer than anticipated because many of the interviewers did not work consecutive days, thus delaying the review process. Completed interviews were divided into 50 geocode area files which had approximately the same number of sample records. Coders were grouped by large geographic areas and assigned to specific geocode areas. Grouping coders allowed specialization by geographic areas while maintaining some diversity of personnel.

As with the interview process, coding started within the GTA and expanded to cover the entire survey area by November. The fact that some of the non-GTA reference databases were not ready until early November posed some delay but was not a huge hindrance. Geocoding was normally a day time activity. This allowed sharing of computers between the day time coders and the evening interviewers. Interview completions were slow for the first half of the survey, not reaching full strength near the end of the survey. The number of completions which needed coding came in large volumes in the last month of the survey. Although coding was short staffed, hiring new coders at that time was impractical. Hence, some coders put in extra hours in the evenings and on Saturdays, if computers were available, to code as much as possible. Sharing computers in the evenings was difficult because priority had to be given to interviewing.

Coding finished in January 1997, three working weeks after interviewing ended. There were three reasons that coding took longer than anticipated. First, there was the lack of staff for coding the sudden surge of interviews conducted at the end of the survey. Second, the majority of non-GTA areas were surveyed in the last month. Coders were not as familiar with non-GTA areas and the coding reference material tended to be less complete than GTA areas. Third, call backs to clarify information for geocoding were delayed. This was because priority had to be given to assigning available interviewers to conduct interviews instead of call backs. In fact, after interviewing completed in mid-December, a team of interviewers were brought back to conduct call backs.

7.3 Clean-up and Recoding

The most significant problem encountered in coding was the lack of up-to-date geocode reference material. At the time of setting up the reference database, many of the participating agencies did not have a GIS database or were in the process of updating their files. After coding officially finished, a small crew was retained to recode records which required additional reference material. Approximately 1% of the records (12,000) required recoding. Some of the problem records were sent to participating agencies for assistance. For newly developed areas which did have GIS coverage, MapInfo was used to pin point geocode coordinates. The recoding took an additional three weeks for six coders to complete.

Other clean-up work included checking for miscoded locations. Look-up lists used in the DDE and geocode programs made it easy for interviewers and coders alike to select wrong entries. Given the large survey area, there were a lot of duplicate names for streets, monuments and even local districts. Validation checks which revealed extremely long school and work trips, lengthy access or egress distance from transit transfer points, batch geocoded place names, etc. were individually reviewed and recoded as necessary.

Lastly, a small portion of the Waterloo survey was recoded. The geocode reference database used in the pilot survey for areas outside of Waterloo Region was largely incomplete and outdated. Recoding non-Waterloo locations with the new reference files was quite simple.

7.4 Statistics

A location was geocoded by one of three methods:

1. cross referenced to another location field (i.e., trips to home, usual place of work or usual place of school),
2. batch processing, or
3. interactive geocoding.

The cross-reference feature processed more than half (55%) of the location data, mainly home-based trips. Of the remaining locations which required geocoding, the batch process had a success rate of 35%. This is much lower than in 1991 where 48% of the data were batch coded. The lack of good GIS information to create the geocode reference database reduced the success of the batch process significantly. Metro Toronto has a comprehensive GIS database and the batch success rate was at 50%.

Exhibit 7.4.1 is a breakdown of coding method (i.e. address type) for different surveyed information (i.e. location type). The number of records in the final TTS database is less than that in the exhibit because a number of invalid household samples (e.g., those outside of the survey area) were included. Exhibit 7.4.2 gives a summary of Exhibit 7.4.1 by excluding records which did not require geocoding and illustrating the batch and interactive coding statistics.

Exhibit 7.4.1 Location Types verses Address Types

LOCATION TYPE	ADDRESS TYPE						
	Street Address	Intersection	Monument	Place Name	Traffic Zone	Cross Reference	Row Total
Home	103,466	755	70	2,295	2,019	-	108,605
	95.27%	0.70%	0.06%	2.11%	1.86%		9.59%
School	10,531	863	38,193	1,033	614	-	51,234
	20.55%	1.68%	74.55%	2.02%	1.20%		4.52%
Work	55,869	54,872	18,038	2,155	1,214	6,245	138,393
	40.37%	39.65%	13.03%	1.56%	0.88%	4.51%	12.22%
1st Origin	307	463	582	715	17	202,211	204,295
	0.15%	0.23%	0.28%	0.35%	0.01%	98.98%	18.03%
Destination	53,162	100,444	53,317	6,417	2,676	414,365	630,381
	8.43%	15.93%	8.46%	1.02%	0.42%	65.73%	55.64%
Column Total	223,335	157,397	110,200	12,615	6,540	622,821	1,132,908
	19.71%	13.89%	9.73%	1.11%	0.58%	54.98%	

Exhibit 7.4.2 Address Types verses Coding Method

ADDRESS TYPE	CODING METHOD				
	Batch Geocode	Interactive Geocode	Using MapInfo	Uncodable	Row Total
Street Address	82,295	137,037	3,329	399	223,335
	36.85%	61.36%	1.49%	0.18%	43.81%
Intersection	68,121	88,859	1	416	157,397
	43.28%	56.46%	0.00%	0.26%	30.87%
Monument	25,234	84,456	4	501	110,200
	22.90%	76.64%	0.00%	0.45%	21.62%
Place Name	3,245	9,352	3	14	12,615
	25.72%	74.13%	0.02%	0.11%	2.47%
Traffic Zone	2	6,538	-	-	6,540
	0.03%	99.97%	0.00%	0.00%	1.28%
Column Total	178,897	326,242	3,337	1,330	510,087
	35.07%	63.96%	0.65%	0.26%	

8. Survey Budget and Costs

The budget for the survey was **$2.374 million** including development, conduct of the survey, preparation of the final database and the production of five reports:

- Conduct of the survey
- Data Guide
- Validation
- 1996 TTS Travel Survey Summary
- 1996, 1991 and 1986 Travel Survey Summary for the GTA

Cost savings were realized in a number of areas permitting additional analysis and application of the survey data to be carried out within the original budget. The direct marginal cost of conducting the survey, excluding development, management coordination and post survey analysis and reports, is estimated to have been **$10.38** per completed interview.

8.1 University Overhead and Taxes

The overhead charged by the University of Toronto was 40% of University staff staffing costs and 2% of other expenditures. These overhead charges helped cover the cost of providing the Data Management Group office facilities, general supplies and secretarial services. University staffing costs includes the fees charged by the Project and General Managers but excludes the interviewers, coders and supervisors hired specifically for the survey. The survey qualified as a University research project. Most equipment purchases were therefore exempt from Provincial Sales Tax. The University also qualifies for a refund of 2/3 of the net amount paid in Federal Goods and Services Tax (GST). University staff costs, excluding the Project and General Manager, were exempt from GST. The appropriate amount of University overhead and net taxes have been included in the individual itemized costs in the following sections.

8.2 Cost Summary

Exhibit 8.2.1 provides a summary of actual expenditures. Development and testing includes the set up and management costs for the Waterloo component of the survey, conducted in the fall of 1995, but not the staffing and other direct expenses associated with the actual surveying. These latter costs have been included with the costs for the main part of the survey in the appropriate categories.

The costs shown for interview staff, coding staff and supervisors are the net of payroll expenditures including fringe benefits and payroll taxes. The staff were hired and paid by the Survey General Manager, who then invoiced the Data Management Group for the net amount of the payroll cost. The General Manager received an additional fee, equal to 2.5% of the net payroll, to cover the cost of administration and interim financing. The chief supervisors were hired under contract to the Data Management Group and were paid directly by the Data Management Group.

Most of the computers were purchased second hand and were resold at the end of the survey. Exceptions were the main fileserver, rented from the BA Group, and a small number of personal computers retained for post survey processing. The cost of telephones does not include any charges for the use of the Government of Ontario Centrex phone system at Queen's Park or the use of the Ontario Communications Network (OCN) for toll free long distance calling. These services were provided by the Government of Ontario free of charge representing a total saving of about $75,000 in the survey budget. Most of the telephone headsets were purchased as refurbished units and were resold under a buyback agreement with the supplier.

Office space and furniture, for the conduct of the main part of the survey, were provided by the Metropolitan Toronto Planning Department as part of their contribution to the cost of the survey. The amount shown is the net amount of the credit they received under the cost sharing agreement with the other

agencies. Office space and furniture for the Waterloo component of the survey were provided by the Regional Municipality of Waterloo at no cost to the survey budget.

8.3 Cost Comparison With the 1986 and 1991 Surveys

Exhibit 8.3.1 gives a comparison of the 1996 survey costs with the costs of the 1986 and 1991 surveys as reported in the 1991 TTS Design and Conduct of the Survey report. Categorization of the costs has been made as consistent as possible given the available information, the difference in organization structure between the 1986 survey and the other two years, and the spreading of the 1996 survey over two years. Inflation factors of 40% and 10% have been added to the 1986 and 1991 survey costs, respectively, to make them comparable to the 1996 values.

Interview staff costs per completed interview were higher for both the 1991 and 1996 surveys than they were in 1986 as a result of the higher wage rates paid to attract quality interview staff. Supervisor costs for the 1996 survey were below budget due to the inability to find and train the desired number of supervisory staff in the time available. The associated cost saving should not be regarded as a benefit as overall quality control likely suffered as a result. The slightly lower trip rate reported in the 1996 survey, compared to 1991, may be one factor attributable to less than the desired amount of supervision.

Lower equipment costs for 1996 were due primarily to the purchase of used equipment and from the use of the same equipment for both the Waterloo and the main component of the survey. The per interview cost of equipment in 1996 was lower than in 1986 despite the fact that the 1986 survey did not use computers for direct data entry and electronic monitoring.

The greatest percentage reduction in cost has occurred in the coding of the survey data. The use of automated geocoding for the 1986 survey likely reduced coding costs by 50% relative to the manual coding methods used in surveys prior to the 1986 TTS. Improved software design, more comprehensive and up to date reference databases, the use of direct data entry and the networking of computers have, together, resulted in a further 85% reduction in the unit cost of coding survey records since 1986. A significant portion of that saving can be attributed to a higher "hit" rate in the initial batch processing of records to be geocoded. The total savings due to automation and the use of electronic media is therefore in excess of 90% of the cost of manual coding methods and has likely reduced total survey costs by 40% or more. Other benefits include the flexibility of zonal aggregation afforded by geocoding, much improved quality control and a reduction in the total time required for post interview processing from 18 months down to a few weeks. The continuity of effort between surveys has likely been a significant factor in achieving these benefits and savings.

The other variable costs likely benefited from some economies of scale relative to the 1991 survey. The use of a commercial mailing house to mail the advance letters was the most the most significant factor in achieving the cost reduction associated with the advance letter. The use of identical letters and envelopes for all geographic areas reduced printing costs, kept handling costs to a minimum and enabled each mailing to qualify for the most favourable bulk mailing rate. The reduction might have been greater if official government envelopes had been used. The use of non-government envelopes may have contributed to a higher refusal rate, compared to the 1991 survey, with an associated decrease in interview productivity. The lower unit cost in the "Other Direct Costs" category, compared to 1986 and 1991, is due in part to savings in administrative overhead and organization resulting from the provision of office space and furniture by both the Metropolitan Toronto Planning Department and the Regional Municipality of Waterloo. A general surplus of office space in central Toronto at the time of the 1996 survey helped contribute to favourable costs. The credit received by Metropolitan Toronto represents the economic value of the space at the time of the survey.

Equitable comparisons of the fixed costs associated with the three surveys are more difficult. Approximately $180,000 (1996 value) has been included in the 1986 survey cost figures to reflect contributions made by the various agencies including direct staff assistance, the loan of computer

equipment, printing and the provision of office space and phones for the Hamilton portion of the survey. No costs have been included for the time devoted by senior agency staff involved in the management and direction of the survey or for the provision of office space and secretarial services to the Survey General Manager. None of these hidden costs are applicable to either the 1991 or 1996 surveys. The continuity provided by the Data Management Group and its Director significantly reduced the demands made on agency staff eliminating the need for some activities such as the preparation of detailed terms of reference and contract documents. At least $140,000 in development costs and $70,000 in survey costs should be added to the 1986 costs in order to provide a fair comparison with the 1991 and 1996 figures.

The development and fixed costs are significantly higher per interview for the 1991 survey than for the other two years due to the smaller scale of the survey. However, it should not be assumed that fixed costs associated with the conduct of the survey are completely independent from the size of the survey. Compared to the 1991 survey the 1996 survey required an additional level of supervision staff and a great deal more coordination.

In using the 1996 survey costs to estimate the cost of future surveys somewhat higher cost allowances may need to be made for the provision of telephone service and office space. Quality control might benefit from more intense training and an increase in the level of supervision ,assuming that the appropriate staff can be located and retained to provide those services. Total costs, depending on the size of the survey, should be in the $20 to $25 range per completed interview.

Exhibit 8.2.1 Summary of Expenses

Development and Testing		
Software Development		44,700
Pretest and Pilot Projects		85,600
Development Support and Management		101,800
Subtotal	**$**	**232,100**
Interviewing		
Interview Staff		499,900
Supervisors		114,200
Chief Supervisors		85,200
Administration		15,100
Subtotal	**$**	**714,400**
Coding		
Coding Staff		128,800
Administration		3,500
Subtotal	**$**	**132,300**
Equipment		
Computer Hardware & Software		197,800
Telephone Rental & Headsets		24,200
Sale of Equipment		(75,000)
Subtotal	**$**	**147,000**
Other Direct Expenses		
Printing		16,200
Mailing and Publicity		56,600
Office Space & Furniture		71,900
Security		14,100
Sample		18,500
Office Expenses & Supplies		25,300
Subtotal	**$**	**202,600**
Post Interview Processing		
Bulletins and Reports		36,700
Analysis and Applications		272,500
Subtotal	**$**	**309,200**
Management and Coordination		
Management		416,800
Support Staff		219,500
Subtotal	**$**	**636,300**
Total Expenses	**$**	**2,373,900**

Exhibit 8.3.1 Cost Comparison with the 1986 and 1991 Surveys

Adjusted for Inflation

	1986 TTS Costs		1991 TTS Costs		1996 TTS Costs	
	Total	Per Completed Interview	Total	Per Completed Interview	Total	Per Completed Interview
Variable Costs (Directly related to the number of interviews conducted)						
Interviewing						
Interviewers & Supervisors	$ 322,000	$ 5.24	$ 170,000	$ 6.94	$ 714,400	$ 6.20
Equipment & Supplies	$ 123,000	$ 2.00	$ 59,000	$ 2.41	$ 172,300	$ 1.50
Subtotal	$ 445,000	$ 7.24	$ 229,000	$ 9.34	$ 886,700	$ 7.70
Coding						
Data Entry	$ 98,000	$ 1.59	n/a	n/a	n/a	n/a
Geocoding	$ 368,000	$ 5.99	$ 55,000	$ 2.24	$ 132,200	$ 1.15
Subtotal	$ 466,000	$ 7.58	$ 55,000	$ 2.24	$ 132,200	$ 1.15
Other Variable Costs						
Advance Letter	$ 84,000	$ 1.37	$ 23,000	$ 0.94	$ 70,000	$ 0.61
Other Direct Costs	$ 74,000	$ 1.20	$ 36,000	$ 1.47	$ 107,300	$ 0.93
Subtotal	$ 158,000	$ 2.57	$ 59,000	$ 2.41	$ 177,300	$ 1.54
Total variable Cost	**$ 1,069,000**	**$17.40**	**$ 343,000**	**$ 14.00**	**$1,196,200**	**$ 10.38**
Per Person Record		$ 6.25		$ 4.73		$ 3.82
Per Trip Record		$ 2.89		$ 2.18		$ 1.82
Fixed Costs (Not directly related to the number of interviews conducted)						
Pilot Survey & Pretests	$ 52,000	$ 0.85	$ 17,000	$ 0.69	$ 85,600	$ 0.74
Management	$ 123,000	$ 2.00	$ 177,000	$ 7.22	$ 416,800	$ 3.62
Other Costs	$ 91,000	$ 1.48	$ 4,000	$ 0.16	$ 219,500	$ 1.91
Total Fixed Costs	$ 266,000	$ 4.33	$ 198,000	$ 8.08	$ 721,900	$ 6.27
Development Costs	$ 53,000	$ 0.86	$ 190,000	$ 7.75	$ 146,500	$ 1.27
Total Cost (Excluding analysis and reports)	**$ 1,388,000**	**$22.59**	**$ 731,000**	**$ 29.83**	**$2,064,600**	**$ 17.92**
Per Person Record		**$ 8.11**		**$ 10.08**		**$ 6.60**
Per Trip Record		**$ 3.75**		**$ 4.65**		**$ 3.14**

9. Conclusions and Recommendations

9.1 Data Quality

Non-respondents are a potential source of bias in any survey. A high response rate minimizes the potential magnitude of the bias, should any exist. The total non-response rate of approximately 25%, including a refusal rate of 22%, is higher than for the 1991 survey but lower than in 1986. There has been no evidence to suggest that there is significant non-response bias in any of the three surveys.

After correcting for differences in the survey area and sample stratification the overall reported trip rate per person in the 1996 survey was 5% lower than in the 1991 survey and 3% higher than in the 1986 survey. Analysis by trip purpose indicates that the differences are primarily in the amount of discretionary travel recorded. Comparisons with 1995 Cordon Count and Transit Ridership data from several sources reveal no evidence of any under reporting of a.m. peak period, work trip or school trip data. The apparent level of under reporting of discretionary travel is much greater than the differences in total reported trip rate between the three years. Care should therefore be exercised in drawing any conclusions as to trends in trip rates. Comparisons with the 1986 and 1991 survey data reveals a high degree of consistency in the distribution of trip rates, modal splits, trip lengths and many other factors.

9.2 Software

The 1996 TTS was the largest travel survey conducted to date and utilized the technological developments that were either used or recommended in previous surveys. The 1986 TTS was a pioneer in the use of automated geocoding. The 1991 TTS was the first to use Direct Data Entry. The most significant new development for the 1996 survey was the on-line networking of the interview computers.. It is anticipated that the scope of any future developments and improvements will be minor in comparison to those three items. All three major components (Data Entry, Sample Control and Geocoding) performed well providing an excellent model for use in future surveys. Areas identified where improvements for future surveys may be feasible include:

- Achieving better integration of the post interview review and geocoding processes in order to reduce the delay in geocoding and to provide more immediate feedback to the interviewers. The review strategy adopted for the 1996 TTS required that the visual review, and an initial round of call backs and edit revisions, for all households interviewed on a given day be completed before any of the interviews for that day were passed on for geocoding. A high proportion of interviewers did not work consecutive days, causing delays in the call back process, which resulted in a 3 to 7 day delay from the time of the interview until geocoding could begin.
- The process for reviewing and editing completed interviews required all the completed interviews for each interview team be placed in a single review database for that team. The size of the review database for each team became so large that it was necessary to restrict access to a single user in order to achieve acceptable computer response time. The single user restriction meant that only one person could access the database to make edit corrections. Faster computer processors should be used in order to permit the removal of the single user restriction.
- The frequency with which street intersections were used to record geographic locations, particularly the usual place of work, was higher than desired despite frequent instructions to interviewers that they should only accept intersections as a last resort. The use of intersections presents a problem if the intersection lies on a boundary of two or more traffic zones, as is often the case. Adding the frequency with which intersections are being used to record geographic information to the daily performance statistics might be a more effective means of deterrent.

- Providing the ability to retrieve incomplete or not started interview records from the work station to which they have been assigned to increase sample control. Having that option would improve the sample management capabilities in several respects including the ability to more readily adjust the geographic area being covered at any one time in response to strikes, or other labour disruptions. Appropriate safeguards are essential, however, to ensure that there is no possibility of an interview record being duplicated or lost in the process.
- The logic checks built into the DDE and Sample Control Software should be reviewed again to determine if there are any additional checks that could be added.
- The software used for visual monitoring (Closeup) had some serious limitations. The list of stations that could be monitored could not be specified by team. The same list was displayed at all monitoring stations. The number of stations that could be included on the list was limited by the capacity of the software and it was not possible to accurately control which stations were available to be monitored in a given session. An improvement in the selection capability or an alternative approach to monitoring is desirable.

9.3 Hardware

Very few computer hardware problems were experienced during the conduct of the survey. The purchase, and subsequent resale, of used name brand equipment is recommended as the most cost effective and efficient way to equip a survey of this magnitude. The fileserver is central to most operations. "Over" purchasing, in terms of its performance, reliability and back up capabilities, is recommended.

The 1996 survey realized significant productivity gains by using a local area network to connect all the interview, monitoring and coding stations to one central fileserver. Sample control software could be run from any work station on the network or an off-site computer via a modem connection. New sample could be allocated to any work station at any time and backup copies of all files were created automatically. Changes to the software (Direct Data Entry and geocoding) and look-up reference files were quick to implement and were automatically distributed to all work stations. Although potential improvements have been identified, to both the monitoring process and the editing of completed interviews, the use of the local area network did simplify both procedures relative to the 1991 survey.

9.4 Supervisory Staff

The single most difficult problem encountered in the conduct of the 1996 TTS was finding an adequate number of staff with the experience and background necessary to act in a supervisory role. Inevitable conflicts arose between the level of supervisory quality control being provided and the production needed to meet the completion targets.

Supervisory responsibilities include:

- the training of new interviewers
- basic supervision and assistance to interviewers
- selective monitoring of interviews in progress
- visual review of completed interviews
- review of call back information and editing corrections

The quality of first level supervision is probably the single most important aspect in overall quality control. It was anticipated that many of the supervisory positions would be filled from the early ranks of the interview staff. Unfortunately it was found that while there was no shortage of good candidates as interviewers the resulting pool of supervisory talent was smaller than desired. It was also necessary to appoint some staff to supervisory positions before they were fully trained or had a complete understanding of the survey and the unique situations that can arise during the conduct of a typical interview. Previous surveys, including the 1991 TTS, the 1995 Ottawa survey and the Waterloo component of the 1996 TTS,

were notably more successful in obtaining good supervisors early in the recruitment process. The situation in Toronto would have been much worse had it not been for the availability of several trained staff from the Ottawa and Waterloo surveys able to assume supervisory and training responsibilities at the outset.

A change in the organization and approach to recruitment of supervisory staff is recommended as being essential if another survey of the same magnitude as the 1996 TTS is to be conducted in the future.

Those recommendations are:

1. To specifically recruit supervisors with previous supervisory and telephone survey experience. The recruitment of supervisory staff should take place 3 to 4 months before the training of interviewers begins. The caliber of people required are not likely to be unemployed. Rates of pay must therefore be competitive, and reflect the temporary nature of the job, in order to attract people who may be employed elsewhere. Management staff must be in a position to make the necessary commitments at that time, implying that all the approvals required to conduct the survey be in place no later than April of the year the survey is to be conducted.

2. To conduct a pilot survey in May or June for the purpose of training the supervisory staff and ensuring consistency in the manner the survey data are collected. The selection of supervisory staff for the main survey and the appropriate organizational structure should be finalized after the pilot survey is complete.

3. That, as with the 1996 TTS, the interview staff be divided into teams but with a greater degree of autonomy. Each team leader should be responsible for hiring and training their own interview staff. To ensure that the teams are kept to a manageable size the number of completed interviews expected from each team should not be more than 30,000 in a three month time period.

An adequate budget allocation must be made to recruit the right people and to retain them from the start of the pilot survey through to the end of the main survey. The 1996 TTS came in under budget in the area of management and supervisory staff due to delays in project approval and the inability to identify the people needed. The quality of the data collected may have suffered as a result.

The 1996 TTS benefited from the pool of trained staff from the conduct of the Ottawa and Waterloo surveys. The benefits from the Waterloo survey would likely been greater if the survey had been larger and in the same location as the main survey. Performing between 20% and 30% of the survey in the previous fall would likely be an optimum situation and would remove the need for a large pilot survey in the spring. In a survey the size of the 1996 TTS all of the areas external to the GTA would be a manageable size to survey the previous year. Other benefits that might be realized from staggering the survey over 2 years include increased hardware utilization and the ability to thoroughly test the performance of both the software and management procedures in a less demanding situation than that of the main part of the survey.

An alternative approach for finding the required number of supervisory staff would be to contract out the interviewing to the market research industry. However, it is unlikely that any one company will have the necessary resources on hand and would face many of the same problems in gearing up for a survey of this magnitude. Past experience, including the 1986 TTS, has shown that there are significant differences between a transportation survey and an opinion or market research survey. A transportation survey generally requires the interviewer to make a lot more “judgment” calls and to be completely familiar with the purpose of the survey. These differences have to be recognized by all levels of management and supervisory staff. If the market research industry were to be utilized it is essential that staff with a transportation background be involved in the day to day management. Other problems that would need to be addressed would be potential discrepancies in the rates of pay needed to obtain good interview staff, responsibility for the provision of hardware and software, responsibility for coding and the ability to maintain consistency if more than one site is used. Furthermore, it is not expected that there would be significant cost savings and, perhaps, overhead costs would be higher.

9.5 Interview Site

The decision to conduct the survey from a single site proved to be highly fortuitous. The Management Team would not have been able to provide the support services, both supervisory and technical, needed at multiple sites. The provision of the site facility by one of the funding agencies, as was done in both Waterloo and Toronto, is highly recommended as a model for future surveys both as a cost saving and management support measure. Staff at both Metro Toronto and the Regional Municipality of Waterloo are to be commended for their cooperation and support that allowed the Management Team to concentrate on the actual conduct of the survey.

The central site location with convenient subway access proved to be extremely good. There was no shortage of applications for interview and coding staff positions. As mentioned previously, there were relative few people with the maturity and experience needed for supervisory positions. Both Waterloo and Ottawa proved to be better locations in that regard.

9.6 Telephone System

The use of the Queen's Park Centrex phone system with access to the Ontario Communications Network resulted in substantial cost savings. Staff from the Ministry of Transportation, Management Board Secretariat, Metro Toronto and Bell Canada were most cooperative and helpful in making the necessary arrangements.

9.7 Mailing House

The use of a commercial mailing house for the mailing of the advance letter resulted in significant cost savings. The savings result from the pre-sorting and packaging that the mailing house is able to do in order to qualify for bulk postage rates that are about half the cost of first class postage. The mailing process was problem free.

9.8 Advance Letter

More than 50% of respondents claimed not to have received the advance letter, up from 35% in 1991. The reason for the increase is not readily apparent. The rate was consistent for most interviewers suggesting that there was not a problem with the way the question was being asked or recorded. Control letters included in each mailing confirmed that the mailings were well timed. The use of non-government envelopes could have been a factor in letters being discarded as junk mail or the information not being passed on to other family members. It is recommended that approval be sought to use official MTO envelopes for future surveys as was in 1991. The advance letter has always been regarded as a critical item in achieving a low refusal rate. The reported refusal rate was higher in the 1996 TTS than in the 1991 survey.

9.9 Answering Machines

The number of answering machines encountered was a more serious problem than in previous surveys resulting primarily in a loss of productivity. In most cases, contact with the household was eventually made before the limit of 8 attempts was reached. The situation needs to be monitored to ensure that the widespread use of answering machines and voice mail does not create a bias in the response to future surveys. Adequate staffing provision must also be made to respond to call backs both during the day and at night when other interviews are in progress. The 1996 survey experienced some problems with the storage capacity of the voice mail system used on weekends.

9.10 Student Population

Student travel is an important component of total daily travel patterns with distinct characteristics. Two problems exist in capturing information on that component. The first problem is in obtaining a representative sample that includes the student population. The second is the methodology for expansion given that the Canada Census is not done during the post secondary school year. There is a need to investigate alternative methods of obtaining student population sample and to develop an appropriate expansion methodology.

9.11 Geocoding

Duplication of street and municipal names within the vast survey area made coding especially difficult. For example, there are 52 Church Streets in the survey area without accounting for variations such as Church Road, Church Lane and Church Street East and West. Coding small towns and hamlets in rural areas were more difficult because of the lack of commercial street maps and reference materials.

Overall, coding productivity improved even though the batch coding rate dropped significantly. The improvement in interactive coding is attributed to several factors:

- Coding by households instead of by record types (i.e., home, work, etc.) enabled the coder to understand household travel patterns. This proved to be invaluable in solving coding problems. For example, an incomplete school description can be solved by locating schools in proximity to the home location. In addition, this also allows on-line validations such as speed and distance checks.
- The sounds-like and full-text search routines in the geocode program permit the coder to browse through the massive reference database in a robust and organized fashion. Search results were more complete and less dependent on the coder's own geographic knowledge.
- Supplementary information such as city directories and electronic telephone listings lighten the dependency on the participating agencies to provide detailed monument listings.
- Grouping the coders into units by large geographic areas enabled the coders to gain experience in particular areas while allowing them to assist one another in solving problem records. It is worth noting that there were no partitions between coding stations as there were with interview stations. This was to allow coders to freely communicate with one another and share reference materials.

9.12 Coding Reference Databases

The most strenuous coding issue encountered was the development of the geocode reference database. The problem was two-fold. There was a lack of up-to-date GIS information and a lack of a common GIS standard.

- Only about one-third of the survey area had GIS data updated to 1996 information prior to the start of the survey. Additional information from various sources was added to the geocode reference database regularly as the survey progressed. Furthermore, some records had to be recoded after the survey when additional information became available.
- GIS data are maintained independently by agencies. Aside from using different GIS packages, the kinds of information being maintained also vary. For example, some agencies maintain address ranges while others code to parcel dot detail. The major problem is the different naming conventions used for numbered streets and abbreviations for street types and direction. Furthermore, some agencies are using the1927 geographic datum while others use, or are in the process of converting to, the 1983 datum. In theory, using a proper datum conversion program should resolve this problem. However, inconsistencies were noted at boundary locations even between adjacent areas that were using the same geographic datum.

For future surveys, it is strongly recommended that development work on the geocode reference database start well in advance of the survey, preferably 7 to 8 months ahead. The benefits of time taken to

understand and combine data from various sources is likely to out weigh the benefit of last minute upates. A geographic reference standard, in terms of datum, naming conventions, etc., should be promoted for the GTA. Although it is not necessary to adopt the same GIS package, a periodic check on street and boundary alignments is definitely beneficial.

10. Recommendations for 2001 and 2006

The conduct of a fourth TTS in the year 2001 is recommended for three reasons:

1. To provide consistent time series information on global demographic, socio-economic trends and their influence on travel behaviour.

2. To provide reliable before and after travel behaviour information specific to major new transportation initiatives such as Highway 407 tolling and construction of the Sheppard subway line.

3. To maintain the continuity of effort, and the expertise, for the efficient and consistent conduct of large scale travel surveys.

If a decision is taken to proceed with some form of travel survey in 2001, preliminary discussions should take place in 1998 so that advance planning can begin in the fall of 1999.

The needs of the agencies in the GTA as well as the Regional Municipalities of Niagara and Waterloo, differ significantly from those of the other agencies that participated in the 1996 TTS. Niagara and Waterloo Regions are of a similar size, in terms of number of households, to regions in the GTA and have conducted travel surveys in the past. Therefore, these recommendations are presented in two parts. The first part deals with the options that should be considered by the GTA and, by extension, the Regional Municipalities of Niagara and Waterloo. The second part contains recommendations for consideration by the other participants in the 1996 TTS.

10.1 GTA in 2001

10.1.1 Option 1 - A Repeat of the Survey Procedures Used in 1996

Repeating a survey on the scale of the 1996 TTS in 2001 would provide a reliable and consistent time series of observations on travel in the GTA. The Montreal Urban Community Transportation Commission (MUCTC) and the Quebec Ministry of Transport have conducted surveys of this magnitude on a regular basis with approximately a four-year time interval between surveys since the early 70's. The resulting data are considered by the MUCTC to be vital for service planning. In Toronto, the TTC uses detailed trip information from the travel surveys for service planning and would therefore likely be the major beneficiary of a repeat survey on the same scale as 1996.

The principal justifications for a 5% sample are to obtain reliable snapshot of transit use and to provide sufficient detail on the connections between trip origins and trip destinations. Detailed O-D information is used primarily for demand modelling and forecasting. However, indications from previous TTS indicate that travel patterns change slowly over time. A 10 year interval between major updates to the trip distribution components of these models is appropriate given the rate of change and level of effort involved. Therefore, much of the justification for repeating a survey on the same scale as 1996 would need to come from a general concern about the character of transit riders and the service planning needs of transit properties such as the TTC.

The estimated number of households in the GTA in 2001 is just under 2 million. Using a 5% sample and the cost estimates presented in Section 8.3 of this report, a survey of this magnitude would cost between $2 million and $2.5 million. In addition, if the Regional Municipalities of Niagara and Waterloo were to participate, the cost would increase by $350,000 to $400,000.

10.1.2 Option 2 – Telephone Interviews on a Smaller Sample Plus Supplementary Surveys

An alternative to the large sample telephone survey is to use the same or very similar survey instrument to the 1996 TTS on a smaller sample and supplement these data with parallel surveys aimed at particular urban transportation issues of importance to the funding agencies. Some geographic detail could be sacrificed, for example nearest major intersection would be sufficient for origins and destinations. Additional questions or refinement of the existing questions pertaining to household structure, occupation and auto occupancy could be considered. It is recommended that the telephone survey should focus primarily on changes in socio-economic and demographic characteristics that influence trip rates and mode choice. These relationships can be volatile, can be influenced by government policy and can have long term implications that take time to measure and fully understand. Therefore, a travel survey in 2001 is important in tracing these changes at a reasonable geographic scale. A completed sample of 1,500 households is about the minimum that will permit some degree of stratification within a single geographic area. A 1.5% sample would be sufficient to achieve that minimum target in each of the regional municipalities. The use of a stratified sample or differential sampling rates by geographic area is not recommended. Using a 1.5% sample and the cost estimates presented in Section 8.3 of this report, a survey of this magnitude would cost between $600,000 and $700,000. In addition, if the Regional Municipalities of Niagara and Waterloo were to participate, the cost would increase by $100,000 to $130,000.

Two additional surveys should be considered strong candidates to supplement the information collected in a smaller telephone survey. The first candidate is a survey that attempts to gain an understanding of how individuals and households are influenced by family structure and life style preferences in their interaction with the urban transportation system. The recommendation is to design a panel survey to be conducted over a period of years on a sample of 2000 to 2500 households representing a cross section of the household structures found in the GTA. A panel survey is a set of households that are interviewed, usually in their home, at regular time periods. A suggestion would be to interview every two or three years. Contact is maintained with the household for as long as feasible. As households drift out of the sample for one reason or another, new panels can be formed in an effort to maintain a representative sample of different household structures. The duration of the project should consider interviewing participants for a period of at least 10 to 12 years. It is not possible to estimate the cost of such project at this time. A necessary first step if a panel survey is contemplated, is to design the survey procedures and estimate costs.

A second candidate for a supplementary survey is to collect information on the magnitude of under reporting of travel for purposes other than work or school. A major concern in the TTS has always been the under reporting of off-peak and discretionary travel. This concern may be even greater in the future if discretionary travel continues to increase at a faster rate than travel related to work and school. A smaller scale TTS could provide an appropriate opportunity to obtain a better understanding of the magnitude and characteristics of discretionary travel. A small sample is possible, in part, because of the characteristics of travel for purposes other than work or school. These trips do not exhibit the same regular patterns as trips related to work and school, are much more stochastic in nature, and are usually repeated infrequently. An appropriate factor applied to the observed trips in TTS would be an appropriate way to estimate total travel for these trip purposes. An investigation of these trips might involve a follow up trip diary type of survey along with the basic survey. The unit cost would likely be much higher than for the TTS but a relatively small sample, 1,000 to 2,000 households, would likely be sufficient to quantify the extent of the under-reporting in the TTS in a number of different categories.

Cost estimates are not possible at this time, but should not exceed the cost of Option 1.

10.2 Other Agencies in 2001

Due to the smaller population of the areas represented by the other agencies that participated in the 1996 survey, a 5% sample is about the minimum that is likely to produce useful information. It would not be cost effective for those agencies to participate in a survey with a lower sample rate. Should those agencies wish to expand on the 1996 experience to create a time series database they should consider a larger sample that will provide better information than was obtained in the 1996 TTS. A sample rate of between 10% and 20% is recommended. Differential sampling rates, by geographic area, are not recommended due to the problems inherent in pre-defining the sample area boundaries. The survey could be quite separate from the one that is done for the GTA and could use a different survey instrument. Exhibit 10.2.1 provides a summary of the required number of interviews. The numbers for the Counties of Wellington, Simcoe and Peterborough assume that the geographic coverage is limited to the same area as was surveyed in 1996.

Exhibit 10.2.1 Proposed Non-GTA Sample for 2001

Area	Estimated Households	10% Sample	20% Sample
City of Guelph	40,000	4,000	8,000
City of Barrie	30,000	3,000	6,000
City of Peterborough	32,000	3,200	6,400
Town of Orangeville	8,000	800	1,600
County of Wellington	16,000	3,200	3,200
County of Simcoe	44,000	8,800	8,800
County of Victoria	28,000	5,600	5,600
County of Peterborough	16,000	3,200	3,200
Total	214,000	21,400	42,800

10.3 Recommendations for 2006

It is recommended that the next full TTS be scheduled for the year 2006. The target sample within the GTA, Niagara and Waterloo should be 5%. Other external areas, if they participate, should consider a higher sample rate.

Spreading the survey over two time periods should result in cost savings and better quality data. The suggested schedule is:

Fall of 2005 (or spring of 2006)	All areas external to the GTA
Fall of 2006	GTA (including Hamilton-Wentworth)

10.4 Expansion of Survey Area

There are economies of scale to be realized if other agencies, in addition to the ones that participated in the 1996 survey, wish to be included in future surveys. Information on travel and growth trends in surrounding areas would also benefit the GTA agencies. To fully rationalize the area covered by the 1996 survey, consideration should be given to include the Regional Municipality of Haldimand-Norfolk and the Counties of Brant, Dufferin and Northumberland. It is suggested that the agencies representing these areas be contacted well before the next large scale survey to determine whether they would be interested in participating.

11. Appendix - Press Release Package