DEVELOPMENT OF AN URBAN TRAVEL DEMAND MODEL OF THE TOWN OF OAKVILLE

by

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A Dissertation

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in partial fulfillment of the requirement for the degree of

Master of Engineering

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ABSTRACT

Dissertation Title: Development of an Urban Travel Demand Model of the Town of Oakville
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This dissertation documents the development of a travel demand model of the Town of Oakville. The purpose of the model was to predict traffic demand on study area roadways during the morning peak hour. The model focused on the prediction of auto driver trips. The model was developed based on the 1996 Transportation Tomorrow Survey data, available from the Data Management Group at the University of Toronto.

The model was developed in accordance with the Urban Transportation Modelling System (UTMS) of models. Activities included: Trip Generation, Trip Distribution, and Trip Assignment. Accounting for Mode Split was unnecessary as the model focused only on auto driver trips. The final product of the model is a set of traffic flows over links in the transportation network.

The model was developed using TransCAD transportation GIS (Geographic Information System) software. TransCAD is a microcomputer software specifically designed for transportation planning and data management.

ACKNOWLEDGEMENTS

In the course of completing this dissertation I have had the privilege of working under the supervision of Dr. Bhagwant Persaud to whom I extend my gratitude. I would also like to thank Dr. Said Easa for his guidance and input. I would also like to acknowledge the support I received from my co-workers, at Dillon Consulting Limited.

My appreciation goes to all those who provided me with data: the Data Management Group at the Joint Program in Transportation, University of Toronto who provided access to the Transportation Tomorrow Survey data; the Region of Halton; and the Town of Oakville.

I would like to thank Joe Gallivan and the City of Kingston for the use of the City's TransCAD software.

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CHAPTER 1

INTRODUCTION

1.1 STUDY AREA

The Town of Oakville is a municipality within the Greater Toronto Area, some 40 kilometers to the west of the City of Toronto, Ontario, Canada. It is a medium sized municipality with a population of 144,738 (2001 Census). In contrast, the Greater Toronto Area GTA has a total population of 5,096,682 (2001 Census). In short the Town of Oakville is part of one of the largest urban centers in North America. A map of the Study Area is illustrated in **Figure 1**.

Figure 1: Study Area

1.2 ROLE OF TRANSPORTATION

The role of the city is to increase exchange efficiency (i.e. optimize access to diverse exchanges while minimizing access costs, in particular travel). The role of the urban transportation system is to facilitate the movement of people and goods between different points within the urban center.

Transportation is a derived activity, in that people do not typically travel for travel's own sake. Transportation occurs to facilitate community activities, both social and economic. Traffic is thus the product of an interaction between urban land use and the transportation system.

Ortuzar defines a 'good transportation system' as one that widens the opportunities to satisfy human or industrial needs – needs that are distributed over space. That is, a system that facilitates the interaction between persons and lands distributed over a given geography. While a heavily congested and poorly connected system is one that restricts options, and as a result, limits social and economic development.

1.3 STUDY PURPOSE

Modelling is the process of applying scientific techniques to develop mathematical/abstract representations of real world phenomena. 'Travel demand' models, otherwise known as a 'traffic assignment' model (Easa), are a family of models designed to predict the flow of traffic over a transportation network. Developing such models involves the creation of an analytic representation of the transportation system. Socio-economic data serve as inputs to

the model, and are used to predict the origin-destination demands over the transportation network. Procedures are then applied to determine the geographic distribution of the various origins and destinations in question. The trips between the origin and destination pairs are then assigned over routes in the transportation network. In doing so, such models are useful to transportation planners, engineers, or municipal agencies, in making system wide decisions regarding infrastructure investments, traffic management strategies, or to test the implications of alternative land use or development options. For example, such a model may be used to identify areas in need of transportation system investment under different growth scenarios. To test alternative growth scenarios, forecasts of socio-economic data would need to prepared and input into the model (Easa).

The purpose of this dissertation is to document the development of an urban travel demand model of the Town of Oakville. The model focuses on the morning peak hour, and predicts auto travel trips over the transportation network.

The project utilized data collected as part of the 1996 Transportation Tomorrow Survey, this data served as the primary source of socio-economic data input into the model. The Transportation Tomorrow Surveys, conducted periodically by the Joint Program in Transportation at the University of Toronto, are comprehensive household telephone travel surveys of the Greater Toronto Area. Survey data was available through the University of Toronto's Data Management Group, via the Data Retrieval System available through the internet.

The model was developed using TransCAD transportation GIS (Geographic Information System) software. TransCAD is a microcomputer software specifically designed for transportation planning and data management. The software incorporates the data management capabilities of standard GIS software, and integrates these with advanced transportation modelling and logistics applications.

CHAPTER 2

LITERATURE REVIEW

The concepts presented in this section of the report are intended to introduce the reader to the fundamental theories that form the basis of transportation analysis. A number of economic theories are discussed, as these are particularly useful in helping understand transportation, and transportation decisions.

2.1 ECONOMIC THEORY OF TRAVEL DEMAND

As will be pointed out, transportation decisions: mode choice, route selection, destination location, and others, can be best be explained by the application of economic theory. "The estimation of the amount of travel on a transportation system is, in principle, a simple application of economic theory." (Highway Research Board, 1973)

The following sections present a number of the economic theories particularly useful to the understanding of transportation demand phenomena.

2.1.1 Consumer Behaviour

The theory is based on the premise that consumer choice is governed by the consumer's desire to maximize his/her personal utility/satisfaction. Ben-Akiva defines '*utility*' as index of attractiveness of a transportation alternative, in terms of its attributes (Discrete Choice Analysis). It is a measure by which different alternatives are evaluated by the decision maker in terms of the evaluation of 'trade offs'. Individuals are seen as utility maximizers, and in making decisions they select alternatives that they perceive will give them the highest utility (alternatively, the lowest disutility). Miller describes consumer behaviour as follows "...an individual will select a bundle of goods over all other affordable bundles if it yields the

greatest utility, that is, satisfaction". He goes on to describe that the individuals decision making process involves the maximizing of a utility function U subject to a budgetary constraint:

$$\text{Maximize } U = U(X_1,\ldots,X_n)$$

$$\text{Subject to } Y = PX_1 + \ldots + P_nX_n$$

Where: $X_1, X_2,\ldots, X_n$ = goods that are consumed

$P_1, P_2, \ldots, P_n$ = prices of goods

Y = income

An individual's income is finite, and represents the maximum dollar value of goods and services that an individual can purchase. Thus income is equal to the sum of all goods purchased at their given prices. The total utility derived by the individual is a function of the utilities of the purchased goods. The solution to the utility maximization problem is illustrated in **Figure 2** assuming a two good problem. The income line indicates the different combinations of Good 1 and Good 2 that can be purchased by the consumer. A rational consumer will purchase the particular combination of the goods that maximizes the derived utility.

In transportation the 'goods' being demanded are the transportation services by different modes. The price of the good may simply refer to the monetary cost of trips or alternatively may include other costs such as travel time, inconvenience, etc. The desire to minimize

incurred costs is a fundamental consideration in travel decision-making. The price of cost of a particular transportation decision may be thought of as the disutility associated with that transportation alternative (the cost of travel). Thus, in making transportation choices (i.e. mode choice, route choice, etc.), individuals seek to minimize both the cost and time of travel. The extent to which one goal dominates another depends on the value of time for the individual in question. For example, in assigning traffic to routes in the transportation network, a model may assume individuals make choices so as to minimize their travel time.

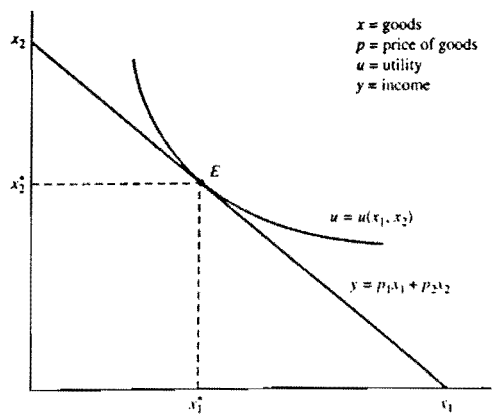


Figure 2: Consumer Utility Maximizing Behaviour (Meyer and Miller)

2.1.2 Supply and Demand Functions

One of the cornerstones of economic theory is the concept of a relationship between the demand and supply for a consumer good. Although these concepts are ordinarily associated with economic analysis, they can nonetheless, be utilized in the prediction of traffic volumes. In fact the prediction of traffic volumes necessitates an understanding of these concepts.

A road network at any given time consists of a definite number of roadways of a given width, and a given number of intersections with specific control devices. These elements of the road network determine its capacity. Thus, at any given time the capacity of the road network can be thought of as fixed. The number of vehicles using the transportation system varies with different times of the day, and seasons of the year (Wohl and Martin).

If one thinks of the transportation system in economic terms, the capacity of the network at any given time may be thought of as the transportation system '*supply*'. Likewise, the number of vehicles using the transportation system may be thought of as the '*demand*' for the system, at that level of supply. The capacity of the roadway as well as the number of vehicles using the system/facility influence the level of service experienced by the traveler. This level of service is related to the disutility associated with a particular travel choice. Thus, the level of road system supply is related to the level of disutility associated with a given travel choice. Consumer behaviour implies that the demand for a good is related to its price, as well as its supply. Thus, transportation is related to transportation supply – changes in the transportation supply (changes in road network capacity or price) will affect transportation demand. The short-run relationship between supply and demand is illustrated in **Figure 3**.

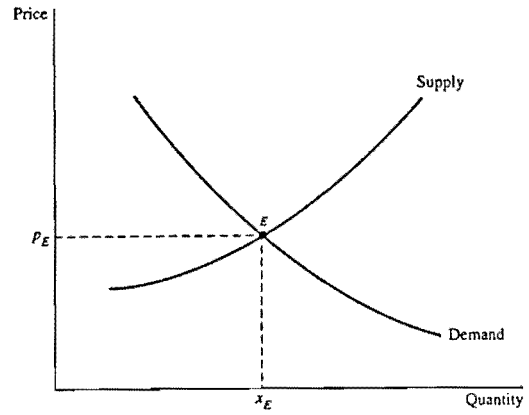


Figure 3: Equilibrium of Supply and Demand (Meyer and Miller)

Miller suggests that, markets generally move toward an equilibrium position; that is, the quantity demanded is equal to the quantity supplied. In the short run shifts in the supply and demand curves do not occur (there are no changes in the capital, labour, production techniques) that would reduce the marginal production cost for a given good. If excess demand were to exist, prices would rise as people would bid up the price of available goods, this would stimulate an increase in the production of the good – putting downward pressure on prices. Thus the system would tend toward equilibrium.

Such a relationship between transportation supply and transportation demand is also thought to exist. If the supply of the transportation system were to be increased (the widening of a roadway), travel cost over the widened section of roadway would decrease and would result in increased capacity. A decrease in the travel cost would make that alternative (section of roadway) more attractive. Traffic would be drawn from other roadways – increasing the congestion, delay, and travel cost (decreasing its attractiveness). This process would continue until a state of equilibrium is achieved.

2.1.3 Capacity Restraint

Conceptually, when dealing with vehicular traffic, it is easiest to think of the performance of a given section of roadway as the travel time over that section of roadway. The travel time for each additional vehicle to use that section of road is dependent on the capacity of the road, and the volume of traffic already using the roadway. Keeping this in mind, it can be seen how the economic theories described above can be thought to influence traveler route choice over the transportation network.

It is assumed that route choice is made such that traveler travel time is minimized (utility maximization). Thus, the travel time likely to be incurred by the traveler influences his/her route choice. The U.S. Department of Commerce, Bureau of Public Roads had presented the following relationship between travel time, assigned volume, and capacity (link performance function).

$$T = T_0 (1 + \alpha (Assigned\ Volume/Capacity)^{\beta})$$

Where: T = the travel time at which the assigned volume can travel over the subject link

T_0 = the base travel time at zero volume

α, β = parameters to be estimated during model calibration (typically, α = 0.15, β = 4.0)

The capacity restraint relationship is illustrated in **Figure 4**. The illustration assumes a base travel time of 60 km/h, $\alpha = 0.15$, $\beta = 4.0$, for a 1 kilometre section of road.

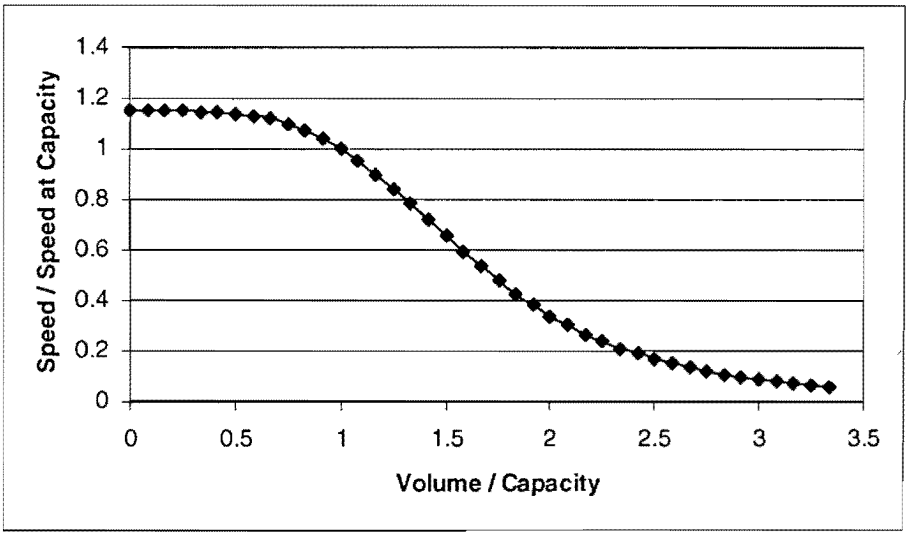
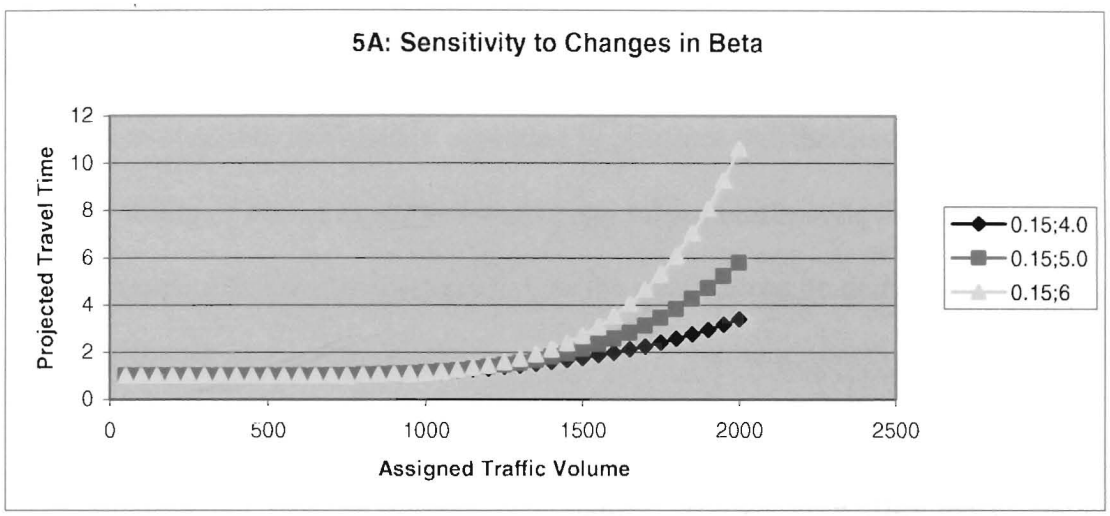


Figure 4: Capacity Restraint Relationship (Bureau of Public Roads)

Figures 5A and **5B** illustrate the sensitivity of the link performance function to changes in model parameters. The model parameters (α and β) affect the sensitivity of the projected travel time over the link to assigned traffic volumes.



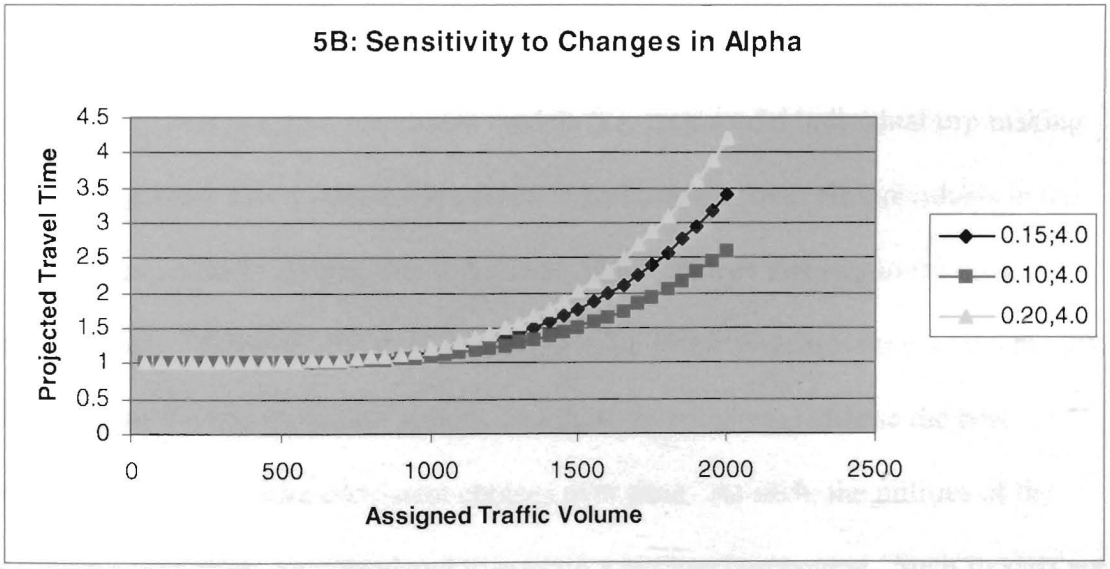


Figure 5A and 5B: Sensitivity of the Link Performance Function

2.2 URBAN TRANSPORTATION MODELLING SYSTEM

The purpose of a transportation model is to estimate travel demand over the transportation network based on available information regarding populations and the transportation system. The predictive ability of such a model can be of great value in estimating the future transportation needs of future growth scenarios, or the implications on demand of changes in development scenarios and transportation system.

Two of the most common types of transportation models are **Random Utility** models, and **UTMS (Urban Transportation Modelling System)** models.

Random utility models are **discrete choice** models (i.e. they model individual trip making behaviour). Aggregate travel demand is estimated by summing over all individuals in the population. These models assume that individuals make choices that maximize their individual utilities. However, the models acknowledge that individuals do not always have full knowledge of the transportation system, and thus, do not always choose the best alternatives, nor do they make consistent choices over time. As such, the utilities of the transportation alternatives are considered to contain a random component. Such models are useful in associating travel choices with individual's socio-economic attributes. As a result they are often used to test estimate the effects of policy changes (i.e. an increase in gasoline taxes or auto ownership, etc) on travel demand.

UTMS models are **aggregate models**. These models typically estimate travel demand based on the average attributes of different geographic zones within the municipality. These models

do not attempt to model travel behaviour (i.e. they do not estimate the individual decision making process). UTMS models estimate travel throughout the transportation network based on predictions of trips made between pairs of zonal origins and destinations for a given time period. The models commonly comprise of four stages of analysis: *trip generation* – the prediction of trips produced and attracted to each zone; *trip distribution* – the prediction of origin-destination flows, the linking of trip ends predicted by trip generation; *mode split* – the estimation of percentages of trip flows made by each transportation mode in the model; and *trip assignment* – the allocation of trips to routes in the transportation network. The four stages represent a sequential decision structure. The transportation model developed for the Town is a four-stage UTMS model. Since the model focuses solely on the prediction of automobile trips, mode split may be seen as the first stage in the model's development.

2.2.1 Trip Generation

Trip generation involves the prediction of trips produced and attracted to each traffic analysis zone. Any number of variables may be used as predictors of trip production including: household income, auto ownership and size, number of workers per household, residential density, population. Predictors of trip attractions may include, employment levels, commercial floor space, etc. (Meyer and Miller).

Two common approaches to determining trip generation are **regression models** and **category analysis**. Regression models apply least square methods to trip generation as a linear function of one or more socio-economic variables (for a given zone). Households are grouped spatially, and zonal total or averages of given attributes are determined. Category analyses

group households according to common socio-economic characteristics (i.e. household income, auto ownership, etc.). Average trip rates are then computed for each category from observed data (Meyer and Miller). Category analysis was first developed in the late 1960's – three variables are assumed to influence household trip generation: car ownership, household size, and household income (Black).

2.2.2 Mode Split

The determination of the mode split, essentially entails the determination of the proportion of trips made using each of the transportation modes available to the trip makers (auto, transit, walk, etc.). The determination of the mode split can be undertaken at different points in the Universal Transportation Modelling System. Meyer and Miller identify two types of UTMS models depending on the stage at which the mode split is determined. **Trip-end** models, where mode split is determined prior to trip distribution, and **trip-interchange** models, where the mode split is determined after trip distribution. Trip-interchange models are useful in testing the response of mode split to changes in various socio-economic, as well as service characteristics, particularly where there is competition between modes. Interchange models can, for example be used to test the sensitivity of the mode split to the cost of a given, or competing mode. Trip-end models, by splitting modes prior to trip distribution, are more limited in their usefulness (for testing sensitivities of mode split), since they are based on the assumption that users of certain modes are captive (e.g. transit users take transit because they do not have access to a car, etc.).

John Black identifies four types of mode choice models: Type I models, where mode split is combined with trip generation (i.e. the trip generation procedure is specific to each mode, thus, trips using each mode, are generated separately). This method has the same limitations as the trip-end mode choice model previously described. Type II models, these are the trip-end models described above. Type III models, combine trip distribution with mode split, where the proportion of trips using each mode is a function of the impedances to travel between traffic zones for each given mode. Type IV models, these are the trip-interchange models described above. The four types of mode choice models possible with UTMS models are illustrated in **Figure 6**.

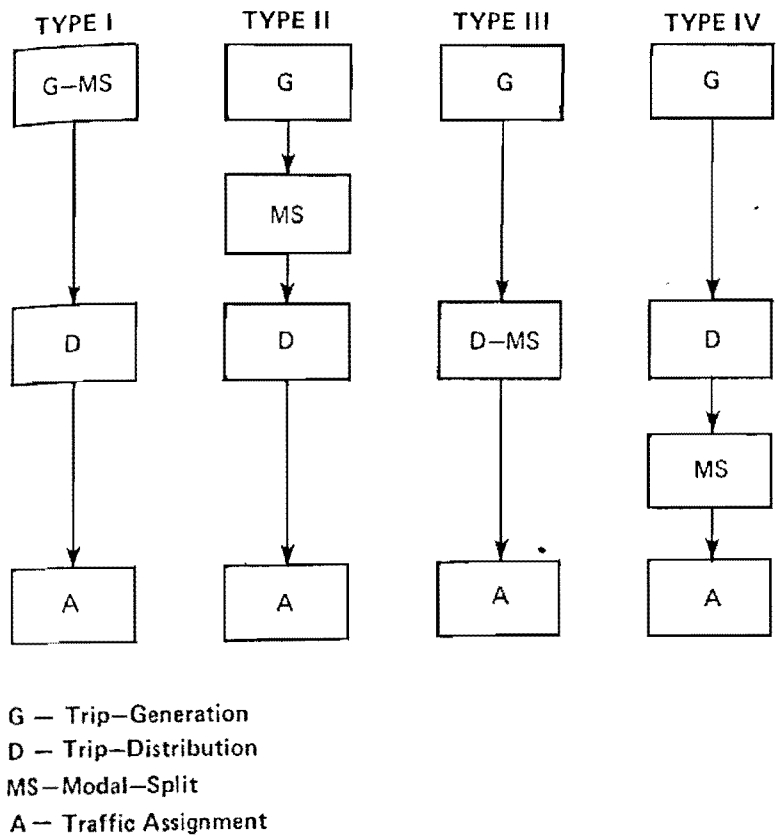


Figure 6: Alternative Positions for Mode Split Analysis (Black)

2.2.3 Trip Distribution

The purpose of any trip distribution model is to predict the spatial pattern of trips between origins and destinations. "The purpose of trip distribution modelling is to find an equation that reproduces the intra- and inter-zonal patterns of traffic survey" (Black, pg. 72). The task of trip distribution is link the trip ends together. Essentially, it is to determine where the trips destined to each zone are expected to originate, and likewise, to determine where trips originating from each zone are destined. The goal is to produce an origin-destination matrix for the study area. A typical origin-destination matrix is illustrated in **Figure 7**.

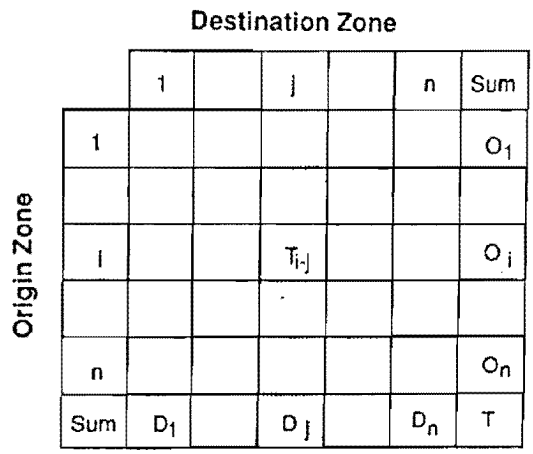


Figure 7: An Origin-Destination Matrix (Easa)

In the above matrix, T_{i-j} represents the number of trips originating in zone i and destined to zone j.

There are a number of methods that can be applied to determine trip distribution. Two common methods include the **Fratar Method**, and the **Gravity Model** for trip distribution.

The fratar method is the simpler of the two to apply, however, the model is subject to some limitations. Essentially, the method requires an existing origin-destination matrix. Having projected future trip ends (origins and destinations). A future origin-destination matrix can be determined by proportionally factoring up the existing origin-destination matrix. This procedure is applied iteratively to ensure that projected trip ends are met to within a specified error. As noted by Easa, one advantage of the model is the ease with which it can be applied, however, the model is generally useful for short-range analysis, and is not sensitive to characteristics in the road network. Most notably, entries in the present o-d matrix that indicate zero trips would be unaltered in the determined future matrix. In addition, the method is not applicable where there is a change in the number of traffic zones in the transportation system. New future zones are simply not present in the existing matrix, and therefore, there would be no trips in the existing matrix, that could be factored up to represent the future condition.

The more common of these is the gravity model for trip distribution. The underlying premise of the gravity model of trip distribution is that human travel behaviour is governed by something analogous to Newton's law of gravity. The gravity model for trip distribution is described by the following relationship.

$$T_{ij} = (P_i(A_j f_{ij} k_{ij}))/(\Sigma A_j f_{ij} k_{ij})$$

Where: P_i = the number of trips produced in zone i

A_j = the number of trips attracted to zone j

f_{ij} = a friction factor between zones i and j

k_{ij} = an adjustment factor for trip interchanges between zones i and j

"...the amount of traffic interaction between two places is directly proportional to the amount of land-use intensity in both places and inversely proportional to the transport difficulty in getting from one place to the other..." (Black, pg. 74)

These "transport difficulties" are the impedances to travel between traffic analysis zones. These impedances are generally a function of travel time or travel distance between the traffic zones.

The application of a gravity model of trip distribution, required a number of inputs:

- The number of trips originating in each zone;
- The number of trips terminating in each zone;
- The impedance between the origin and destination zone pairs; and
- The friction factor between the origin-destination zone pairs.

A friction factor matrix is based in the impedance matrix and a friction factor function. The function can take the form of the following exponential function:

$$f(dij) = exp(-c * d_{ij})$$

Where: d_{ij} represents the impedance between each i, j pair of zones.

$f(d_{ij})$ represents the friction factor between each i, j pair of zones.

c represents a parameter established through calibration.

The purpose of the friction factor function is to account for the trip length frequency distribution. Where in general, the frequency of trips diminishes with increasing trip length. "Calibrating the gravity model consists of evaluating the parameters of the impedance function ... so that the gravity model reproduces as closely as possible, the base year productions and/or productions and the base year trip length distribution." (Caliper, p.93).

2.2.4 Traffic Assignment

The purpose of traffic assignment is to predict the flow of trips between pairs of origins and destinations over the transportation network. In building the model the intent is to replicate the amount of traffic on the principal routes of the transportation network.

Several methods of performing traffic assignment have been documented in professional literature. The methods differ in their underlying assumptions regarding the information possessed by the traveler at the time route choice decisions are made, and the overall objective of the traveler.

All-or-nothing assignment is the most basic of the assignment techniques. This procedure assumes travelers have perfect information regarding the transportation network, all of the

travelers between a given origin-destination pair are assumed to take the shortest path (based on travel distance or travel time). This method is relatively straightforward to apply, however, its strength is also its greatest weakness. In assuming all travelers take the shortest path, the procedure is useful only in predicting the routes likely to be taken by most travelers given uncongested roadways. The procedure is likely to result in and unrealistic assignment of trips given that alternative routes between origins and destinations are unaccounted for, nor is the effect of roadway capacity/congestion. The assumption that all users have perfect information regarding the transportation system is also likely to be unrealistic.

Equilibrium assignment techniques were developed to account for the effect of congestion in influencing driver route choice. As described by Kanafani, "...it is assumed that the users will choose routes in such a way that no individual trip maker can improve the choice by unilaterally changing routes". Equilibrium is thus achieved when all travelers are on their minimum cost routes. The concept is illustrated graphically in **Figure 8** – in this case, traffic flow from a single origin-destination pair has the choice of two alternative routes, S_1V_1 and S_2V_2, are volume delay function for the two routes in question. The equilibrium position is achieved at the intersection of the respective volume delay (link performance) functions. This procedure is applied iteratively. As long as the travel costs on the two routes do not equal, additional road users will alternate between route choices. What has been described thus far is a deterministic approach in which users are assumed to have perfect route and travel cost information.

Stochastic (random) assignment methods are ones that recognize and explicitly account for travelers possessing imperfect information regarding the road network, and potential route choices.

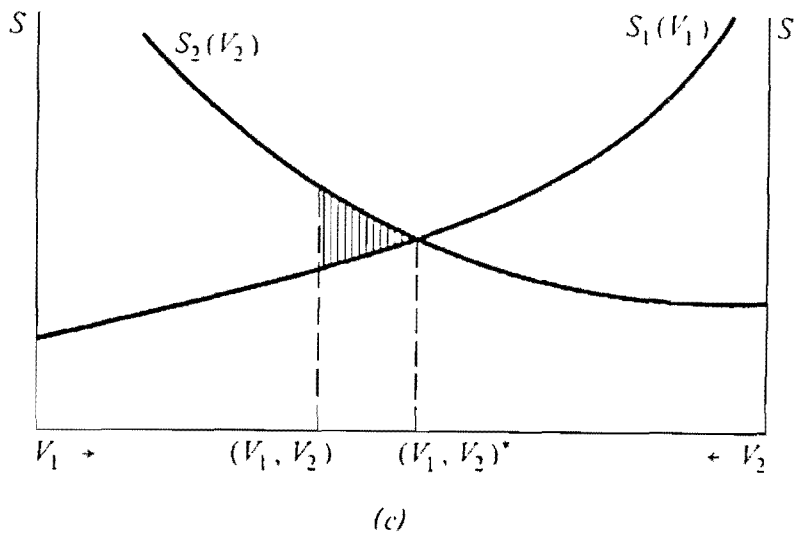


Figure 8: Equilibrium Assignment (Kanafani)

Stochastic User Equilibrium traffic assignment is an assignment procedure that accounts for the fact that users, while seeking to maximize their travel utility, have imperfect information regarding alternative paths through the network. Thus, they make rational route choices, however their choices are based on less than complete information.

This assignment method also acknowledges that the transportation link costs depend on the volume using the link (as in deterministic user equilibrium). In this method the link performance function discussed in an earlier section of the report is assumed to be valid. Thus, as more volume is assigned to a particular link, travel times over the link increase. When travel times over a link increase, subsequent road users are discouraged from using the

link. In this way, the assignment method applies the principles of supply and demand, in that, as routes become congested, the available capacity over the route is diminished (supply), this results in a fewer additional travelers using the route (demand).

CHAPTER 3

TRANSPORTATION TOMORROW SURVEYS

3.1 JOINT PROGRAM IN TRANSPORTATION

The Joint Program in Transportation is a research center of Faculty of Applied Science and Engineering at the University of Toronto. Established in 1970, the Centre specializes in research on issues relating to the Canadian transportation system. The primary objectives of the Centre (as noted on the Centre's web page) are:

- To encourage research relevant to improved transportation in Canada through the influence of research findings in investment planning, policy development, operations, and the development of human resources and expertise;
- To serve government and the transportation industry by acting as a source of information, expertise and special purpose training programs; and
- To provide an environment within the university community that is productive to high quality teaching and research in the transportation field.

3.2 DATA MANAGEMENT GROUP

The Data Management Group is a research project located at the Joint Program in Transportation. The Group was established in 1988 (DMG - Annual Report), and has been entrusted with conducting comprehensive surveys of the demographic and travel characteristics of the Greater Toronto Area (GTA) population. The group is funded and overseen by a Steering Committee made up of representatives of the City of Toronto, GO Transit, Toronto Transit Commission, Ontario Ministry of Transportation, and the Regional Municipalities of Durham, Halton, Hamilton-Wentworth, Peel, and York.

3.3 TRAVEL SURVEYS

The travel surveys conducted by the Data Management Group are the Transportation Tomorrow Surveys (TTSs). Beginning in 1986, the surveys have been conducted every 5 years. In total, four such surveys have been conducted – the surveys have been conducted in 1986, 1991, 1996, and 2001. The data from the 2001 TTS has only recently become available.

The surveys are household telephone surveys, based on a random sample of household telephone numbers within the Greater Toronto Area. The 1996 survey collected data from 115,193 households within the GTA (1996 TTS Data Guide).

Data contained in the survey includes:

- Household Attributes – location, number of residents, number of vehicles, number of persons possessing a drivers license, number of workers, number of students, etc.
- Person Attributes – age, gender, possession of a drivers license, occupation (based on five categories), student status, place of work, etc.
- Trip Attributes – household and person number, origin, destination, primary mode of travel, start time, trip length, etc.

Details of the household, person, and trip attributes are presented in **Appendix A**.

3.4 TRAVEL DATA

Data from all of the Transportation Tomorrow Surveys is available to interested parties via the **Internet Browser Data Retrieval System (iDRS)**. One simply needs to submit an Access Request form to the Data Management Group to be provided with a 'username' and 'password' that will permit one to access the system via the internet.

Once internet access is obtained, a series of links can be followed to the TTS database. There the user can customize a desired query based on the person, trip, or household attributes in the database. **Appendix B** presents a number of screenshots illustrating the data extraction procedure. In the example, the 1996 TTS database is queried to provide an origin-destination matrix of all trips at the planning district level. Extraction results can be summarized based on a number of geographic boundaries (traffic zones, planning districts, regional and municipal boundaries, etc.). Steps in the data extraction procedure are described in **Table 1**.

Table 1
Steps in the TTS Data Extraction Procedure

Step*	Description
1	Go to the secure website of the Joint Program in transportation (https://www.jpint.utoronto.ca), click the link to the Data Retrieval System. This will lead to a page requesting the user to enter the 'username' and 'password'.
2	When prompted, enter the 'username' and 'password'.
3	The next page requests the user to identify the required dataset. Select 'TTS'.
4	Identify the survey year and data unit (household, person, trip) to which the query will apply. On this page, the method of tabulation is also specified.
5	The next page is the 'query form' where the desired variables for tabulation are specified. The query can then be initiated.
6	The following screen indicates that the query has been executed and prompts the user to get the query results.
7	The results of the query are provided in the form of a comma delimited text file.
8	The text file can then be imported into Excel (or other program) to view in matrix form.

*Appendix B provides a separate screenshot for each step in the extraction procedure.

CHAPTER 4

GEOGRAPHIC INFORMATION SYSTEMS AND TRANSCAD

This section provides a brief introduction to Geographic Information Systems (GIS), as well as to the specific software used in the development of the transportation model.

4.1 GEOGRAPHIC INFORMATION SYSTEMS

Geographic Information Systems are a family of software used to integrate geographic mapping and data storage capabilities. GIS software links map elements to specific databases, enabling the data to be mapped, displayed, queried, or altered, simply by interfacing with the mapped image, or the database directly. The software's power comes from the ability to display and analyze data geographically, and the ability to help the user analyze geographic trends and patterns.

Geographic information systems typically, employ a layered data management strategy, where map features (points, lines, or areas) are displayed on separate layers. The layers can be superimposed on one another much like transparencies, in such a way that all or some of the features and layers can be viewed together, thus, forming a map. An example of the manner in which data is organized into layers is illustrated in **Figure 9**.

Maps can be used to represent any number of and type of geographic information: transportation networks, municipal boundaries, population demographics, statistics, sales and marketing trends, traffic zones, individual addresses, any information that can be found in an atlas, and more. Most importantly, all these features are linked directly to databases containing the feature's attributes. Examples of some of the capabilities of GIS are presented in the following section of the report.

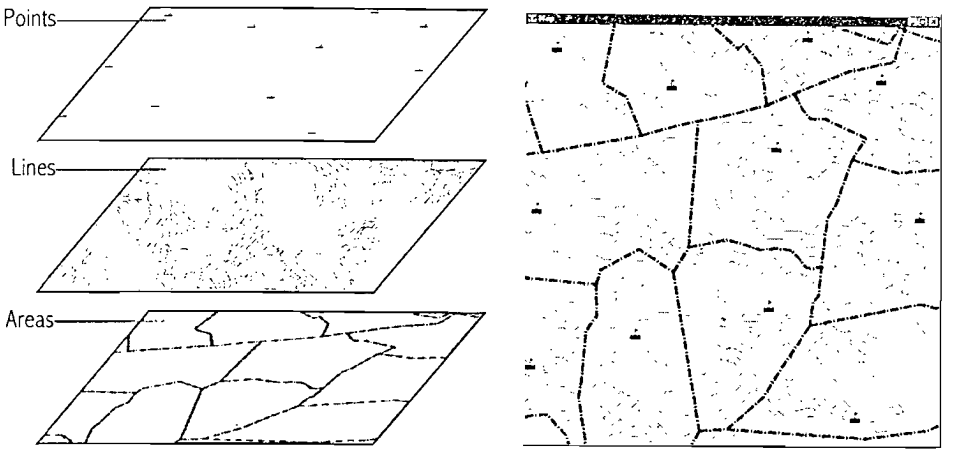


Figure 9: Layered Organization of Data in GIS (Caliper)

Geographic information systems are particularly useful to planning analysis because they lend themselves to the analysis, and display of spatially referenced data. As noted by Meyer and Miller:

"...the primary purpose of the planning effort...is to generate information useful to decision makers for the specific types of decisions they are facing"

The ease with which GIS enables us to display information makes it an important tool in transportation planning. Apart from the ability to manipulate data, geographic information systems make it possible to display and thus, visualize both the inputs and outputs of a particular transportation model.

4.2 TRANSCAD SOFTWARE

TransCAD is a geographic information system designed specifically for the planning, managing, and analyzing of transportation systems. The software provides a set of tools for

travel demand modelling as well as capabilities for geographic database management, presentation graphics and transportation models. The software provides tools which can be used in all phases of the model development process – mode split, trip generation, trip distribution, and trip assignment. The software was provided by the City of Kingston. Much of the analysis undertaken in the completion of the assignment, as well as the figures presented in the report were prepared using TransCAD software.

CHAPTER 5

EXISTING CONDITIONS

5.1 DATA COLLECTION

A transportation model developed is an analytic representation of the road network of the Town of Oakville. The development of the model relied on obtaining accurate and reliable data regarding travel within the Town. This section documents the data collection that was undertaken in the course of completing the project. Travel and transportation system data were collected from three sources: the Data Management Group (DMG), Joint Program in Transportation – University of Toronto; the Regional Municipality of Halton (the Region); and the Town of Oakville (the Town).

5.2 ROAD NETWORK

A digital representation of the street network was obtained from the Town of Oakville in GIS format. The GIS files contained all of the roads within the Town's boundary under all three jurisdictions, municipal, regional, and provincial. The street network files were provided in ESRI shape file format (a particular GIS file format).

TransCAD permits the import and export of files among many CAD and GIS software packages. The GIS files provided by the Town were imported into TransCAD.

Traffic assignment compute models require the representation of the transportation network in terms of links and nodes. **Figure 10** illustrates alternative intersection representations. The macro link-node representation, utilizes a single node to represent the entire intersection, and is used for system level planning studies. The micro link-node representation can be used to account for capacities and travel times of different movements (Easa).

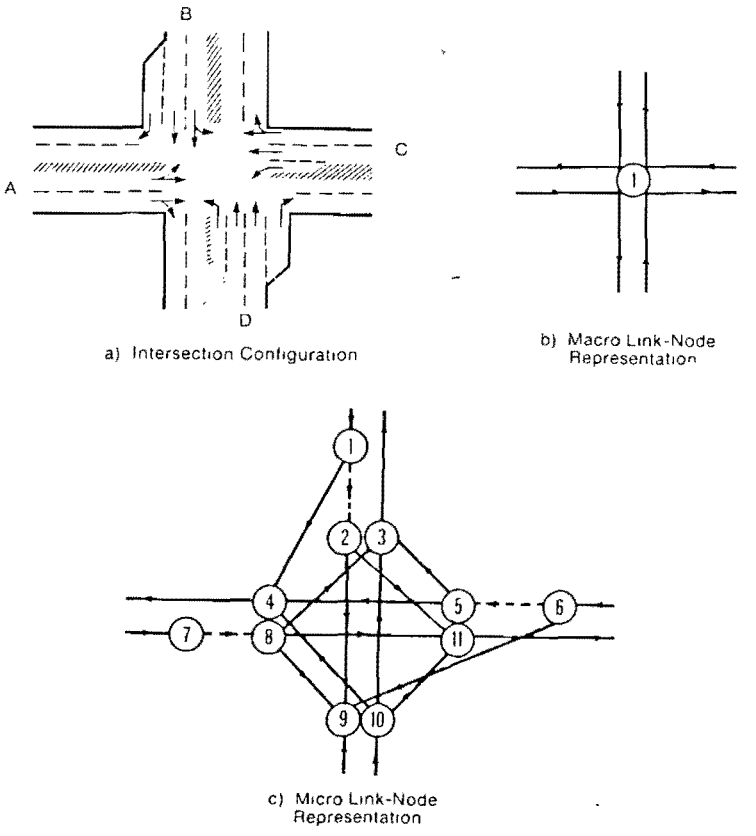


Figure 10: Alternative Intersection Representations (Easa)

In a geographic information system line layers are stored as a series of links and nodes. Thus, the road network files obtained from the Town, were by default in the macro link-node format. A close-up view of the Towns road network line layer is illustrated in **Figure 11**. Evident in the figure are the roadway links, and the intersection node numbers.

Analysis at a system level of detail is sufficient and thus, the marco link-node network representation is acceptable. Attention was given to ensuring connectivity of the street network links, particularly for major roadways and freeways.

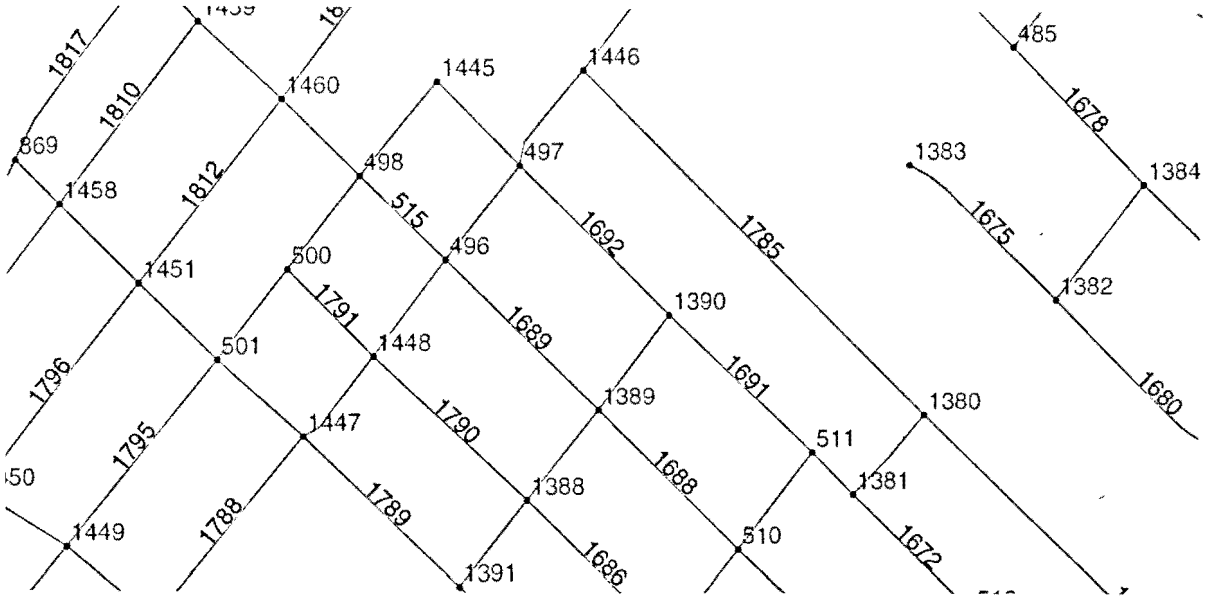


Figure 11: Sample of the Town of Oakville GIS Road Network Line Layer

Given that GIS files can be linked to databases containing attributes of map features, it should be noted that the following information was contained in the street network file: section identification number, section length, road name, and address range information. A number of data, particularly relevant for the development of an assignment model was omitted from the GIS database. Specifically, the street network files did not contain information regarding link capacity, and travel speed. These data are needed to apply capacity restraint assignment techniques.

Commuter use of a transportation network is largely dependant upon the characteristics of the individual streets within the network. The use of a particular street is influenced by the capacity and function of that street. The capacity of a street is influenced by the street's

cross-section (number of lanes) and the free flow speed for the street. Posted speed limit data, as well as road cross-section data for the street network were obtained from the Town and Region – these data were obtained in hard copy format in the form of the speed limit by-law for the Town. Considerable effort went into populating the network GIS files with the lane and speed limit data. Cross-section data included the number of through lanes available for each roadway link in the network. Auxiliary left, and right-turn lanes were excluded from the dataset. Where necessary, assumptions regarding network data were made.

Figures 12 illustrates the 1996 street network for the Town of Oakville including speed limit data. For the most part, the Town is served by a grid-like road system.

Key east-west corridors include, Lakeshore Road, the Queen Elizabeth Way (QEW), Dundas Street, and Highway 407. Upper Middle Road is another important east-west corridor. Key north-south corridors within the Town include: Winston Churchill Boulevard, Ford Drive-Ninth Line, Eighth Line, Trafalgar Road, Sixth Line, Fourth Line, Dorval Drive, Third Line, and Bronte Road.

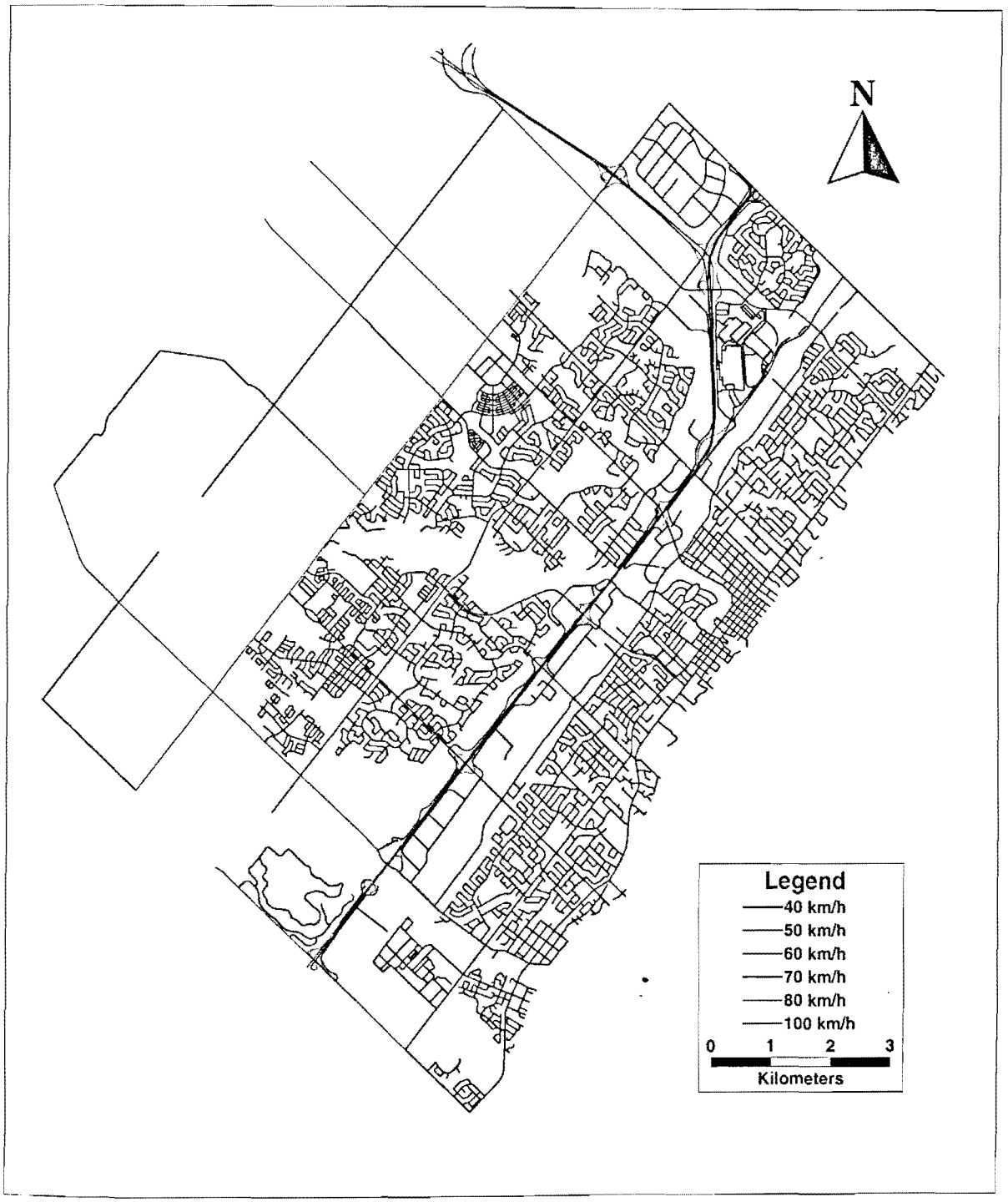


Figure 12: Town of Oakville, 1996 Road Network with Speed Limit Data

Existing through-lane cross-sections are illustrated in **Figure 13**. Lane capacities were assigned based on roadway functional classification. **Table 2** presents the capacity per through lane by road classification. Roadway functional classifications are illustrated in **Figure 14**.

Table 2
Through Lane Capacity by Road Classification

Classification	Lane Capacity (veh/hour/lane)
Freeway	2,000
Freeway Ramp	1,300
Arterial	900
Collector	600
Local	500

Source: City of Oshawa Transportation Study.

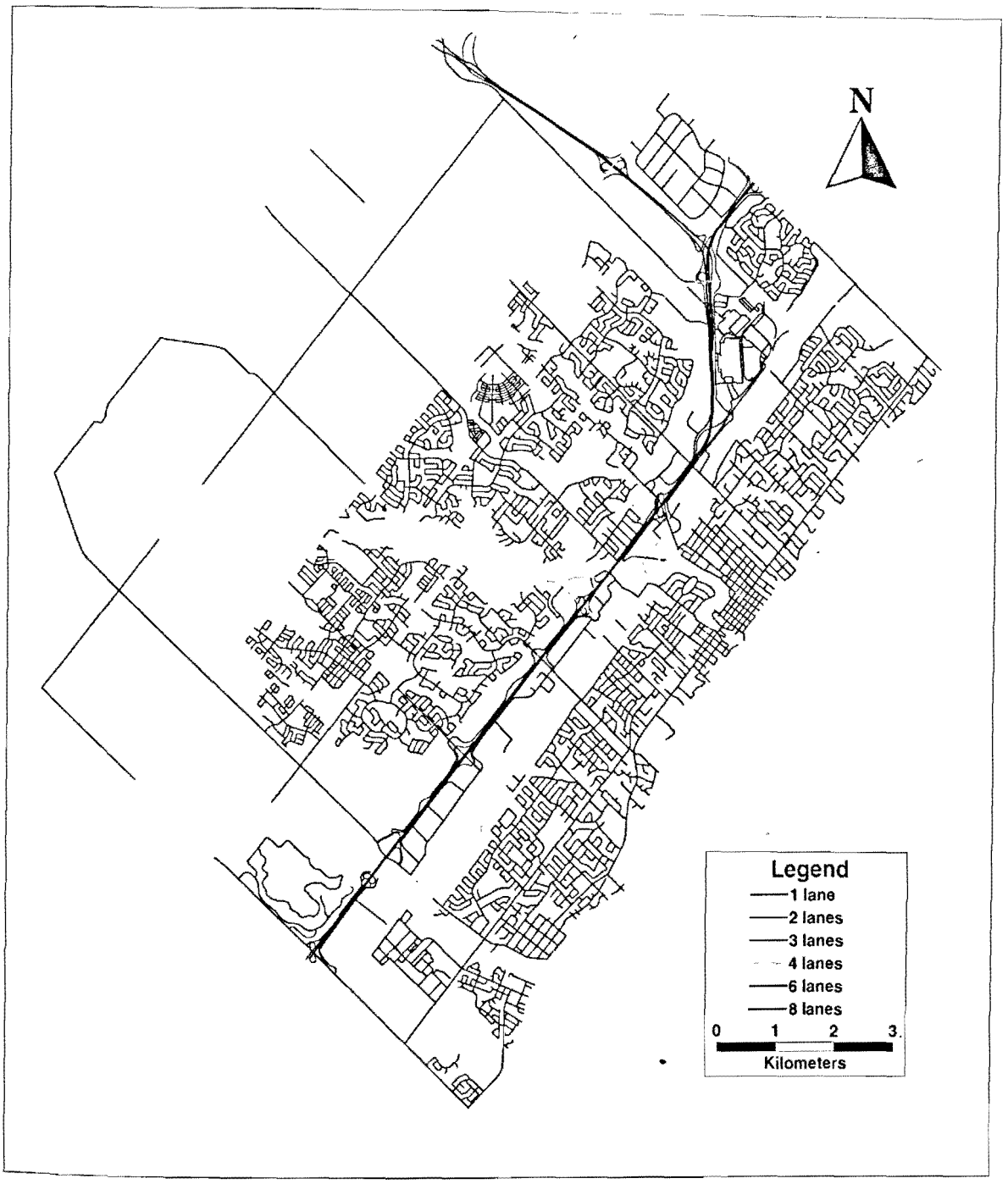


Figure 13: Town of Oakville, 1996 Road Network and Traffic Lanes

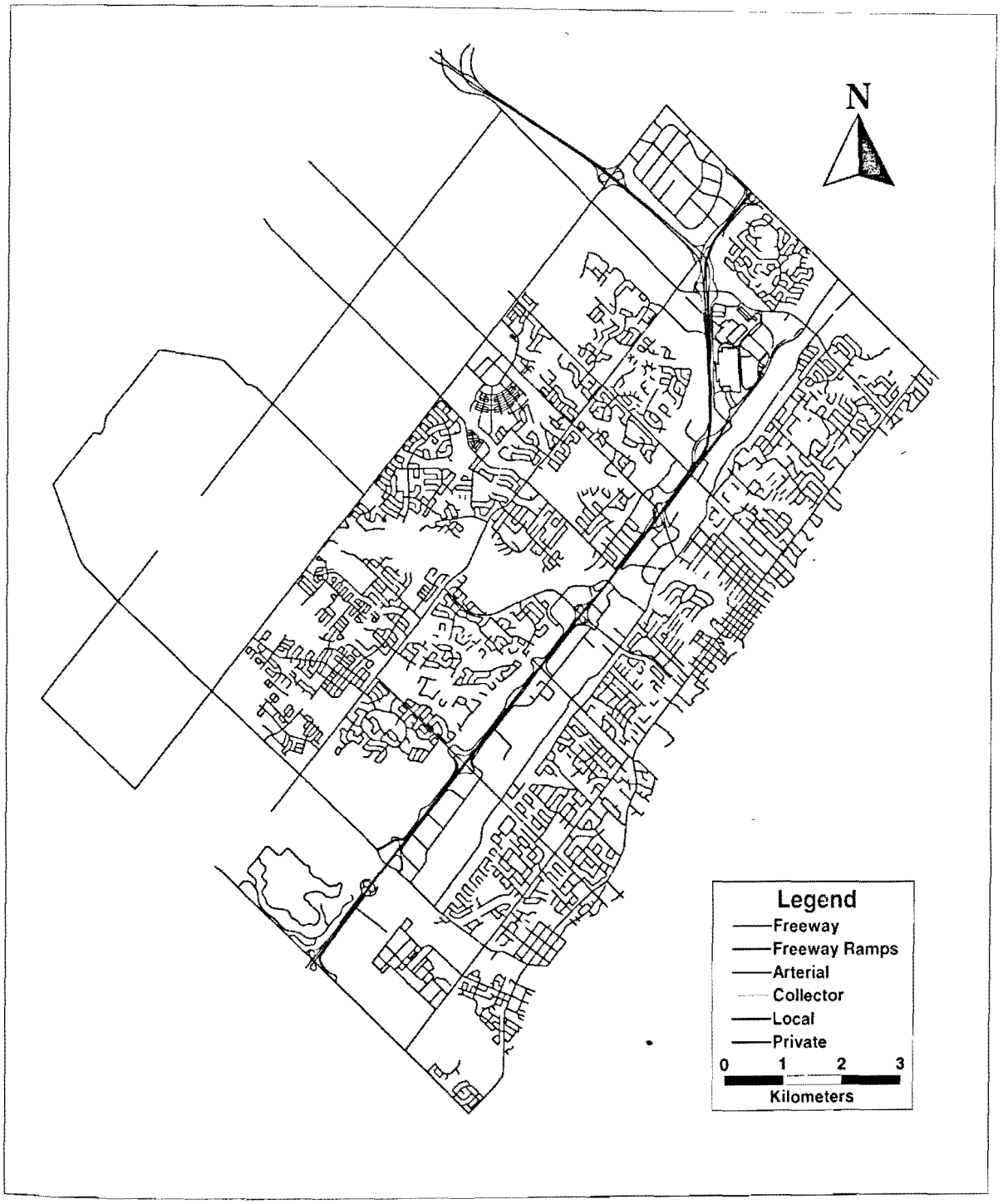


Figure 14: Town of Oakville, 1996 Road Network and Functional Class

5.3 SOCIO-ECONOMIC DATA

Transportation is a derived activity, in that people do not typically travel for travel's own sake. Transportation occurs to facilitate community activities, both social and economic. Traffic is thus, the product of an interaction between urban land use and the transportation system. Thus a travel demand model needs to consider the distribution of socio-economic activities throughout the study area. In this model all travel over a transportation network is assumed to be a function of the population and employment throughout the Greater Toronto Area.

Socio-economic data were extracted from two sources: the 1996 Canada Census, and the 1996 Transportation Tomorrow Survey (TTS). Given that the TTS data was readily available for each individual traffic zone (subsequent sections of the report will describe the traffic zone system adopted for the study), it was applied in the development of the transportation model. The traffic zones used are consistent with those developed and documented by the Data Management Group. Census data were used to check the validity of the TTS data. Data regarding the population and employment within the Town, and surrounding GTA are summarized in the **Tables 3** and **4**.

A comparison of the population and employment data contained in each of the 1996 TTS and 1996 Census databases reveal that the data are comparable, as the data vary by only a few percentage points.

Table 3 Population Summarized by Region				
Geographic Area	**1996 TTS**	**1996 Census**	**Difference**	**Difference (%)**
Toronto	2,305,558	2,386,213	(80,655)	3.4
Durham	450,354	458,616	(8,262)	1.8
York	567,689	592,445	(24,756)	4.2
Peel	812,512	852,526	(40,014)	4.7
Halton	328,264	339,875	(11,611)	3.4
Hamilton-Wenthworth	461,990	467,799	(5,809)	1.2
Total GTA	4,926,367	5,097,474	(171,107)	3.4

*Source – '*GTA A.M. Peak Model Documentation and User's Guide*' Peter Dalton.

Table 4 Employment Summarized by Region				
Geographic Area	**1996 TTS**	**1996 Census**	**Difference**	**Difference (%)**
Toronto	1,257,005	1,209,010	47,995	4.0
Durham	149,552	148,545	1,007	0.7
York	275,724	267,550	8,174	3.1
Peel	389,275	390,755	(1,480)	0.4
Halton	141,390	148,275	(6,885)	4.6
Hamilton-Wenthworth	181,219	183,615	(2,396)	1.3
Total GTA	2,394,165	2,347,750	46,415	2.0

*Source – '*GTA A.M. Peak Model Documentation and User's Guide*' Peter Dalton.

The overall population for the GTA recorded in the 1996 TTS database is 3.4% lower than that recorded in the 1996 Census. The overall employment for the GTA recorded in the 1996 TTS is 2.0% higher than the employment levels enumerated in the 1996 Census. The 1996 census and 1996 TTS were conducted at different times of the year which could partially explain the differences between the two databases. The population and employment totals determined by the 1996 TTS are a reasonable approximation of the population and employment for the GTA.

CHAPTER 6

DEVELOPMENT OF THE MODEL

The purpose of a transportation model is to estimate travel demand over the transportation network based on available information regarding populations and the transportation system. The predictive ability of such a model can be of great value in estimating the future transportation needs of future growth scenarios, or the implications on demand of changes in development scenarios and transportation system.

6.1 TEMPORAL DISTRIBUTION OF TRIPS

The development of the model is based on the travel behaviour captured in the 1996 TTS. To increase the number of observations upon which the model is based, trips were generated and distributed for the three-hour morning peak period. Peak period traffic volumes were then converted to represent the morning peak hour traffic volumes by applying a 'peak hour' factor.

Data were extracted from the 1996 TTS that indicated the total automobile trips captured in the survey. The data indicated a morning Peak Period of 6:00 to 9:00AM, in which a total of 1,737,751 auto driver trips were made, and an AM Peak Hour from 8:00 to 9:00 AM in which a total of 778,427 automobile trips were made. Thus, AM Peak Period traffic volumes can be converted to AM Peak Hour traffic volumes by applying a factor of 0.448. **Figure 15** illustrates the distribution of trip start times by mode of travel.

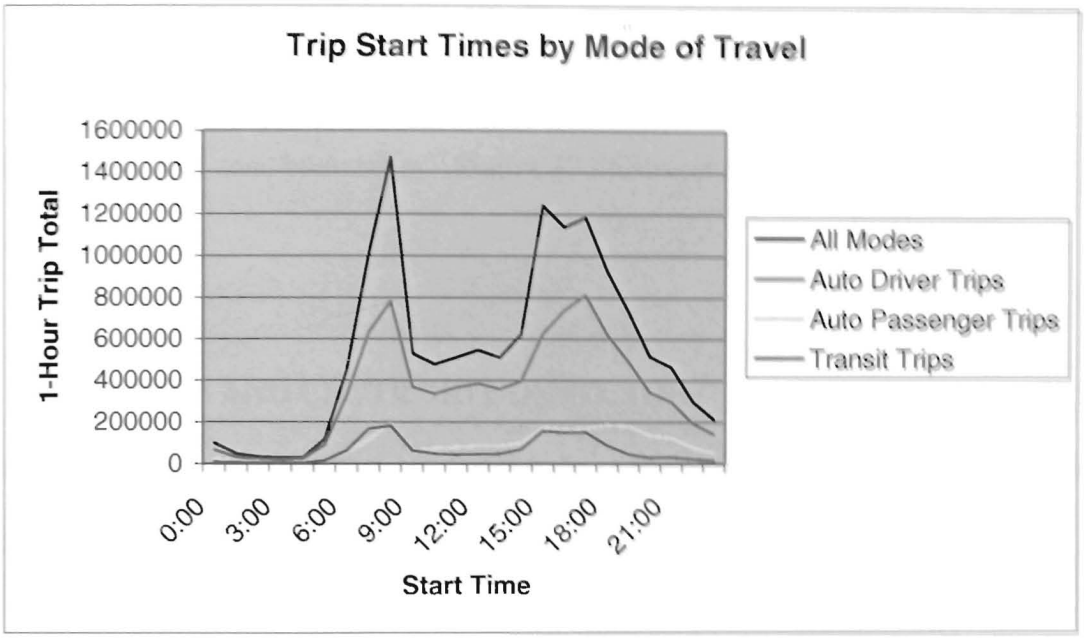


Figure 15: Distribution of Travel Trip Start Times

The above figure illustrates the mode split of travel trips in the GTA. The dominance of auto trips is quite evident.

6.2 TRAFFIC ANALYSIS ZONES

The nature of the model being developed necessitated the development of traffic analysis zones (TAZ's). Zonal attributes were used in the generation and distribution of trips. To facilitate data analysis and the extraction of data from the TTS database, traffic zone boundaries as applied in the TTS were followed in this assignment. The extent of the boundaries was obtained from **1996 GTA Boundaries**, (a complete list of References is provided). It was initially intended to use the numbering convention followed by the DMG. This was later abandoned and a numbering convention corresponding to the road network endpoint identification numbers (at zone centroids) was adopted.

The GTA is comprised of over 2,500 TAZ's. The Town of Oakville is divided into 49 traffic zones. **Figure 16** illustrates the Greater Toronto Area included in the 1996 TTS, and identifies the regional zone boundaries. **Figure 17** illustrates the traffic zones within the Town of Oakville.

6.3 CENTROIDS AND CENTROID CONNECTORS

In building the model, it is necessary to connect the traffic analysis zones to the road network. This is accomplished by connecting the centroid of each TAZ to one or more network links.

Centroids are special nodes in the transportation network that represent the centers of the transportation analysis zones. Trips originating from a zone or destined to a zone are assumed to originate from or be destined to the centroid of the zone in question.

Centroid connectors are not real physical links, but instead are a simplified representation of the local road network. It should be noted that a special property of centriod connector links is that paths between an origin and destination travel over one centroid connector at the beginning and end of the trip respectively, but never use centroid connectors in any other way.

Trips originating from or destined to zones beyond the Town of Oakville boundary are assumed to originate from or be destined to **External Cordon Stations**. These cordon stations are simply nodes in the transportation network where principal external routes connect to the transportation network within the Town's boundary. **Figure 18** illustrates the traffic zone centroid connectors, as well as the external cordon Stations.

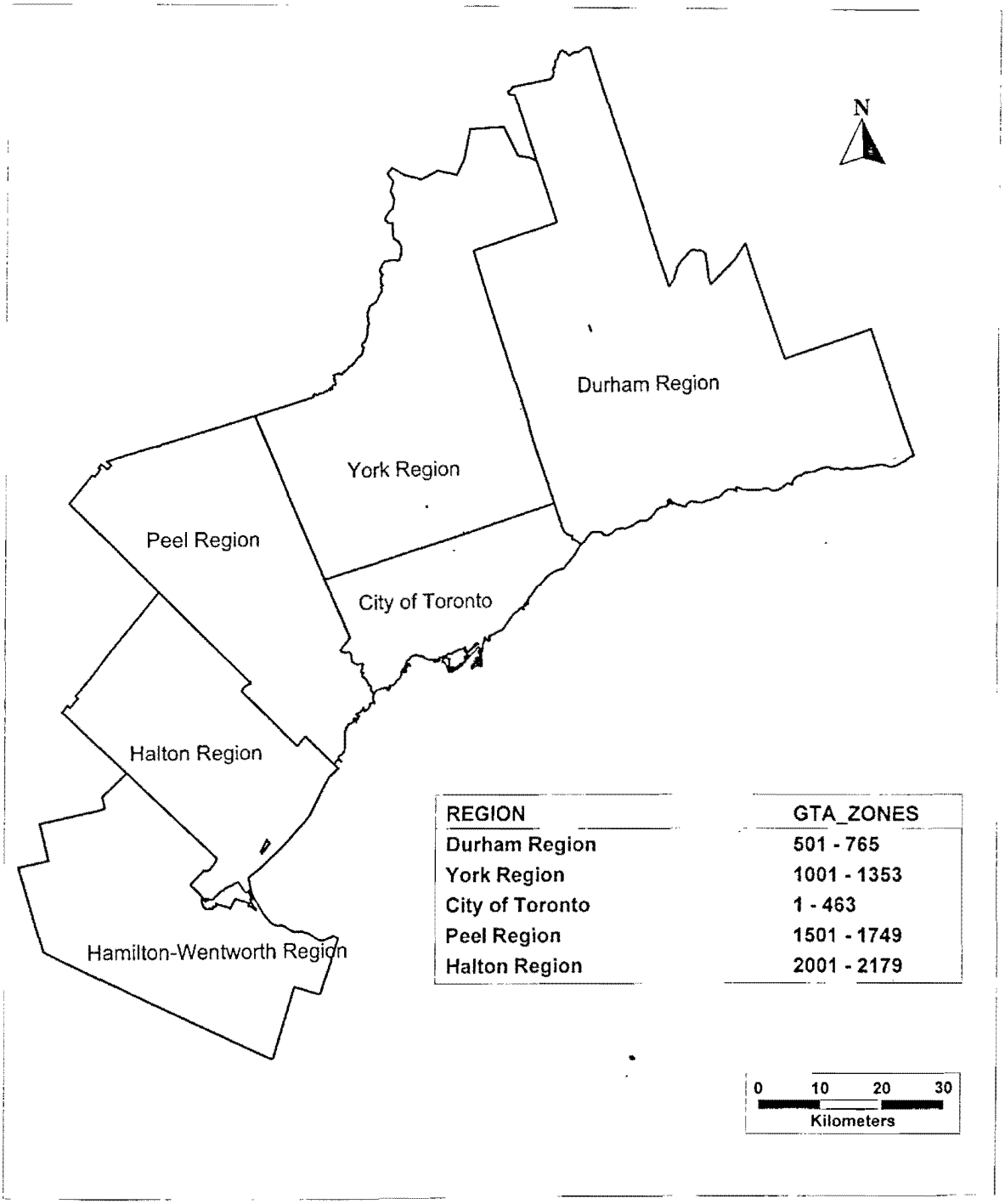


Figure 16: 1996 GTA Zones

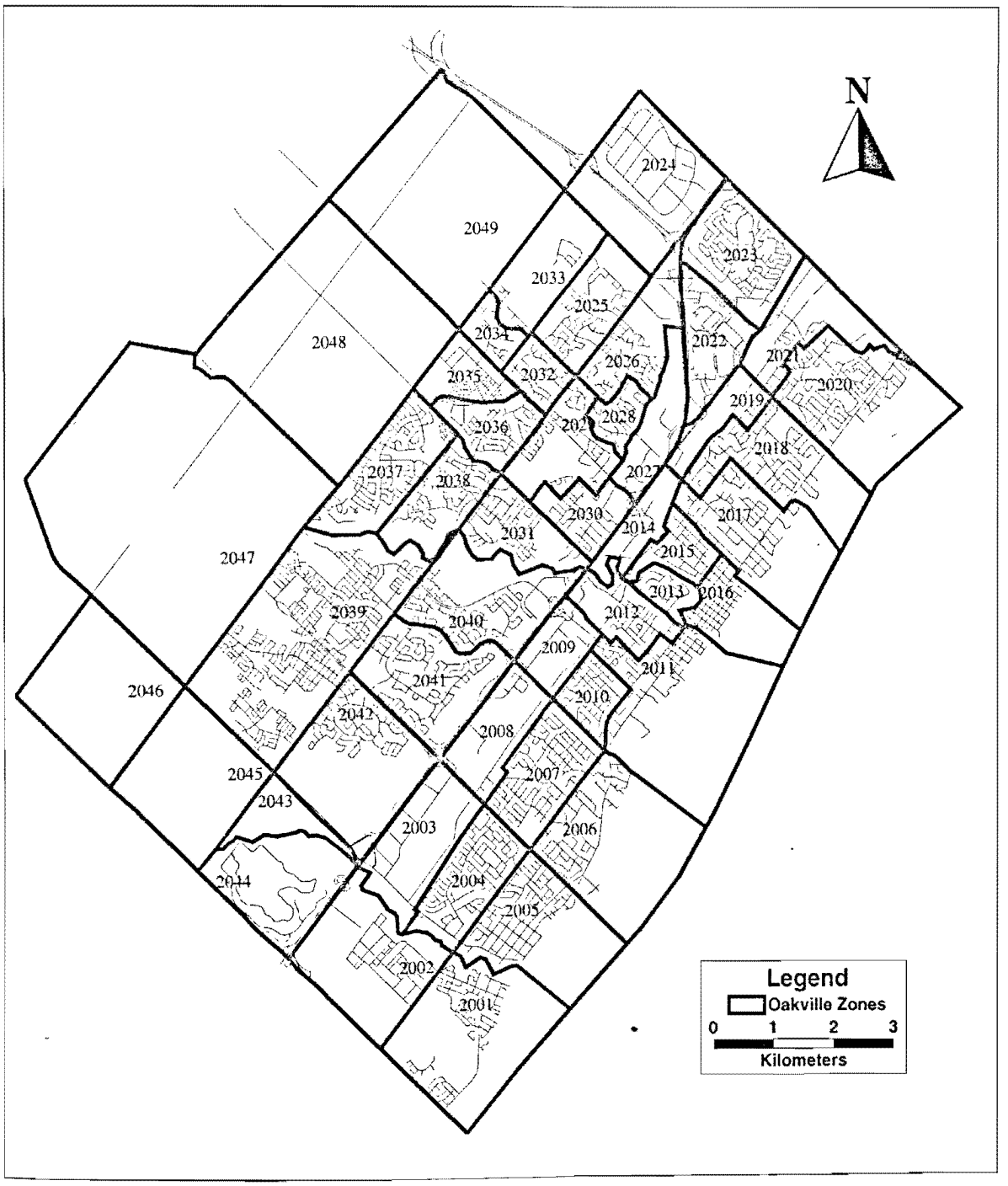


Figure 17: Town of Oakville, 1996 Traffic Zones

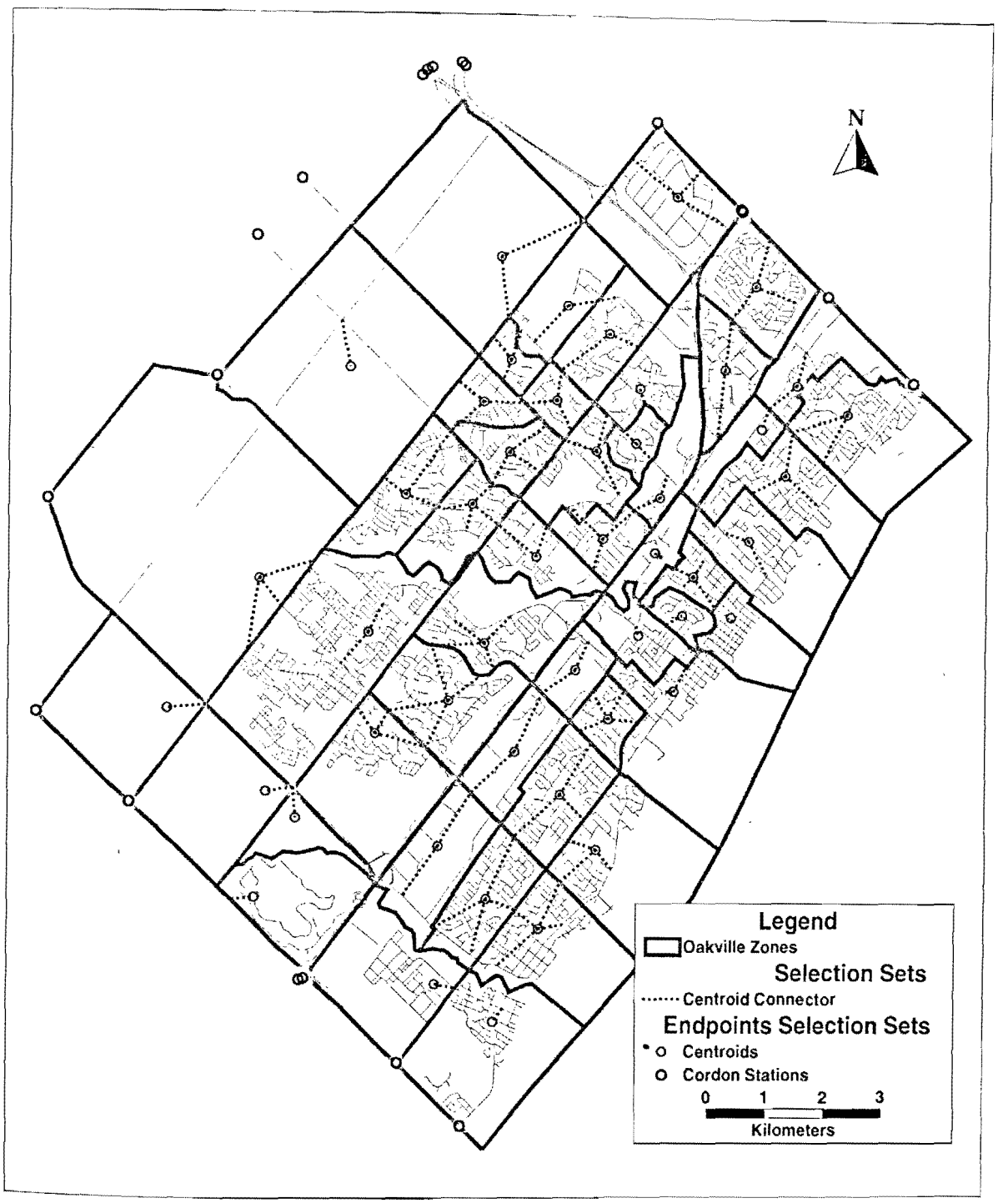


Figure 18: Town of Oakville, 1996 Traffic Zones, Centriod Connectors, and External Cordon Stations

6.4 TRIP GENERATION

Trip generation is the first stage of the development of a travel demand model. The aim of this process is to predict the total number of trips produced and attracted to each traffic zone within the study area (i.e. how many trips originate from and are destined to each traffic zone).

For the model developed, trips are generated for the entire AM peak period, and then a factor is used at a subsequent stage in the modelling process to convert the peak period trips generated to AM peak hour trips.

Relationships were developed between trips originating and destined to each traffic zones and the employment and population levels within the zone. This was done for aggregations of traffic zones at the regional level: Durham Region, York Region, City of Toronto, Peel Region, Halton Region, and the Hamilton-Wentworth Region. The trip generation equations were developed by trip purpose (i.e. for Home-Based trips), these are assumed to account for the majority of automobile trips on the road network during the AM peak period. Home-Based trips are trips for which the home is either the origin or destination of the journey. Since I am dealing with an AM peak period model, Home-Based trips are work trips that originate at home. It should be noted that I dealt with only auto driver trips. Thus, the trips generated refer to automobile trips only.

Table 5 summarizes the results of the trip generation procedure. Details of the trip generation procedures can be found in **Appendix C**. In applying the trip generation procedure trip

productions and attractions were determined separately. This results in a minor discrepancy between productions and attractions. The trips presented below were balanced so that the total number of trip productions and attractions are equal.

Table 5
Summary of Trip Generation

Zone	Productions	Attractions
2001	1,693	186
2002	16	93
2003	0	2,371
2004	2,200	132
2005	2,602	273
2006	948	185
2007	1,815	188
2008	0	1,612
2009	0	2,518
2010	959	31
2011	1,545	640
2012	1,984	742
2013	681	0
2014	33	1,129
2015	667	523
2016	773	1,404
2017	1,100	189
2018	1,070	364
2019	165	109
2020	2,019	31
2021	440	774
2022	0	1,496
2023	2,813	76
2024	0	2,354
2025	1,584	122
2026	2,054	283
2027	292	1,087
2028	639	48
2029	2,547	1,077

Table 5 (Continued)
Summary of Trip Generation

Zone	Productions	Attractions
2030	1,283	879
2031	1,581	63
2032	1,141	32
2033	15	0
2034	0	18
2035	0	300
2036	1,490	16
2037	1,736	48
2038	1,736	49
2039	915	135
2040	2,360	996
2041	3,085	721
2042	2,019	481
2043	24	0
2044	0	31
2045	32	0
2046	0	40
2047	34	99
2048	130	62
2049	7	31
Durham	151,754	114,738
York	214,592	209,782
Toronto	582,795	666,340
Peel North	250,303	265,200
Peel South	48,012	19,376
Halton North	28,684	65,505
Halton South	51,132	22,601
Hamilton	137,622	125,542
Total	**1,513,120**	**1,513,120**

The trip generation procedures were applied for the entire GTA. The travel demand model should not consider the Town of Oakville in isolation. Trips from various parts of the GTA are expected to travel on the Town's roadways. In addition trips originating in the Town are

expected to be distributed to other parts of the GTA. Conversely, zones within the Town are expected to attract traffic from many parts of the GTA.

Peel and Halton Regions were divided into north and south sections in preparation for traffic assignment (further explanation are provided in **Section 6.6**). It should be noted that Halton South excludes the Town of Oakville, which is made up of zones 2001 to 2049. A further summary of the trip generation data is presented in **Table 6**.

Table 6
A Further Summary of Trip Generation

Jurisdiction	Population	Employment	Productions	Attractions
Oakville	123,639	30,306	48,227	24,037
Durham	450,354	149,552	151,754	114,738
York	567,689	275,724	214,592	209,782
Toronto	2,305,558	1,257,005	582,795	666,340
Peel	812,512	389,275	298,315	284,576
Halton	204,625	111,084	79,816	88,105
Hamilton	461,990	181,219	137,622	125,542
Total	4,926,367	2,394,165	1,513,120	1,513,120

The data presented in the above table indicates that the Town of Oakville, the Regional Municipality of Durham, and to a lesser extent, the Regional Municipalities of York, Peel, Halton, and Hamilton-Wentworth, are net producers of auto driver trips. The City of Toronto is a net attractor of trips. This suggests that the City of Toronto is the strongest employment draw in the GTA, and as such, attracts travelers from the neighbouring municipalities.

6.5 TRIP DISTRIBUTION

Given the shortcomings of the fratar methods of trip distribution, trip productions and attractions were distributed by applying a gravity model of trip distribution. Fortunately, TransCAD software contains procedures for both the calibration, and evaluation of gravity models.

As noted by Easa (#15), the process of calibrating the gravity model depends on the assumed mathematical function of the friction factor function. In this case the friction factor function is assumed to take the exponential form (as discussed in **Section 2.2.3**).

As noted in **Section 2.2.3**, in order to apply a gravity model, the following inputs are required:

- The number of trips originating in each zone;
- The number of trips terminating in each zone;
- The impedance between the origin and destination zone pairs; and
- The friction factor between the origin-destination zone pairs.

The first two of these inputs are the products of the trip generation procedure. The impedance to travel between origin-destination zone pairs was for this assignment, assumed to be the travel distance between the zones in question (alternatively, the impedance may have been determined based on the travel time between zones). The use of travel distance is consistent with the Newtonian analogy, as the distribution is a function of the geographic separation between zones.

Before continuing to discuss the application of the gravity model, a number of points need to be noted:

- An impedance matrix needs to consider the impedances to travel between all zones within the GTA, not only those of the Town of Oakville. However, the original road network that I was provided with contained roadways only within the Town of Oakville's municipal boundary.
- The impedances to travel between zones external to the Town of Oakville, needed to be accounted for.
- The solution to this dilemma was to arbitrarily extend the road network from the Town to the centroids of the neighbouring regions. These additional connectors were simply intended to enable the measurement of the impedances to travel between the Town's zones, and the centers of gravity (assumed to be the geographic centers) of the neighbouring municipalities. This extended road network is illustrated in **Figure 19**.

Given this extended road network, a 'shortest path' procedure was executed in the TransCAD software. The output of this procedure was a shortest path matrix between origin-destination pairs throughout the entire Greater Toronto Area. This matrix is provided in **Appendix D**.

Given that three of the four inputs required for gravity model evaluation are determined, a gravity model has now be calibrated. Calibration involves the determination of the friction factor equation parameters such that the gravity model can satisfactorily reproduce the trip length distribution for the entire study area.

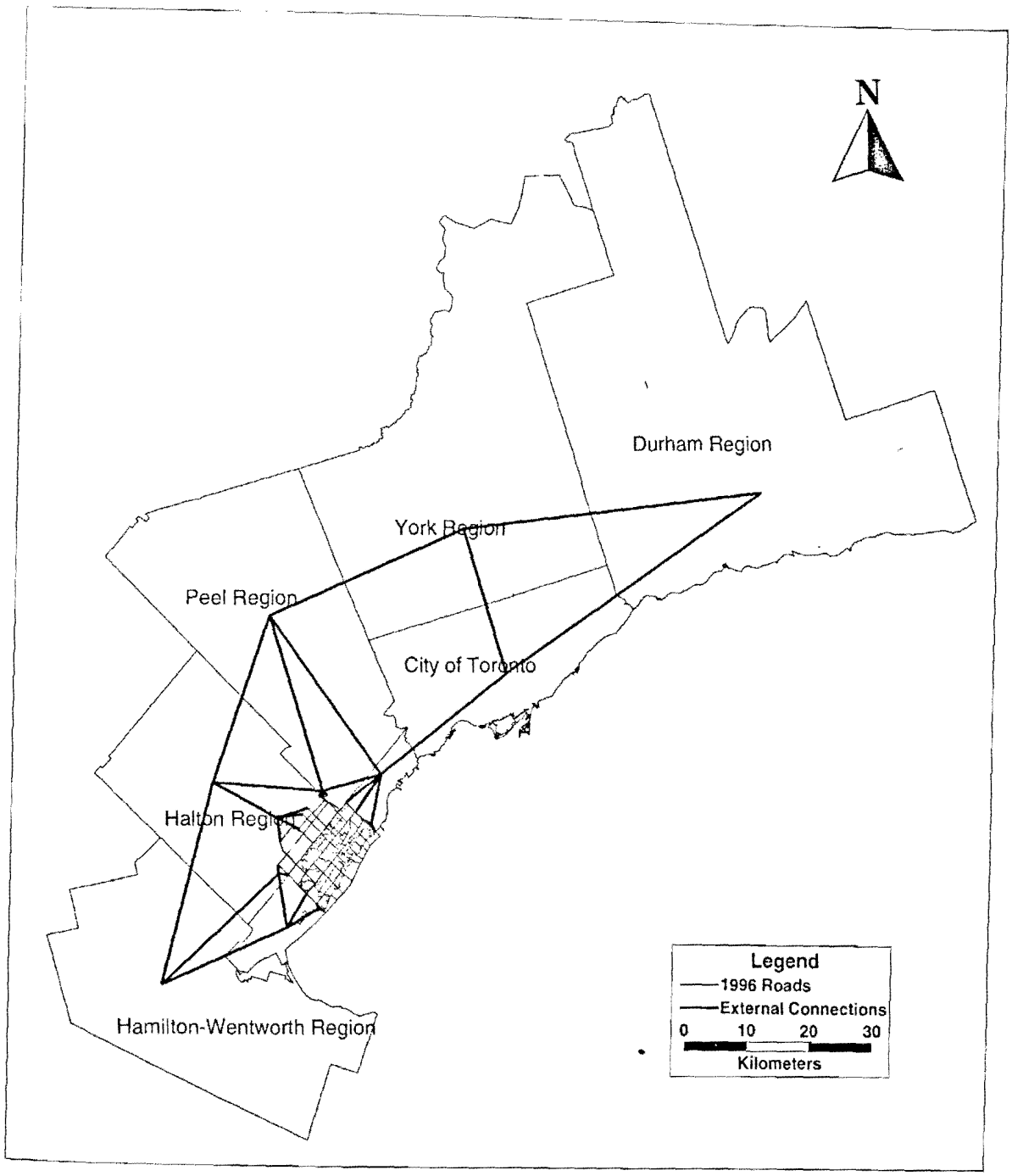


Figure 19: The Extended Road Network

TransCAD software permits the calibration of a Gravity Model given a base year production-attraction matrix, an impedance matrix, and a zone layer. The calibration procedures use the base year production-attraction matrix to generate an Observed Trip Length Distribution (OTLD). The model is then calibrated such that the OTLD is reproduced as closely as possible.

The required base-year production-attraction matrix was extracted from the Transportation Tomorrow Survey directly using the Internet Data Retrieval System. Details of the extraction are presented in **Appendix D**. The extraction can be summarized as follows:

- 1996 TTS;
- Row attribute – 1996 GTA zone of origin;
- Column attribute – 1996 GTA zone of destination;
- Start time – 600 to 900; and
- Primary travel mode of trip – auto driver

The results of the extraction were then grouped for external zones so as to represent the origins and destinations to each of City of Toronto, and the Regional Municipalities of Durham, York, Peel North, Peel South, Halton North, Halton South, and Hamilton-Wentworth, as a whole, rather than the individual TTS traffic zones that make up these neighbouring municipalities.

The gravity model calibration procedure iteratively estimates the parameter (c), and at each iteration compares the observed mean impedance of the forecast to the observed mean impedance. The mean impedance is defined by the following relationship (Caliper).

$$D = (\Sigma t_{ij} * d_{ij}) / T$$

Where t_{ij} = the number of trip between zones i and j

d_{ij} = the impedance to travel of going from zone i to j

T = the total number of trips

The model was then calibrated using the software's gravity model calibration procedure, to a mean cost convergence of 0.01 (difference between the computed and observed trip average trip length in kilometers) such that the friction factor function was given by:

$$f(dij) = exp(-0.0523 * d_{ij})$$

Details of the calibration procedure are provided in **Appendix D**.

The gravity model was then evaluated, given the estimated productions and attractions determined from the trip generation procedure. Other inputs to the procedure included the trip length impedance matrix, and the calibrated friction factor function.

The development of an origin-destination matrix requires that the model be solved iteratively. Such a matrix is based on applying the model to the productions and attractions (by zone). Details of the Trip Distribution procedure, as well as the resulting AM peak period auto driver origin-destination matrix are presented in **Appendix D**. Also in the appendix is the AM peak hour origin-destination matrix (AM peak period multiplied by the peak hour factor 0.448 determined in **Section 6.1**). The AM peak period origin-destination matrix is summarized in **Table 7**.

Table 7
AM Peak Period Origin Destination Matrix Summary

	Destination						
Origin	**Halton**	**Durham**	**York**	**Toronto**	**Peel**	**Hamilton-Wentworth**	**Total**
Halton	49,902	470	4,003	27,682	23,829	22,157	**128,043**
Durham	693	99,631	14,708	32,565	3,966	192	**151,754**
York	3,032	4,738	105,342	74,406	26,542	533	**214,592**
Toronto	10,271	8,197	58,142	482,590	20,748	2,846	**582,795**
Peel	25,282	1,439	26,185	40,273	199,463	5,673	**298,315**
Hamilton-Wentworth	23,282	134	1,152	7,867	10,277	94,910	**137,622**
Total	**112,462**	**114,609**	**209,532**	**665,381**	**284,824**	**126,311**	**1,513,120**

The base year origin-destination matrix representing the actual trip distribution as captured by the travel survey is presented in **Table 8**.

Table 8
AM Peak Period Base Year Origin Destination Matrix Summary

	Destination						
Origin	**Halton**	**Durham**	**York**	**Toronto**	**Peel**	**Hamilton-Wentworth**	**Total**
Halton	72,719	145	1,342	14,166	23,689	9,613	**121,674**
Durham	234	98,778	10,710	34,088	1,893	125	**145,819**
York	560	2,464	115,451	79,074	9,602	180	**207,331**
Toronto	4,180	7,661	60,061	445,296	47,919	975	**566,092**
Peel	12,323	839	12,246	75,422	186,054	1,486	**288,370**
Hamilton-Wentworth	16,510	75	250	3,418	3,831	103,706	**127,790**
Total	**106,526**	**109,962**	**200,051**	**650,464**	**272,988**	**116,085**	**1,457,076**

The difference between these two matrices is presented in the **Table 9**.

Table 9
Difference Between Projected and Observed AM Peak Period Traffic Volumes

	Destination						
Origin	**Halton**	**Durham**	**York**	**Toronto**	**Peel**	**Hamilton-Wentworth**	**Total**
Halton	22,817	(325)	(2,661)	(13,516)	(140)	(12,544)	**(6,369)**
Durham	(459)	(853)	(4,007)	1,523	(2,073)	(67)	**(5,935)**
York	(2,472)	(2,274)	10,109	4,668	(16,940)	(353)	**(7,261)**
Toronto	(6,091)	(536)	1,919	(37,294)	27,171	(1,871)	**(16,703)**
Peel	(12,959)	(600)	(13,939)	35,149	(13,409)	(4,187)	**(9,945)**
Hamilton-Wentworth	(6,772)	(59)	(902)	(4,449)	(6,446)	8,796	**(9,832)**
Total	**(5,936)**	**(4,647)**	**(9,481)**	**(13,917)**	**(11,836)**	**(10,226)**	**(56,044)**

The number of trips generated by the model appears to be slightly higher than the number of trips captured by the survey. This is one reason why a discrepancy exists between the matrices summarized in **Tables 7** and **8**. Some discrepancy between the two matrices are also to be expected given that any developed model for trip distribution represents a simplification of a complex real world phenomenon. Alternatively, additional discrepancies are likely to result as a result of the assumptions applied in developing the gravity model, namely, the use of a simplified street network (beyond the extents of the Town of Oakville), as well as the application of an impedance matrix based on the travel distance between zones, as opposed to alternative travel costs (i.e. travel time).

6.6 TRAFFIC ASSIGNMENT

The purpose of traffic assignment is to predict the flow of trips between pairs of origins and destinations over the transportation network. In building the model the intent is to replicate the amount of traffic on the principal routes of the transportation network.

The Stochastic User Equilibrium procedure was applied to generate the traffic assignment documented below. The this method of estimating the assignment was selected because it accounts for the that users, seek to maximize their travel utility, but do so based on imperfect information regarding alternative paths through the network.

This assignment method also acknowledges that the transportation link costs depend on the volume using the link. In this method the link performance function discussed in an earlier section of the report is assumed to be valid. Thus, as more volume is assigned to a particular link, travel times over the link increase. When travel times over a link increase, subsequent road users are discouraged from using the link. In this way, the assignment method applies the principles of supply and demand, in that, as routes become congested, the available capacity over the route is diminished (supply), resulting in a fewer additional travelers using the route (demand).

The results of the traffic assignment procedure are illustrated in **Figure 20**. Details of the traffic assignment are presented in **Appendix E**. The equilibrium condition was reached after 7 iterations. In addition to indicating the assigned traffic volumes on the roadways, **Figure 20** also indicates the volume to capacity (v/c) ratios for the roadway sections. The ratios indicate the extent to which the roadway capacity is utilized by the assigned traffic. Sections in green indicate that the assigned traffic volumes are below the roadway capacity. Those coloured red are over capacity. Sections in black indicate assigned volumes more than twice the roadway capacity.

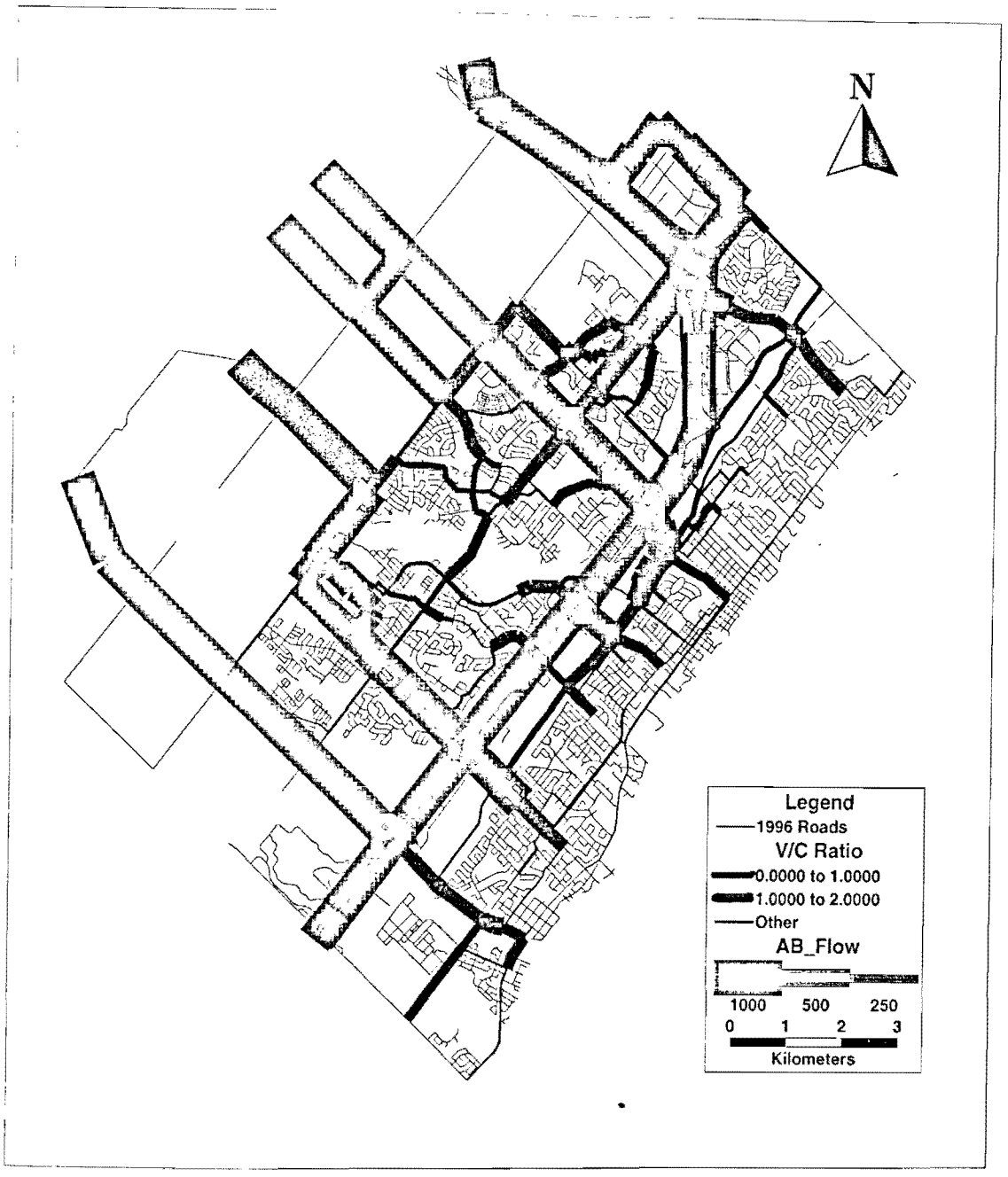


Figure 20 **Town of Oakville, Assignment of AM Peak Hour Trips**

6.7 GREATER TORONTO AREA CORDON COUNT PROGRAM

The Greater Toronto Area Cordon Count Program is an initiative to assemble and manage the vast number of traffic counts that are taken annually by various jurisdictions throughout the GTA. The Data Management Group has been entrusted with assembling and maintaining the cordon database.

A number of Working Papers have been prepared by the Joint Program in Transportation that present summaries of the cordon data. A series of screenlines are used to across which traffic flows are measured. These screen lines represent cross sections through principal travel corridors throughout the Greater Toronto Area. These screenline volume summaries present an opportunity to evaluate the accuracy of the traffic volumes predicted by the model. The screenlines are illustrated in **Figure 21**.

Figure 21: Screenline Definition

6.8 MODEL VALIDATION

The model predicts traffic levels on roadways within the Town based on the population and employment data contained in the TTS travel survey. Validation of the model requires some comparison of the modeled traffic volumes, to actual vehicular volumes on the study area roadways.

The predicted traffic volumes were compared to traffic volume data contained in the Greater Toronto Area Cordon Count Program discussed in **Section 6.7**. The comparisons were made based on a screenline level of detail. In this case modeled traffic volumes crossing the screenlines identified in the Cordon Count Program, with the volumes identified in the Program.

Table 10
Comparison of AM Peak Hour Traffic Volumes

Screenline	Cordon Program		Model	
	NB/EB	SB/WB	NB/EB	SB/WB
Halton West	14,379	10568	9,500	8,200
Halton Peel	19,680	10,421	13500	15,900
Peel Simcoe	9,544	4,508	10,500	11,500
Steeles Avenue	27,378	40,500	26,000	33,300
Durham York	1,995	6,463	2100	6,600
Durham Toronto	8,715	25,031	12,200	20,000

Screenline analysis indicates some differences between the modeled traffic volumes, and those captured in the Cordon Count Program. At some screenlines the modeled volumes are higher than those in the Cordon Counts, at others the model underestimates the traffic volumes. A number of factors could contribute to these differences.

- Seasonal Variation – the Transportation Tomorrow Survey was conducted in the fall, while the cordon data to which the modeled traffic volumes were compared were collected in the months of May and June. There is the strong possibility that traffic volumes peak during the summer months, thereby exaggerating any differences between the modeled and counted volumes. Seasonal variation in traffic volumes is illustrated in **Figure 22**.

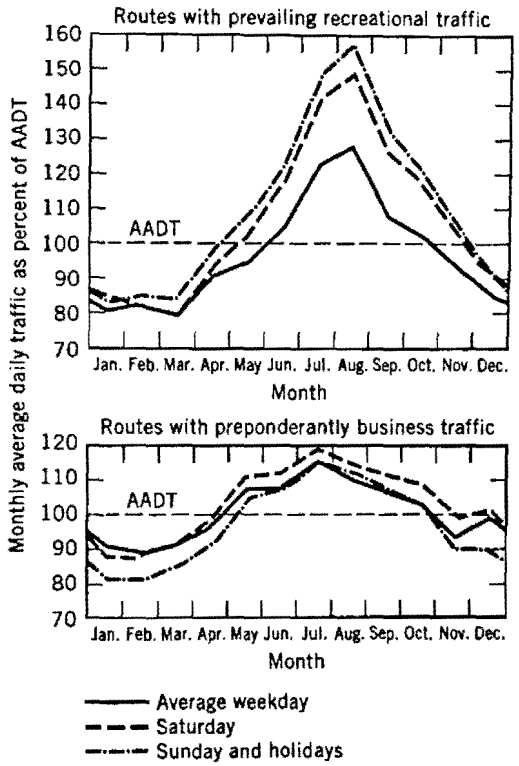


Figure 22: Monthly Variation in Average Annual Traffic Volumes

(Mannering and Kilarski)

- It is important to note that the trip generation rates were determined based on the trips enumerated by the Transportation Tomorrow Survey. The survey is a household survey that was never intended to capture commercial vehicle trips (i.e. heavy

vehicles, and others). Thus, modeled traffic volumes are likely to be lower than traffic counts by at least the number of commercial vehicles on the roadway.

- There is also a component of through traffic (traffic not destined to zones within the GTA) on the study area roadways. Particularly, on the Highway 401 corridor. Through trips on such roadways were not captured in the household survey.

CHAPTER 7

CONCLUSION

This report documents the development of an urban travel demand model of the Town of Oakville. The purpose of the model was to predict traffic demand on study area roadways during the morning peak hour. The model focused on the prediction of auto travel trips. This project utilized 1996 TTS data extracted from the DMG database via the Data Retrieval System available through the internet. The model predicted traffic volumes on study area roadways. The modeled volumes were then compared to cordon count data for the GTA. The comparison revealed some discrepancies between the modeled and observed volumes. Sources of these discrepancies likely include seasonal variation in traffic volumes, as well as traffic volumes passing through the GTA. It should also be noted that the Transportation Tomorrow Survey upon which the model was based, was a household telephone survey, and as such did not capture commercial vehicle trips.

Despite these shortcomings, the model did with some success predict the traffic volumes on the Town's streets. Having been developed the model may be used to predict future travel demands by updating the socio-economic data.

TransCAD GIS based transportation modelling software proved to be an effective tool in the undertaking of this exercise.

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APPENDIX A

1996 TRANSPORTATION TOMORROW SURVEY BOUNDARIES, AND DATA ATTRIBUTES

Exhibit 4: TTS Traffic Zone Numbering - Greater Toronto Area

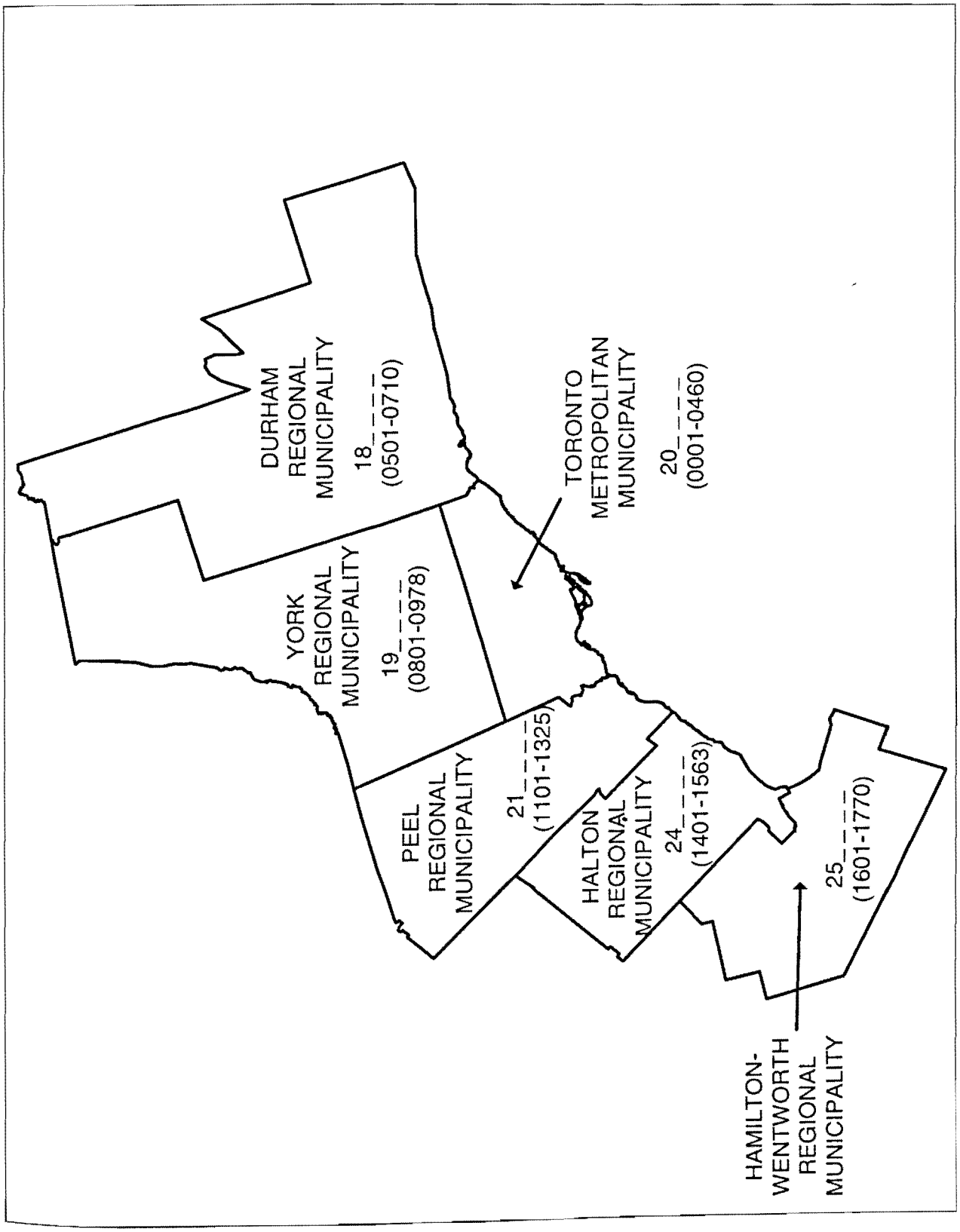


Exhibit 5: TTS Traffic Zone Numbering - Niagara Region, Waterloo Region and the Town of Orangeville

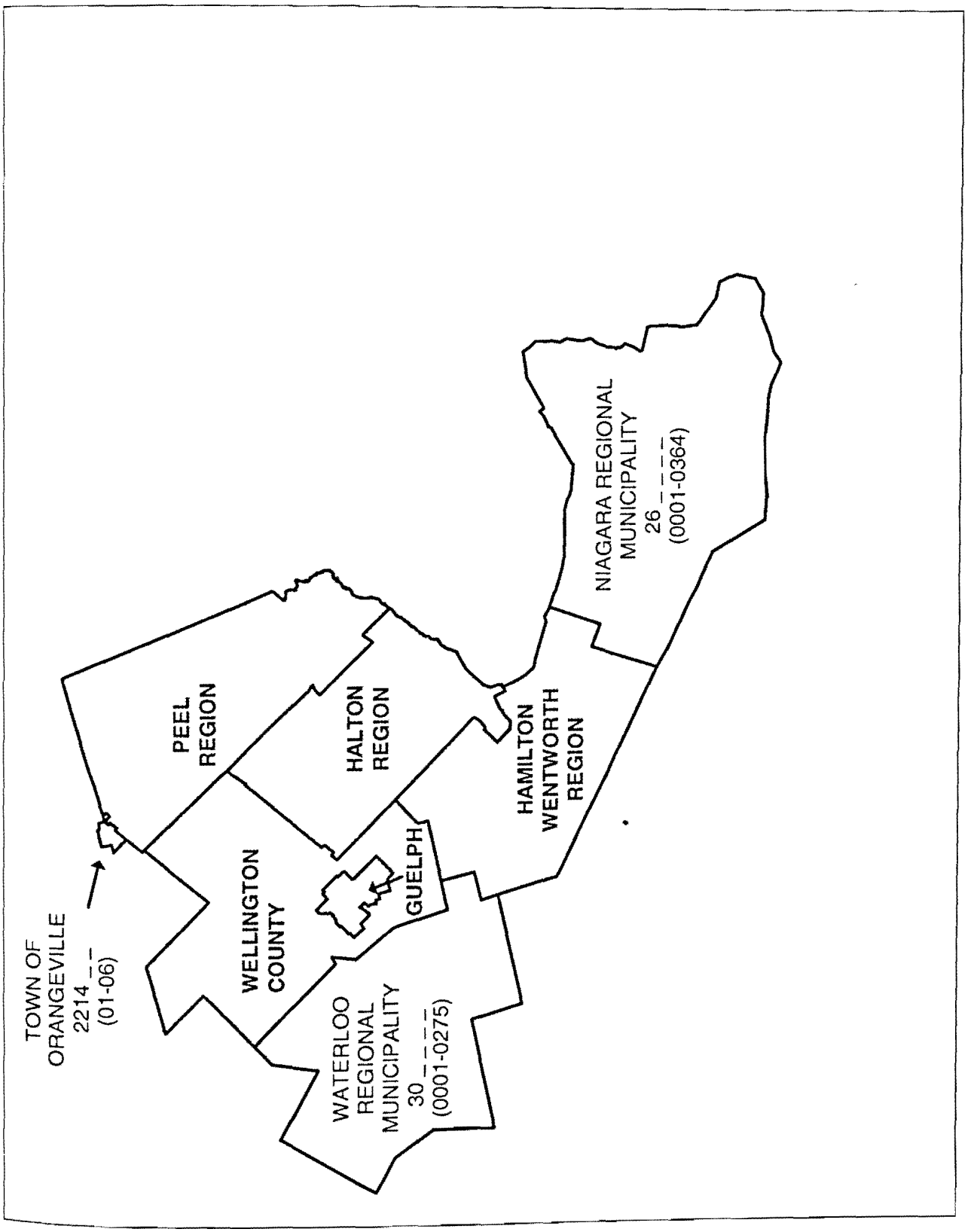
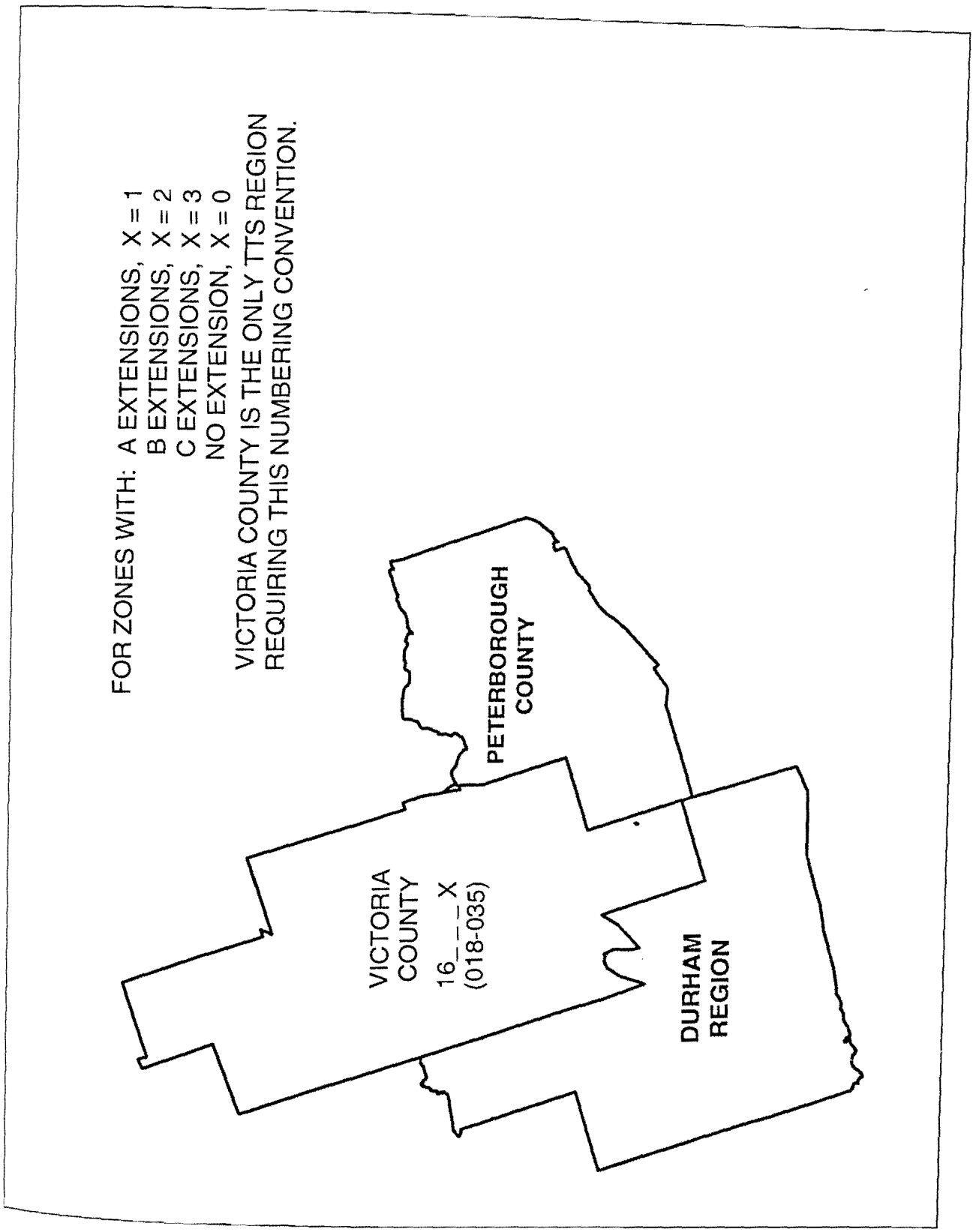


Exhibit 6: TTS Traffic Zone Numbering - Victoria County



CENSUS SUBDIVISIONS WERE USED AS TRAFFIC ZONES IN WELLINGTON AND PETERBOROUGH COUNTIES (INCLUDING BOTH SURVEY AND NON-SURVEY AREAS). THE THIRD AND FOURTH DIGITS OF THE ZONE NUMBER INDICATE THE CSD.

Exhibit 7: TTS Traffic Zone Numbering - Counties of Wellington and Peterborough

CENSUS SUBDIVISIONS WERE USED FOR TRAFFIC ZONES IN THE PORTION OF SIMCOE COUNTY OUTSIDE THE SURVEY AREA. THE THIRD AND FOURTH DIGITS INDICATE THE CSD.

Exhibit 8: TTS Traffic Zone Numbering - Simcoe County and the City of Barrie

Databases for 1996 TTS Version 2.1, 1991 TTS Version 4.1 and 1986 TTS Version 3.1

Household Attributes

The following data was collected or calculated from the TTS for each household that was surveyed in 1996. The attributes and categories are the same for 1986 and 1991 unless noted otherwise.

Exhibit 15: Household Attributes

Attribute	Description	Code
hhld_num	Household sample number	A six digit unique identifier The 1996 TTS numbers lie within the following ranges: 100,001 - 110,000 GTA only (mailing 4) 110,001 - 120,000 GTA only (mailing 5) 120,001 - 130,000 GTA only (mailing 6) 130,001 - 142,000 GTA only (mailing 7) 142,001 - 154,000 GTA only (mailing 8) 154,001 - 166,000 GTA only (mailing 9) 166,001 - 178,700 GTA only (mailing 10) 178,701 - 191,400 combined (mailing 11) 191,401 - 202,826 combined (mailing 12) 102,827 - 215,890 combined (mailing 13) 215,891 - 228,751 combined (mailing 14) 228,752 - 241,634 combined (mailing 15) 241,635 - 258,114 combined (mailing 16) 310,001 - 322,945 Waterloo (1995) 500,001 - 500,491 Northumberland (mailing 3)
region_hhld	Regional/Local municipality of household 1986 - regions 1 - 6 1991 - regions 1 - 7 1996 - regions 1 - 6, 11 - 20, 98	1 - Metro 2 - Durham 3 - York 4 - Peel 5 - Halton 6 - Hamilton-Wentworth 7 - Fringe 11 - Niagara 12 - Waterloo 13 - Guelph 14 - Wellington 15 - Orangeville 16 - Barrie 17 - Simcoe 18 - Victoria 19 - City of Peterborough 20 - Peterborough County 98 - External (Northumberland)
pd_hhld	Planning district of household	1 to 113 - See Planning District Maps (pg. 15 - 17)
ct_uid	Census Canada census tract unit identification	A ten digit identifier assigned by Statistics Canada
gzon_hhld	Traffic zone of the household (1996 only)	See section 'TTS Traffic Zones' (pg. 7 - 14)
gta91_hhld	GTA zone of the household	1991 GTA Zones (pg. 18 - 20)
ex_fac	Expansion factor for the household	A five digit number
utmx_hhld	UTM X coordinate of the household	Distance east in metres, measured from the 81st degree longitude with a false easting of 500,000 metres
utmy_hhld	UTM Y coordinate of the household	Distance north in metres, measured from the equator

Household Attributes Continued

utmxo_hhld	UTM X coordinate of the household prior to allocating intersections (1996 only)	Distance east in metres, measured from the 81st degree longitude with a false easting of 500,000 metres
utmyo_hhld	UTM Y coordinate of the household prior to allocating intersections (1996 only)	Distance north in metres, measured from the equator
dwell_type	Type of dwelling unit	1 - House 2 - Apartment 3 - Townhouse (1996 only) 9 - Unknown
gtyp_hhld	Method used to geocode household	A - Address - Block Face Address Range D - Address - Parcel Dot E - Emergency Location Code (1996 only) I - Intersection M - Monument P - Place Name Z - Traffic Zone
n_call	Number of calls or edit attempts to complete the interview	
trip_week	Weeks into the survey when trip data was collected Refer to previous dataguides for week numbering in 1986 and 1991	For Waterloo 1995, week of survey ending: 31 - October 15, 1995 32 - October 22, 1995 33 - October 29, 1995 34 - November 5, 1995 35 - November 12, 1995 36 - November 19, 1995 37 - November 26, 1995 38 - December 3, 1995 Week of survey ending: 0 - August 31, 1996 1 - September 7, 1996 2 - September 14, 1996 3 - September 21, 1996 4 - September 28, 1996 5 - October 5, 1996 6 - October 12, 1996 7 - October 19, 1996 8 - October 26, 1996 9 - November 2, 1996 10 - November 9, 1996 11 - November 16, 1996 12 - November 23, 1996 13 - November 30, 1996 14 - December 7, 1996 15 - December 14, 1996 16 - December 21, 1996
trip_day	Day of week trip data was collected for	1 - Monday 2 - Tuesday 3 - Wednesday 4 - Thursday 5 - Friday 9 - Unknown (1986, 1991)
n_person	Number of persons in the household	1 - 9 (1991, 1996) 1 -10 (1986)
n_vehicle	Number of vehicles available for personal use in the household	0 - 99
n_licence	Number of persons possessing a driver's license in the household	0 - 9
n_emp_ft	Number of full time workers in the household	0 - 9
n_emp_pt	Number of part time workers in the household	0 - 9
n_emp_home	Number of persons who work full or part time at home in the household	0 - 9
n_student	Number of full or part time students in the household	0 - 9
n_hhld_trip	Number of household trips on trip day (1986 data includes persons aged 6-10)	0 - 99
rec_mail	Receipt of advance letter 1991 and 1996 only	Y - Yes N - No 9 - Unknown

Person Attributes

The following data was collected or calculated for each person in the households surveyed in 1996. The attributes and categories are the same for 1986 and 1991 except as noted.

Exhibit 16: Person Attributes

Attribute	Description	Code
hhld_num	Household sample number	A six digit unique identifier
pers_num	Person number within the household	1 - 9
respond	Respondent status (household member who provided information)	T - Respondent F - Not respondent (i.e., his/her information was reported by another member of the household)
age	Age of person in years	0 - 99 (in 1991 age 1 included all persons under 2 years of age) 97 - Aged 97 and older (1986) 98 - Aged 98 and older(1991 and 1996) 99 - Unknown
sex	Gender of the person	F - Female M - Male 9 - Unknown
driver_lic	Possession of a driver's license	Y - Yes N - No 9 - Unknown
tran_pass	Possession of a transit pass New question in 1996	C - Combination or Dual Pass G - GO Transit Pass M - Metro Pass N - None O - Other Agency Pass 9 - Unknown (persons under age 11 are assumed not to have a transit pass)
emp_stat	Employment status of the person In 1986 a person could be recorded as employed or a student but not both In 1991 and 1996 combinations of employment and student status were allowed	F - Full time H - Work at home full time J - Work at home part time N - Not employed P - Part time 9 - Unknown (persons under 11 are assumed not to be employed)
occupation	Person's occupation type New question in 1996	G - General Office / Clerical M - Manufacturing / Construction/ Trades P - Professional / Management / Technical S - Retail Sales and Service O - Not Employed 9 - Unknown
no_work	Whether a full time employed person who did not make a trip to usual place of work worked from home on the trip day. New question in 1996	N - No Y - Yes O - Not Applicable 9 - Unknown
stu_stat	Student status of person All persons aged 6 - 10 years are assumed to be full time students In 1986 a person could be recorded as employed or a student but not both In 1991 and 1996 combinations of employment and student status were allowed	O - Not a student P - Part time student S - Full time student 9 - Unknown

Person Attributes Continued

region_emp	Regional/Local municipality of person's usual place of work Not in 1986 survey 1991 - regions 1 - 7, 88, 98, 99 1996 - regions 1 - 6, 11 - 99	0 - Not employed 1 - Metro 2 - Durham 3 - York 4 - Peel 5 - Halton 6 - Hamilton-Wentworth 7 - Fringe 11 - Niagara 12 - Waterloo 13 - Guelph 14 - Wellington 15 - Orangeville 16 - Barrie 17 - Simcoe 18 - Victoria 19 - City of Peterborough 20 - Peterborough County 88 - No usual place of work 98 - External 99 - Unknown
pd_emp	Planning district of person's usual place of work Not in 1986 survey	0 - Not employed 1 to 113 (see Planning District Maps (pg. 15 - 17)) 114 - Peterborough County 115 - Hastings County 116 - Haliburton County 117 - Muskoka District Municipality 118 - Simcoe County 119 - Dufferin County 120 - Grey County 121 - Wellington County 122 - Perth County 123 - Oxford County 124 - Brant County 125 - Haldimand-Norfolk Regional Municipality 888 - No Usual Place of Work 998 - External 999 - Unknown
gzon_emp	Traffic zone of person's usual place of work (1996 only)	See section 'TTS Traffic Zones' (pg. 7 - 14)
gta91_emp	GTA zone of person's usual place of work Not in 1986 survey	1991 GTA Zones (pg. 18 - 20)
utmx_emp	UTM X coordinate of person's usual place of work Not in 1986 survey	Distance east in metres 0 - Not Employed 888888 - No usual place of work 999998 - External 999999 - Unknown
utmy_emp	UTM Y coordinate of person's usual place of work Not in 1986 survey	Distance north in metres 0 - Not Employed 8888888 - No usual place of work 9999998 - External 9999999 - Unknown
utmxo_emp	UTM X coordinate of person's usual place of work prior to intersection allocation (1996 only)	Distance east in metres
utmyo_emp	UTM X coordinate of person's usual place of work prior to intersection allocation (1996 only)	Distance north in metres
gtyp_emp	Method used to geocode person's usual place of work Not in 1986 survey	A - Address - Block Face Address Range B - Blank (not employed) D - Address - Parcel Dot (1996 only) E - Emergency Location Code (1996 only) F - MapInfo I - Intersection M - Monument N - No Usual Place of Work

Person Attributes Continued

		P - Place Name R - Unknown Z - Traffic Zone (1996 only)
free_park	Availability of free parking at person's usual place of work New question in 1991, 1996	N - No O - Not Employed Y - Yes 9 - Unknown
region_sch	Regional municipality of person's usual place of school Not in 1986 Survey 1991 - regions 1 - 7, 98, 99 1996 - regions 1 - 6, 11 - 99	0 - Not a student 1 - Metro 2 - Durham 3 - York 4 - Peel 5 - Halton 6 - Hamilton-Wentworth 7 - Fringe 11 - Niagara 12 - Waterloo 13 - Guelph 14 - Wellington 15 - Orangeville 16 - Barrie 17 - Simcoe 18 - Victoria 19 - City of Peterborough 20 - Peterborough County 88 - No usual place of school 98 - External 99 - Unknown
pd_sch	Planning district of person's usual place of school Not in 1986 survey	0 - Not a student 1 to 113 (see Planning District Maps (pg. 15 -17)) 114 - Peterborough County 115 - Hastings County 116 - Haliburton County 117 - Muskoka District Municipality 118 - Simcoe County 119 - Dufferin County 120 - Grey County 121 - Wellington County 122 - Perth County 123 - Oxford County 124 - Brant County 125 - Haldimand-Norfolk Regional Municipality 888 - No Usual School 998 - External 999 - Unknown
gzon_sch	Traffic zone of person's usual place of school (1996 only)	See section 'TTS Traffic Zones' (pg. 7 - 14)
gta91_sch	GTA zone of person's usual place of school Not in 1986 survey	1991 GTA Zones (pg. 18 - 20)
utmx_sch	UTM X coordinate of person's usual place of school Not in 1986 survey	Distance east in metres 0 - Not attending school 888888 - No usual place of school 999999 - Unknown
utmy_sch	UTM Y coordinate of person's usual place of school Not in 1986 survey	Distance north in metres 0 - Not attending school 8888888 - No usual place of school 9999999 - Unknown
utmxo_sch	UTM X coordinate of person's usual place of school prior to intersection allocation (1996 only)	Distance east in metres

Person Attributes Continued

utmyo_sch	UTM Y coordinate of person's usual place of school prior to intersection allocation (1996 only)	Distance north in metres
gtyp_sch	Method used to geocode person's usual place of school Not in 1986 survey	A - Address - Block Face Address Range B - Blank (not a student) D - Address - Parcel Dot (1996 only) F - MapInfo E - Emergency location code (1996 only) H - Home I - Intersection M - Monument N - No Usual Place of School P - Place Name R - Unknown Z - Traffic Zone (1996 only)
n_pers_trip	Number of trips made by the individual on trip day	0 - 99
n_tran_trip	Number of trips made by individual on trip day with primary mode being public transit	0 - 99

Trip Attributes

The following data was collected or calculated for each trip made on the trip day for each person 11 years old and older in the households surveyed in 1996. The attributes and categories are the same for 1986 and 1991 except as noted. Trip information was collected for household members 6 years old and over in 1986, and 11 and older in 1991.

Exhibit 17: Trip Attributes

Attribute	Description	Code
hhld_num	Household sample number	A six digit unique identifier
pers_num	Person number within the household	1 - 9
trip_num	Trip number for that person	1 - 99
start_time	Start time of the trip (24 hour clock)	0400-2800 (4a.m. on the trip day to 4a.m. the next day) 9999 - Unknown
mode_prime	Primary mode of the trip (if any part of the trip is made by public transit, the primary mode is defined as B, G or J)	B - Public Transit (excluding GO Rail) C - Bicycle D - Auto Driver G - GO Rail J - Joint GO Rail and Public Transit M - Motorcycle O - Other P - Auto Passenger S - School Bus T - Taxi W - Walk 9 - Unknown
purp_orig	Origin purpose of the trip (the destination purpose of the previous trip, except for first trip on trip day, which is assumed to be other if the first trip does not start from home, work or school)	D - Daycare (1991 and 1996 only) E - Entertainment (1986 only) F - Facilitate passenger H - Home L - Linked trip (1991 only) M - Marketing (1986 and 1996 only) O - Other P - Personal (1986 only) S - School W - Work 9 - Unknown
region_orig	Regional municipality of trip origin 1986 - regions 1 - 6, 99 1991 - regions 1 - 7, 98 1996 - regions 1 - 6, 11 - 98	1 - Metro 2 - Durham 3 - York 4 - Peel 5 - Halton 6 - Hamilton-Wentworth 7 - Fringe 11 - Niagara 12 - Waterloo 13 - Guelph 14 - Wellington 15 - Orangeville 16 - Barrie 17 - Simcoe 18 - Victoria 19 - City of Peterborough 20 - Peterborough County 98 - External 99 - Unknown
pd_orig	Planning district of trip origin	1 to 113 (see Planning District Maps (pg. 15 - 17)) 114 - Peterborough County 115 - Hastings County 116 - Haliburton County 117 - Muskoka District Municipality 118 - Simcoe County

Trip Attributes Continued

		119 - Dufferin County 120 - Grey County 121 - Wellington County 122 - Perth County 123 - Oxford County 124 - Brant County 125 - Haldimand-Norfolk Regional Municipality 998 - External 999 - Unknown
gzon_orig	Traffic zone of trip origin	See section 'TTS Traffic Zones' (pg. 7 - 14)
gta91_orig	GTA zone of trip origin	1991 GTA Zones (pg. 18 - 20)
utmx_orig	UTM X coordinate of trip origin	Distance east in metres 999999 - Unknown
utmy_orig	UTM Y coordinate of trip origin	Distance north in metres 9999999 - Unknown
utmxo_orig	UTM X coordinate of trip origin prior to intersection allocation	Distance east in metres
utmyo_orig	UTM Y coordinate of trip origin prior to intersection allocation	Distance north in metres
gtyp_orig	Method used to geocode trip origin	A - Address - Block Face Address Range D - Address - Parcel Dot E - Emergency location code F - MapInfo I - Intersection M - Monument P - Place Name R - Unknown Z - Traffic Zone
purp_dest	Destination purpose of the trip	C - Second and subsequent school trips D - Daycare (1991 and 1996 only) E - Entertainment (1986 only) F - Facilitate passenger H - Home L - Linked trip (1991 only) M - Marketing (1986 and 1996 only) O - Other P - Personal (1986 only) R - Second and subsequent work trips S - First school trip of the day W- First work trip of the day 9 - Unknown
region_dest	Regional municipality of trip destination 1986 - regions 1 - 6, 99 1991 - regions 1 - 7, 98 1996 - regions 1 - 6, 11 - 98	Same as region_orig
pd_dest	Planning district of trip destination	1 to 113 (see Planning District Maps (pg. 15 - 17)) 114 - Peterborough County 115 - Hastings County 116 - Haliburton County 117 - Muskoka District Municipality 118 - Simcoe County 119 - Dufferin County 120 - Grey County 121 - Wellington County 122 - Perth County 123 - Oxford County 124 - Brant County 125 - Haldimand-Norfolk Regional Municipality 998 - External 999 - Unknown
gzon_dest	Traffic zone of trip destination	See section 'TTS Traffic Zones' (pg. 7 - 14)

Trip Attributes Continued

gta91_dest	GTA zone of trip destination	1991 GTA Zones (pg. 18 -20)
utmx_dest	UTM X coordinate of trip destination	Distance east in metres
utmy_dest	UTM Y coordinate of trip destination	Distance north in metres
gtyp_dest	Method used to geocode trip destination	A - Address - Block Face Address Range D - Address - Parcel Dot E - Emergency location code F - MapInfo I - Intersection M - Monument P - Place Name R - Unknown Z - Traffic Zone
trip_km	Straight line trip length in kilometres	

APPENDIX B

DATA RETRIEVAL SYSTEM

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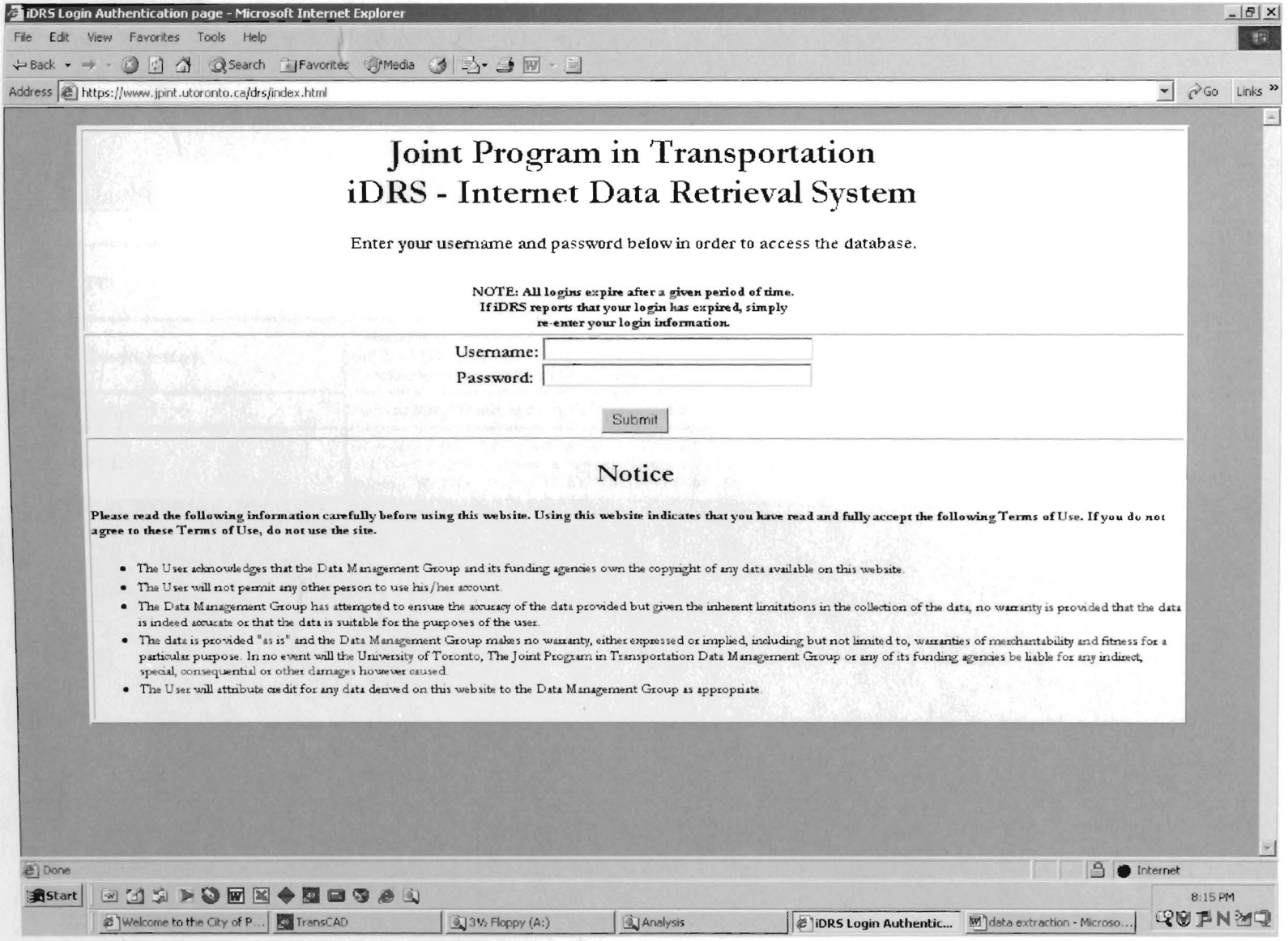
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Enter your username and password below in order to access the database.
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If iDRS reports that your login has expired, simply
re-enter your login information.
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Password:
Submit
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Done
Internet
Start
8:15 PM
Welcome to the City of P...
TransCAD
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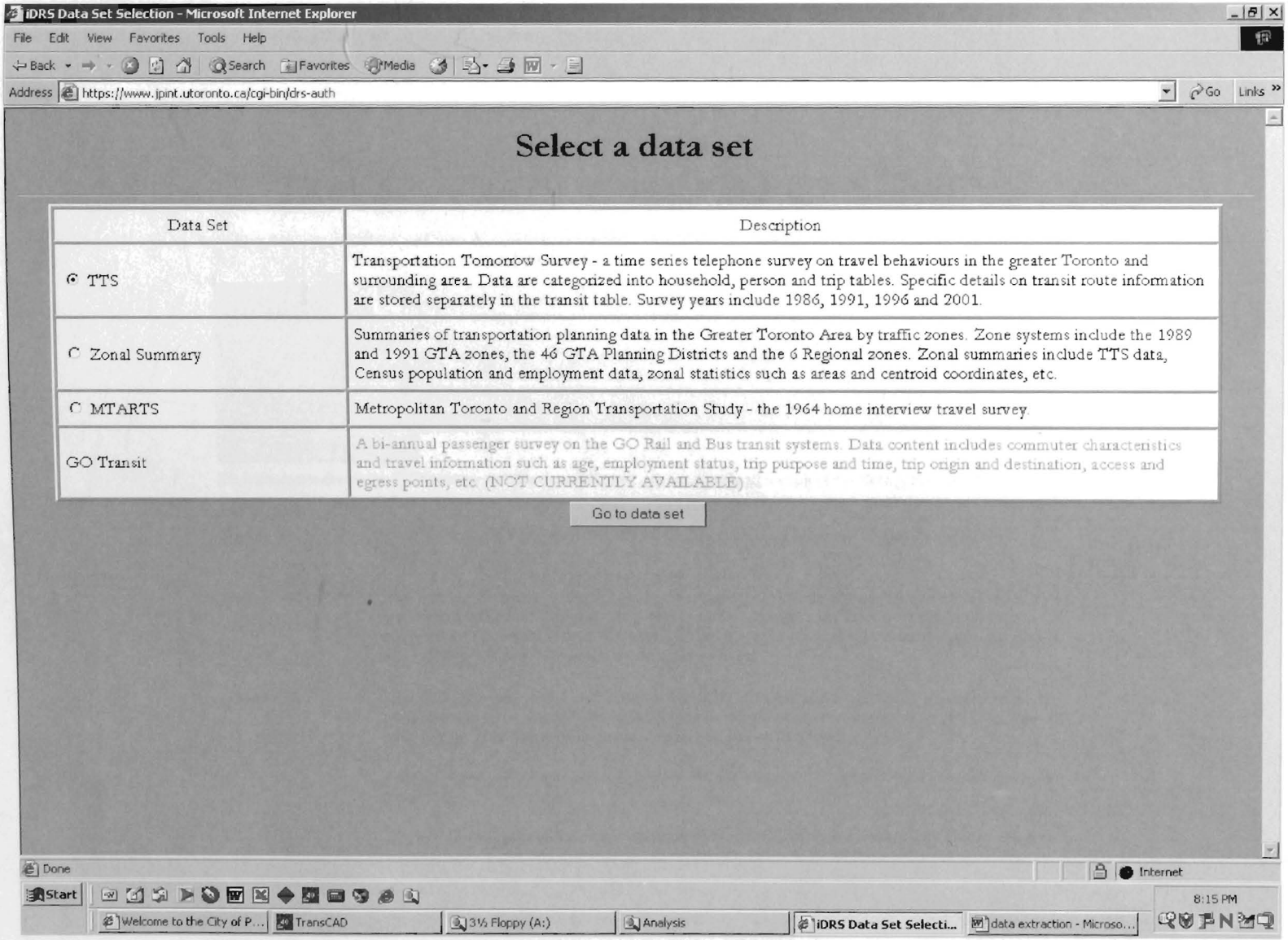
Analysis
iDRS Login Authentic...
data extraction - Microso...


iDRS Data Set Selection - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address https://www.jpint.utoronto.ca/cgi-bin/drs-auth
Go Links
Select a data set
Data Set
Description
TTS
Transportation Tomorrow Survey - a time series telephone survey on travel behaviours in the greater Toronto and surrounding area. Data are categorized into household, person and trip tables. Specific details on transit route information are stored separately in the transit table. Survey years include 1986, 1991, 1996 and 2001.
Zonal Summary
Summaries of transportation planning data in the Greater Toronto Area by traffic zones. Zone systems include the 1989 and 1991 GTA zones, the 46 GTA Planning Districts and the 6 Regional zones. Zonal summaries include TTS data, Census population and employment data, zonal statistics such as areas and centroid coordinates, etc.
MTARTS
Metropolitan Toronto and Region Transportation Study - the 1964 home interview travel survey.
GO Transit
A bi-annual passenger survey on the GO Rail and Bus transit systems. Data content includes commuter characteristics and travel information such as age, employment status, trip purpose and time, trip origin and destination, access and egress points, etc. (NOT CURRENTLY AVAILABLE)
Go to data set
Done
Internet
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TransCAD
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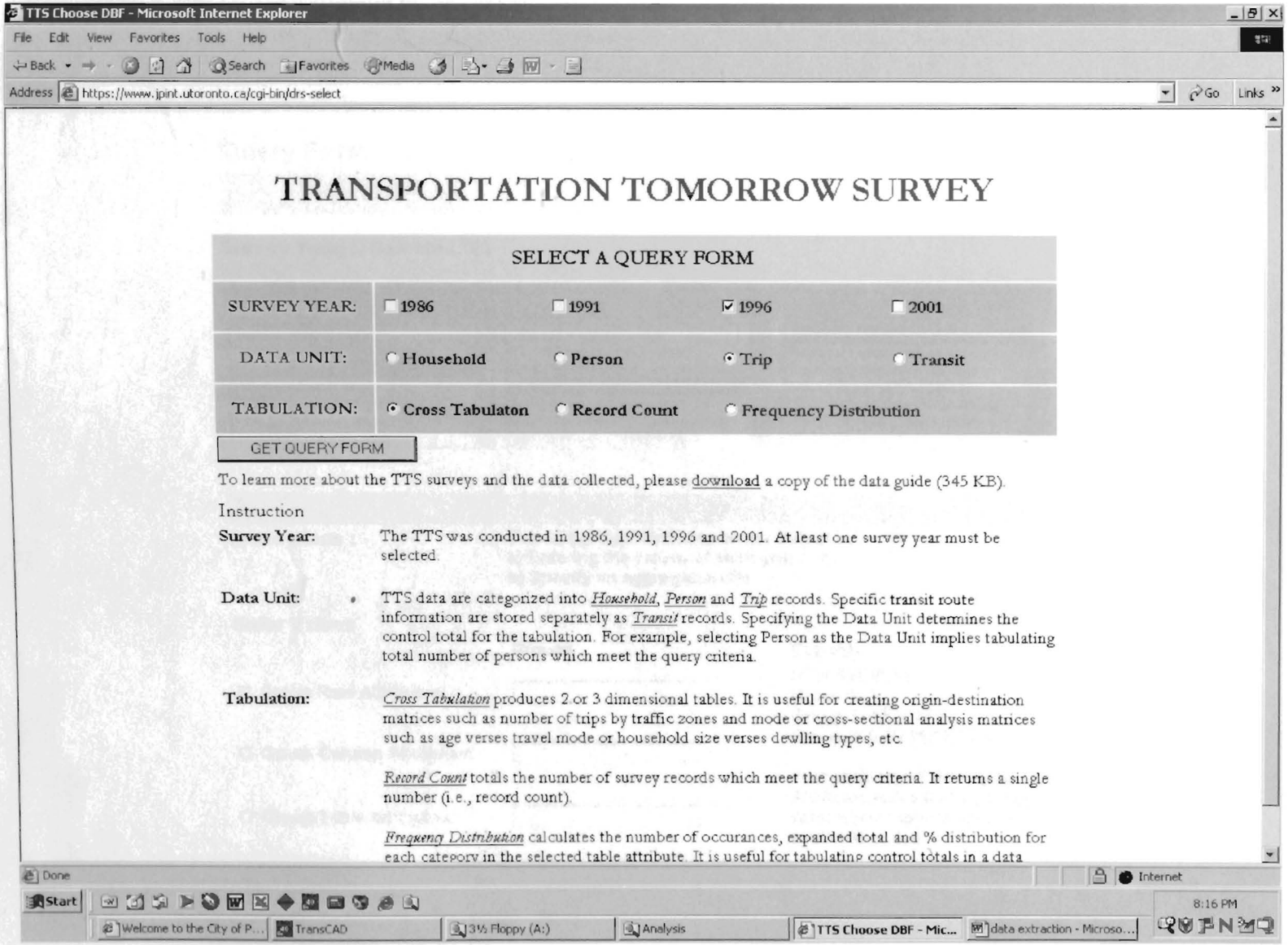
Analysis
iDRS Data Set Selecti...
data extraction - Microso...


TTS Choose DBF - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address https://www.jpint.utoronto.ca/cgi-bin/drs-select
Go Links
TRANSPORTATION TOMORROW SURVEY
SELECT A QUERY FORM
SURVEY YEAR: 1986 1991 1996 2001
DATA UNIT: Household Person Trip Transit
TABULATION: Cross Tabulaton Record Count Frequency Distribution
GET QUERY FORM
To learn more about the TTS surveys and the data collected, please download a copy of the data guide (345 KB).
Instruction
Survey Year: The TTS was conducted in 1986, 1991, 1996 and 2001. At least one survey year must be selected.
Data Unit: TTS data are categorized into Household, Person and Trip records. Specific transit route information are stored separately as Transit records. Specifying the Data Unit determines the control total for the tabulation. For example, selecting Person as the Data Unit implies tabulating total number of persons which meet the query criteria.
Tabulation: Cross Tabulation produces 2 or 3 dimensional tables. It is useful for creating origin-destination matrices such as number of trips by traffic zones and mode or cross-sectional analysis matrices such as age verses travel mode or household size verses dewlling types, etc.
Record Count totals the number of survey records which meet the query criteria. It returns a single number (i.e., record count).
Frequency Distribution calculates the number of occurances, expanded total and % distribution for
Done
Internet
Start
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TransCAD
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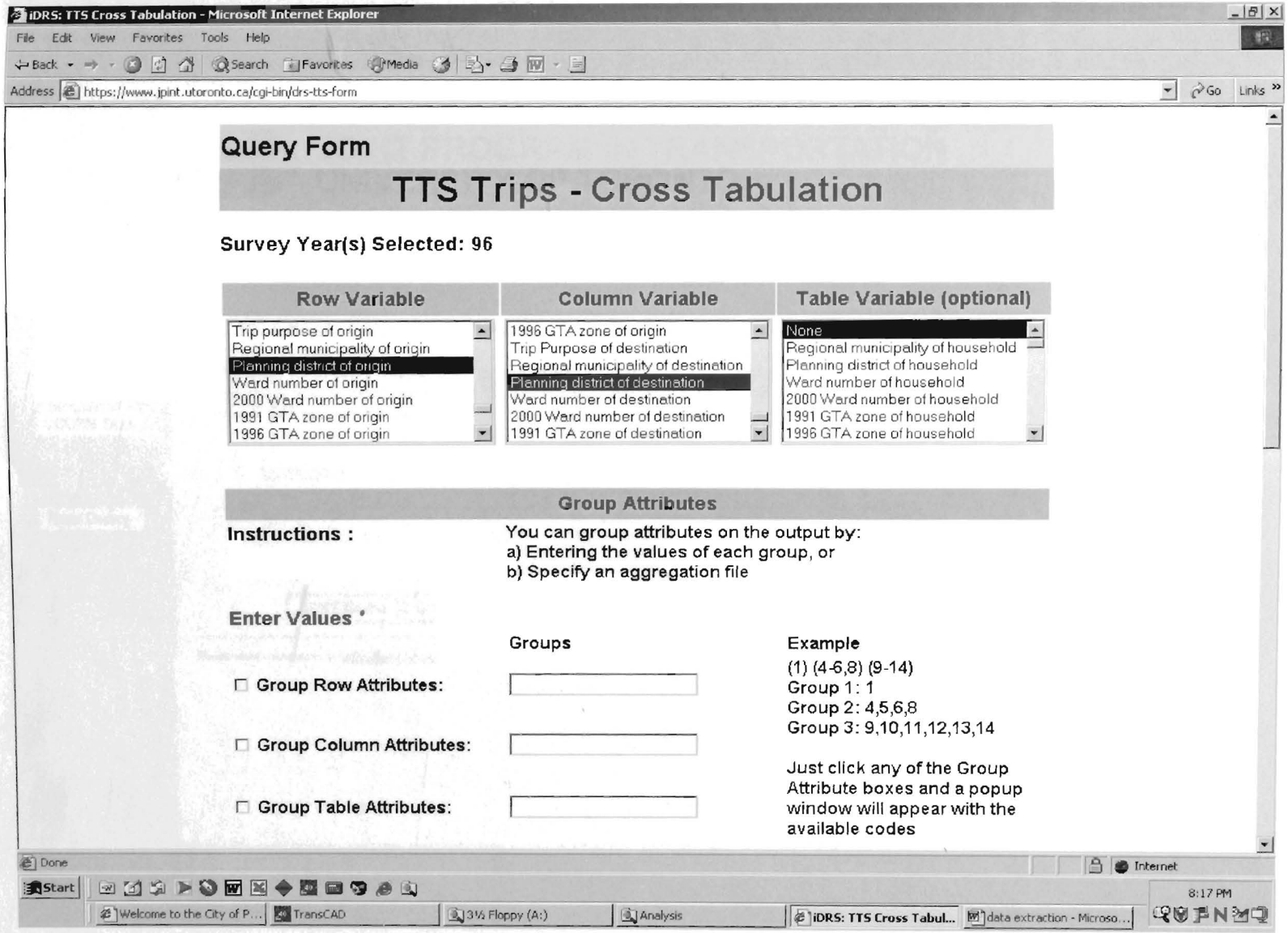
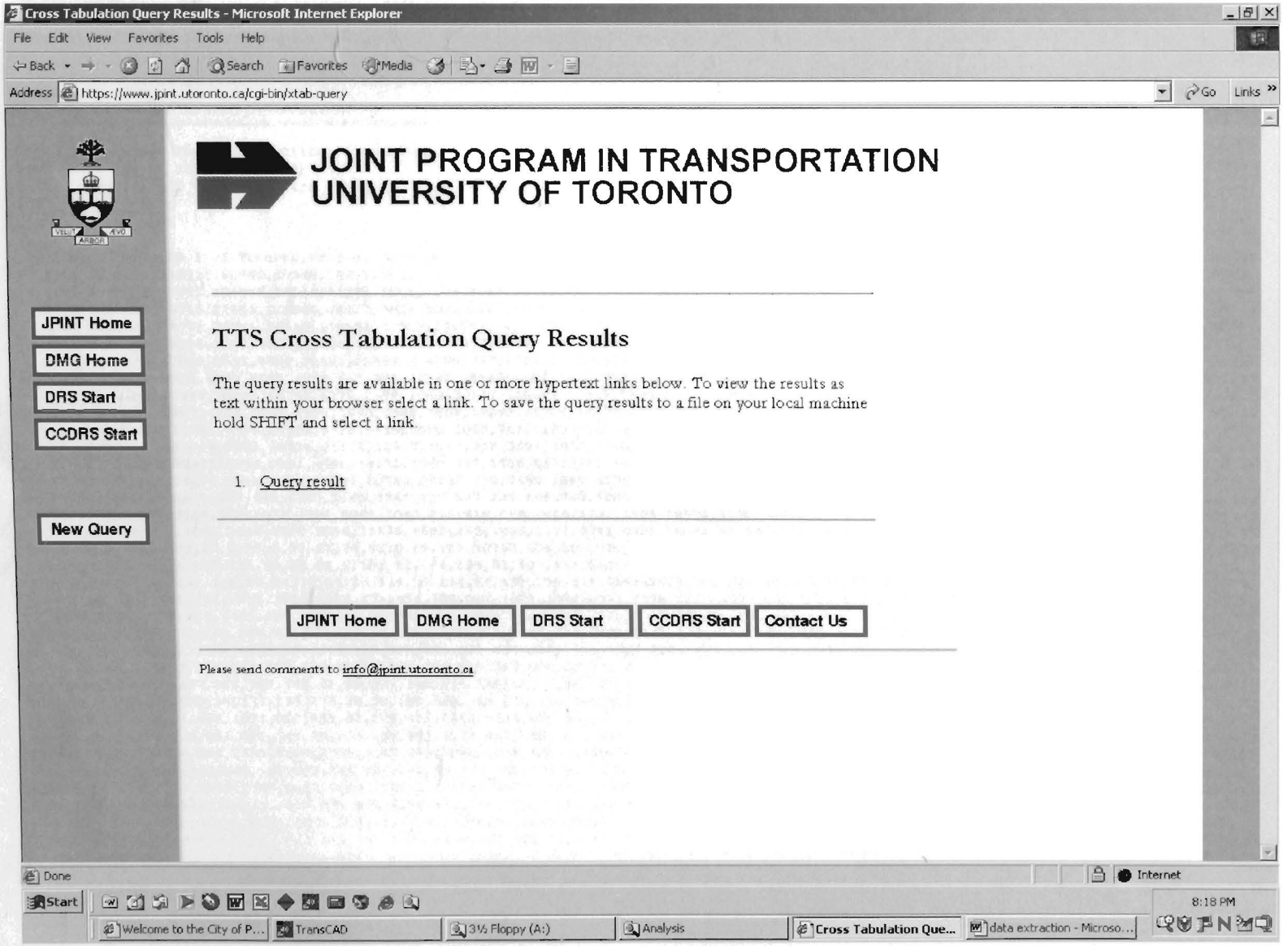
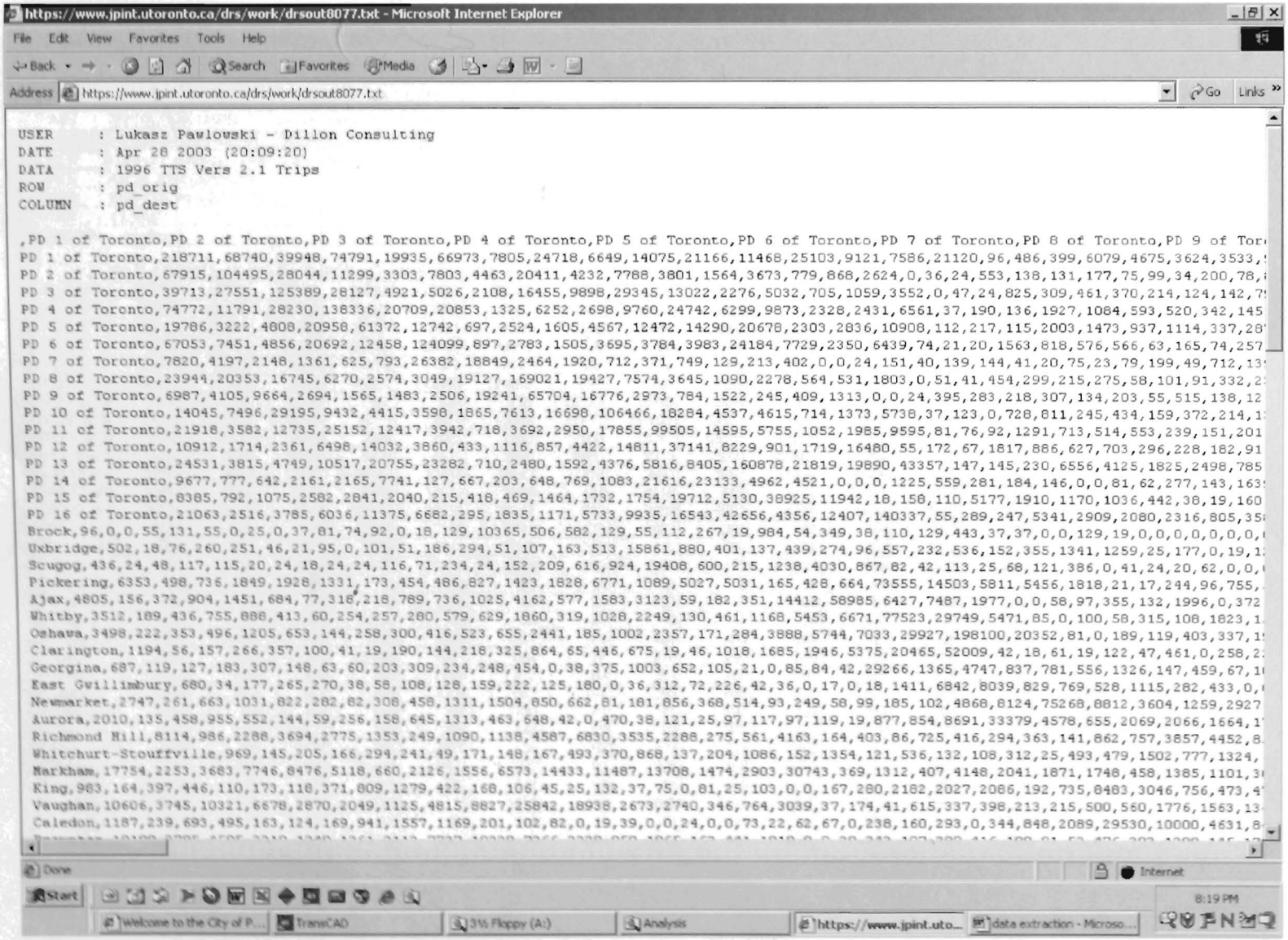
Analysis
TTS Choose DBF - Mic...
data extraction - Microso...


iDRS: TTS Cross Tabulation - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address https://www.jpint.utoronto.ca/cgi-bin/drs-tts-form
Go Links
Query Form
TTS Trips - Cross Tabulation
Survey Year(s) Selected: 96
Row Variable
Trip purpose of origin
Regional municipality of origin
Planning district of origin
Ward number of origin
2000 Ward number of origin
1991 GTA zone of origin
1996 GTA zone of origin
Column Variable
1996 GTA zone of origin
Trip Purpose of destination
Regional municipality of destination
Planning district of destination
Ward number of destination
2000 Ward number of destination
1991 GTA zone of destination
Table Variable (optional)
None
Regional municipality of household
Planning district of household
Ward number of household
2000 Ward number of household
1991 GTA zone of household
1996 GTA zone of household
Group Attributes
Instructions :
You can group attributes on the output by:
a) Entering the values of each group, or
b) Specify an aggregation file
Enter Values
Groups
Example
Group Row Attributes:
Group Column Attributes:
Group Table Attributes:
(1) (4-6,8) (9-14)
Group 1: 1
Group 2: 4,5,6,8
Group 3: 9,10,11,12,13,14
Just click any of the Group Attribute boxes and a popup window will appear with the available codes
Done
Internet
Start
8:17 PM
Welcome to the City of P...
TransCAD
3½ Floppy (A:)
Analysis
iDRS: TTS Cross Tabul...
data extraction - Microso...


Cross Tabulation Query Results - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address https://www.jpint.utoronto.ca/cgi-bin/xtab-query
Go Links
JOINT PROGRAM IN TRANSPORTATION
UNIVERSITY OF TORONTO
JPINT Home
DMG Home
DRS Start
CCDRS Start
New Query
TTS Cross Tabulation Query Results
The query results are available in one or more hypertext links below. To view the results as text within your browser select a link. To save the query results to a file on your local machine hold SHIFT and select a link.
1. Query result
JPINT Home
DMG Home
DRS Start
CCDRS Start
Contact Us
Please send comments to info@jpint.utoronto.ca
Done
Internet
Start
8:18 PM
Welcome to the City of P...
TransCAD
3½ Floppy (A:)
Analysis
Cross Tabulation Que...
data extraction - Microso...


https://www.jpint.utoronto.ca/drs/work/drsout8077.txt - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address https://www.jpint.utoronto.ca/drs/work/drsout8077.txt
Go Links
USER : Lukasz Pawlowski - Dillon Consulting
DATE : Apr 28 2003 (20:09:20)
DATA : 1996 TTS Vers 2.1 Trips
ROW : pd_orig
COLUMN : pd_dest
,PD 1 of Toronto,PD 2 of Toronto,PD 3 of Toronto,PD 4 of Toronto,PD 5 of Toronto,PD 6 of Toronto,PD 7 of Toronto,PD 8 of Toronto,PD 9 of Tor
PD 1 of Toronto,218711,68740,39948,74791,19935,66973,7805,24718,6649,14075,21166,11468,25103,9121,7586,21120,96,486,399,6079,4675,3624,3533,
PD 2 of Toronto,67915,104495,28044,11299,3303,7803,4463,20411,4232,7788,3801,1564,3673,779,868,2624,0,36,24,553,138,131,177,75,99,34,200,78,
PD 3 of Toronto,39713,27551,125389,28127,4921,5026,2108,16455,9898,29345,13022,2276,5032,705,1059,3552,0,47,24,825,309,461,370,214,124,142,7
PD 4 of Toronto,74772,11791,28230,138336,20709,20853,1325,6252,2698,9760,24742,6299,9873,2328,2431,6561,37,190,136,1927,1084,593,520,342,145
PD 5 of Toronto,19786,3222,4808,20958,61372,12742,697,2524,1605,4567,12472,14290,20678,2303,2836,10908,112,217,115,2003,1473,937,1114,337,28
PD 6 of Toronto,67053,7451,4856,20692,12458,124099,897,2783,1505,3695,3784,3983,24184,7729,2350,6439,74,21,20,1563,818,576,566,63,165,74,257
PD 7 of Toronto,7820,4197,2148,1361,625,793,26382,18849,2464,1920,712,371,749,129,213,402,0,0,24,151,40,139,144,41,20,75,23,79,199,49,712,13
PD 8 of Toronto,23944,20353,16745,6270,2574,3049,19127,169021,19427,7574,3645,1090,2278,564,531,1803,0,51,41,454,299,215,275,58,101,91,332,2
PD 9 of Toronto,6987,4105,9664,2694,1565,1483,2506,19241,65704,16776,2973,784,1522,245,409,1313,0,0,24,395,283,218,307,134,203,55,515,138,12
PD 10 of Toronto,14045,7496,29195,9432,4415,3598,1865,7613,16698,106466,18284,4537,4615,714,1373,5738,37,123,0,728,811,245,434,159,372,214,1
PD 11 of Toronto,21918,3582,12735,25152,12417,3942,718,3692,2950,17855,99505,14595,5755,1052,1985,9595,81,76,92,1291,713,514,553,239,151,201
PD 12 of Toronto,10912,1714,2361,6498,14032,3860,433,1116,857,4422,14811,37141,8229,901,1719,16480,55,172,67,1817,886,627,703,296,228,182,91
PD 13 of Toronto,24531,3815,4749,10517,20755,23282,710,2480,1592,4376,5816,8405,160878,21819,19890,43357,147,145,230,6556,4125,1825,2498,785
PD 14 of Toronto,9677,777,642,2161,2165,7741,127,667,203,648,769,1083,21616,23133,4962,4521,0,0,0,1225,559,281,184,146,0,0,81,62,277,143,163
PD 15 of Toronto,8385,792,1075,2582,2841,2040,215,418,469,1464,1732,1754,19712,5130,38925,11942,18,158,110,5177,1910,1170,1036,442,38,19,160
PD 16 of Toronto,21063,2516,3785,6036,11375,6682,295,1835,1171,5733,9935,16543,42656,4356,12407,140337,55,289,247,5341,2909,2080,2316,805,35
Brock,96,0,0,55,131,55,0,25,0,37,81,74,92,0,18,129,10365,506,582,129,55,112,267,19,984,54,349,38,110,129,443,37,37,0,0,129,19,0,0,0,0,0,0,0,
Uxbridge,502,18,76,260,251,46,21,95,0,101,51,186,294,51,107,163,513,15861,880,401,137,439,274,96,557,232,536,152,355,1341,1259,25,177,0,19,1
Scugog,436,24,48,117,115,20,24,18,24,24,116,71,234,24,152,209,616,924,19408,600,215,1238,4030,867,82,42,113,25,68,121,386,0,41,24,20,62,0,0,
Pickering,6353,498,736,1849,1928,1331,173,454,486,827,1423,1828,6771,1089,5027,5031,165,428,664,73555,14503,5811,5456,1818,21,17,244,96,755,
Ajax,4805,156,372,904,1451,684,77,318,218,789,736,1025,4162,577,1583,3123,59,182,351,14412,58985,6427,7487,1977,0,0,58,97,355,132,1996,0,372
Whitby,3512,189,436,755,886,413,60,254,257,280,579,629,1860,319,1028,2249,130,461,1168,5453,6671,77523,29749,5471,85,0,100,58,315,108,1823,1
Oshawa,3498,222,353,496,1205,653,144,258,300,416,523,655,2441,185,1002,2357,171,284,3888,5744,7033,29927,198100,20352,81,0,189,119,403,337,1
Clarington,1194,56,157,266,357,100,41,19,190,144,218,325,864,65,446,675,19,46,1018,1685,1946,5375,20465,52009,42,18,61,19,122,47,461,0,258,2
Georgina,687,119,127,183,307,148,63,60,203,309,234,248,454,0,38,375,1003,652,105,21,0,85,84,42,29266,1365,4747,837,781,556,1326,147,459,67,1
East Gwillimbury,680,34,177,265,270,38,58,108,128,159,222,125,180,0,36,312,72,226,42,36,0,17,0,18,1411,6842,8039,829,769,528,1115,282,433,0,
Newmarket,2747,261,663,1031,822,282,82,308,458,1311,1504,850,662,81,181,856,368,514,93,249,58,99,185,102,4868,8124,75268,8812,3604,1259,2927
Aurora,2010,135,458,955,552,144,59,256,158,645,1313,463,648,42,0,470,38,121,25,97,117,97,119,19,877,854,8691,33379,4578,655,2069,2066,1664,1
Richmond Hill,8114,986,2288,3694,2775,1353,249,1090,1138,4587,6830,3535,2288,275,561,4163,164,403,86,725,416,294,363,141,862,757,3857,4452,8
Whitchurt-Stouffville,969,145,205,166,294,241,49,171,148,167,493,370,868,137,204,1086,152,1354,121,536,132,108,312,25,493,479,1502,777,1324,
Markham,17754,2253,3683,7746,8476,5118,660,2126,1556,6573,14433,11487,13708,1474,2903,30743,369,1312,407,4148,2041,1871,1748,458,1385,1101,3
King,983,164,397,446,110,173,118,371,809,1279,422,168,106,45,25,132,37,75,0,81,25,103,0,0,167,280,2182,2027,2086,192,735,8483,3046,756,473,4
Vaughan,10606,3745,10321,6678,2870,2049,1125,4815,8827,25842,18938,2673,2740,346,764,3039,37,174,41,615,337,398,213,215,500,560,1776,1563,13
Caledon,1187,239,693,495,163,124,169,941,1557,1169,201,102,82,0,19,39,0,0,24,0,0,73,22,62,67,0,238,160,293,0,344,848,2089,29530,10000,4631,8
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TransCAD
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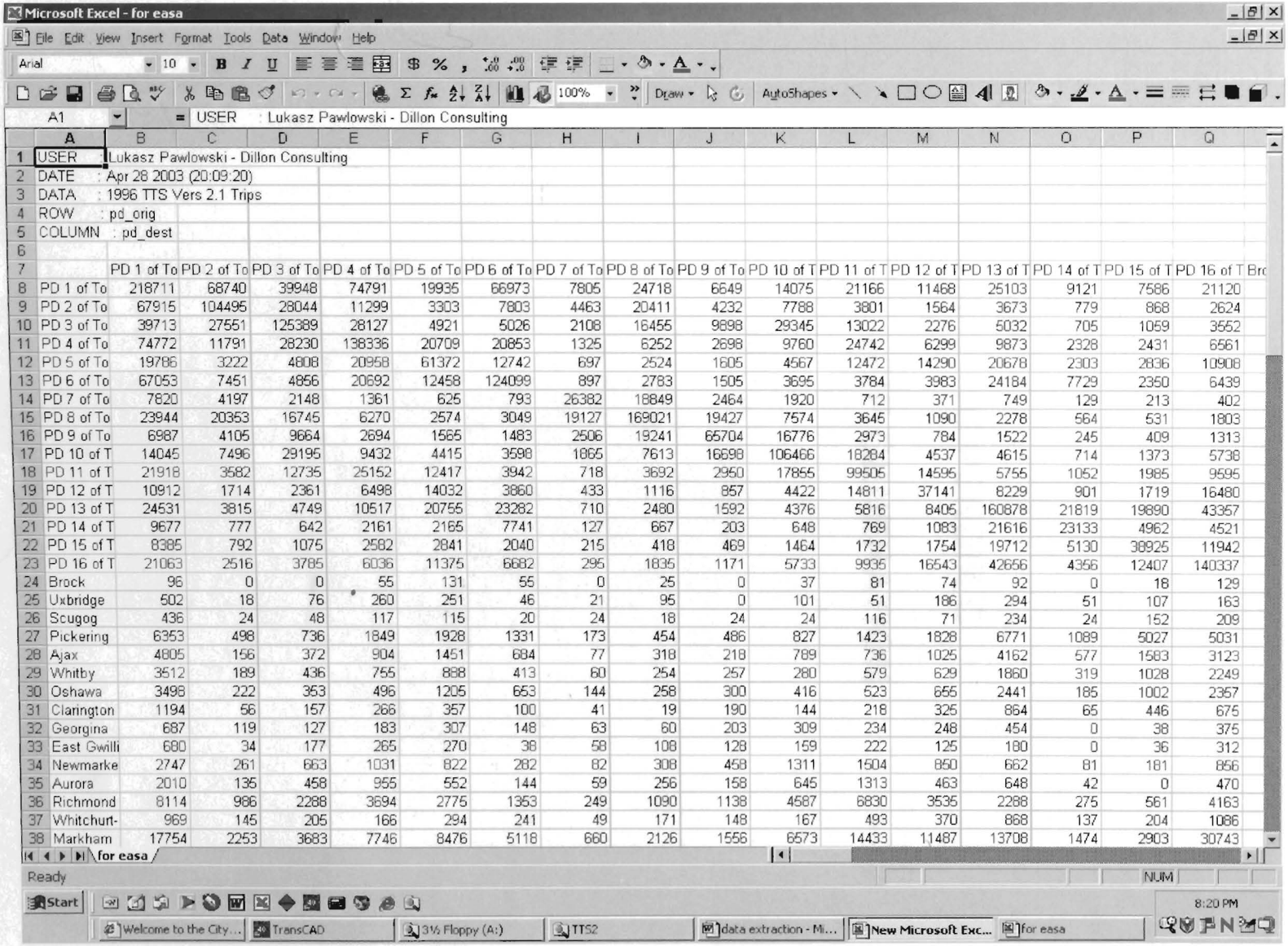
https://www.jpint.uto...
data extraction - Microso...



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	USER	: Lukasz Pawlowski - Dillon Consulting															
2	DATE	: Apr 28 2003 (20:09:20)															
3	DATA	: 1996 TTS Vers 2.1 Trips															
4	ROW	: pd_orig															
5	COLUMN	: pd_dest															
6																	
7		PD 1 of To	PD 2 of To	PD 3 of To	PD 4 of To	PD 5 of To	PD 6 of To	PD 7 of To	PD 8 of To	PD 9 of To	PD 10 of T	PD 11 of T	PD 12 of T	PD 13 of T	PD 14 of T	PD 15 of T	PD 16 of T	Bro
8	PD 1 of To	218711	68740	39948	74791	19935	66973	7805	24718	6649	14075	21166	11468	25103	9121	7586	21120	
9	PD 2 of To	67915	104495	28044	11299	3303	7803	4463	20411	4232	7788	3801	1564	3673	779	868	2624	
10	PD 3 of To	39713	27551	125389	28127	4921	5026	2108	16455	9898	29345	13022	2276	5032	705	1059	3552	
11	PD 4 of To	74772	11791	28230	138336	20709	20853	1325	6252	2698	9760	24742	6299	9873	2328	2431	6561	
12	PD 5 of To	19786	3222	4808	20958	61372	12742	697	2524	1605	4567	12472	14290	20678	2303	2836	10908	
13	PD 6 of To	67053	7451	4856	20692	12458	124099	897	2783	1505	3695	3784	3983	24184	7729	2350	6439	
14	PD 7 of To	7820	4197	2148	1361	625	793	26382	18849	2464	1920	712	371	749	129	213	402	
15	PD 8 of To	23944	20353	16745	6270	2574	3049	19127	169021	19427	7574	3645	1090	2278	564	531	1803	
16	PD 9 of To	6987	4105	9664	2694	1565	1483	2506	19241	65704	16776	2973	784	1522	245	409	1313	
17	PD 10 of T	14045	7496	29195	9432	4415	3598	1865	7613	16698	106466	18284	4537	4615	714	1373	5738	
18	PD 11 of T	21918	3582	12735	25152	12417	3942	718	3692	2960	17855	99505	14595	5755	1052	1985	9595	
19	PD 12 of T	10912	1714	2361	6498	14032	3860	433	1116	857	4422	14811	37141	8229	901	1719	16480	
20	PD 13 of T	24531	3815	4749	10517	20755	23282	710	2480	1592	4376	5816	8405	160878	21819	19890	43357	
21	PD 14 of T	9677	777	642	2161	2165	7741	127	667	203	648	769	1083	21616	23133	4962	4521	
22	PD 15 of T	8385	792	1075	2582	2841	2040	215	418	469	1464	1732	1754	19712	5130	38925	11942	
23	PD 16 of T	21063	2516	3785	6036	11375	6682	295	1835	1171	5733	9935	16543	42656	4356	12407	140337	
24	Brock	96	0	0	55	131	55	0	25	0	37	81	74	92	0	18	129	
25	Uxbridge	502	18	76	260	251	46	21	95	0	101	51	186	294	51	107	163	
26	Scugog	436	24	48	117	115	20	24	18	24	24	116	71	234	24	152	209	
27	Pickering	6353	498	736	1849	1928	1331	173	454	486	827	1423	1828	6771	1089	5027	5031	
28	Ajax	4805	156	372	904	1451	684	77	318	218	789	736	1025	4162	577	1583	3123	
29	Whitby	3512	189	436	755	888	413	60	254	257	280	579	629	1860	319	1028	2249	
30	Oshawa	3498	222	353	496	1205	653	144	258	300	416	523	655	2441	185	1002	2357	
31	Clarington	1194	56	157	266	357	100	41	19	190	144	218	325	864	65	446	675	
32	Georgina	687	119	127	183	307	148	63	60	203	309	234	248	454	0	38	375	
33	East Gwilli	680	34	177	265	270	38	58	108	128	159	222	125	180	0	36	312	
34	Newmarke	2747	261	663	1031	822	282	82	308	458	1311	1504	850	662	81	181	856	
35	Aurora	2010	135	458	955	552	144	59	256	158	645	1313	463	648	42	0	470	
36	Richmond	8114	986	2288	3694	2775	1353	249	1090	1138	4587	6830	3535	2288	275	561	4163	
37	Whitchurt-	969	145	205	166	294	241	49	171	148	167	493	370	868	137	204	1086	
38	Markham	17754	2253	3683	7746	8476	5118	660	2126	1556	6573	14433	11487	13708	1474	2903	30743	

APPENDIX C

TRIP GENERATION

Trip Generation Rates

	Region	Population	Employment	Auto Origins Origins	Auto Origins Rate per Capita	Auto Destinations Destinations	Auto Destinations Rate per Employee
1	Durham Region	450354	149552	149106	0.331	114738	0.767
2	York Region	567689	275724	210847	0.371	209782	0.761
3	City of Toronto	2305558	1257005	572624	0.248	666340	0.530
4	Peel Region	812512	389275	293109	0.361	284576	0.731
5	Halton Region	328264	141390	125808	0.383	112142	0.793
6	Hamilton-Wentworth Region	461990	181219	135220	0.293	125542	0.693

APPENDIX D

TRIP DISTRIBUTION

sample of 1996 base year auto driver od for report

USER : Lukasz Pawlowski - Dillon Consulting
DATE : May 6 2003 (10:23:55)
DATA : 1996 TTS Vers 2.1 Trips
FILTER 1 : start_time => 600-900
FILTER 2 : mode_prime => Auto driver

gta96_orig	gta96_dest	number
1	1	20
1	3	40
1	5	59
1	6	20
1	7	20
1	9	78
1	10	59
1	11	40
1	13	20
1	14	59
1	16	20
1	18	40
1	22	62
1	27	20
1	45	20
1	51	20
1	76	20
1	95	20
1	155	20
1	206	20
1	214	20
1	219	20
1	235	20
1	306	20
1	311	20
1	346	20
1	440	20
1	1163	20
1	1509	20
1	1522	20
1	1530	20
1	1542	40
1	1543	59
1	1549	18
1	1598	20
1	1602	20
1	1603	59
1	1609	20
1	1610	20
1	1619	20
1	1628	20
1	2029	20
1	3582	20
2	2	211
2	3	42
2	4	21
2	5	63
2	6	63
2	9	42
2	10	42
2	11	21
2	12	21
2	14	21
2	18	20
2	22	21
2	28	21
2	37	21
2	40	21
2	41	21
2	43	21
2	48	42

		Attrations																		
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Productions	2001	20	0	20	60	80	40	0	40	20	0	20	40	0	0	0	40	0	20	0
	2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2003	0	0	0	20	0	19	19	0	0	0	18	0	0	0	20	0	0	39	0
	2004	60	0	121	202	0	0	139	121	101	0	40	81	0	20	61	61	0	0	0
	2005	40	0	119	20	139	0	99	80	119	20	20	43	0	60	20	139	20	0	0
	2006	19	19	60	19	19	19	0	0	0	19	39	0	0	38	0	0	0	0	0
	2007	0	0	57	38	76	38	114	38	38	19	0	0	0	60	38	38	0	0	0
	2008	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0
	2009	0	0	0	0	20	0	0	0	0	0	0	0	20	0	0	0	0	0	0
	2010	0	0	0	0	0	19	57	0	57	0	134	38	0	0	38	19	19	0	0
	2011	0	0	19	0	19	57	77	39	74	57	57	39	0	19	19	58	40	19	38
	2012	0	19	19	0	0	0	0	115	59	0	173	59	40	78	20	40	0	40	0
	2013	0	0	0	20	0	0	0	20	20	0	40	40	0	20	20	40	0	20	0
	2014	0	0	0	0	20	19	0	0	20	0	0	20	0	20	20	0	0	21	0
	2015	0	0	0	0	0	0	0	0	0	0	0	21	20	0	63	21	84	21	0
	2016	0	0	0	0	20	0	0	0	21	0	40	0	0	60	83	60	0	0	0
	2017	0	0	0	0	0	0	0	21	0	0	21	21	0	0	84	62	42	63	0
	2018	0	0	0	0	0	0	0	0	42	0	63	0	20	63	63	124	42	103	21
	2019	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21
	2020	0	0	18	0	18	0	0	0	0	0	0	18	0	18	0	111	37	185	18
	2021	0	0	0	0	0	0	0	0	19	0	0	0	0	0	18	0	0	74	0
	2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2023	18	0	0	0	0	0	18	18	18	0	18	0	0	37	0	58	18	37	0
	2024	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0
	2025	0	0	57	0	0	20	0	20	20	0	20	0	0	39	0	20	0	20	0
	2026	0	0	79	0	0	0	0	0	20	0	0	20	0	99	39	39	20	0	0
	2027	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2028	0	0	0	20	0	0	0	20	20	0	0	20	0	39	0	59	0	0	0
	2029	0	0	0	0	20	60	0	80	60	0	60	20	0	98	60	20	0	20	0
	2030	0	20	20	0	0	0	0	40	78	0	20	0	0	98	0	20	0	0	0
	2031	0	0	40	0	20	0	0	20	60	0	20	0	0	100	0	40	20	0	0
	2032	0	0	0	0	0	0	0	0	18	0	35	0	0	88	0	0	0	0	0
	2033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0
	2036	0	0	0	0	0	18	0	0	0	0	0	18	0	0	0	0	0	0	0
	2037	0	0	18	0	18	0	0	53	53	0	0	0	0	53	35	18	18	0	18
	2038	0	0	0	0	0	18	0	0	53	0	0	37	0	18	35	18	0	0	0
	2039	0	0	0	0	20	20	0	0	40	0	20	40	0	20	0	20	20	20	0
	2040	0	0	61	20	20	41	41	0	61	0	42	40	0	20	20	102	41	0	0
	2041	0	0	0	20	40	82	41	102	160	20	38	41	0	41	61	41	0	0	0
	2042	0	0	20	0	0	0	39	20	20	0	0	0	0	40	0	0	0	0	21
	2043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2045	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0
	2046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2049	0	0	0	0	0	0	0	0	0	0	19	0	0	0	0	0	0	21	0
	Durham	0	0	25	0	0	0	0	24	0	0	0	20	0	0	0	0	0	0	0
	York	0	0	19	0	0	0	0	0	18	0	0	39	0	0	0	0	0	0	20
	Toronto	0	0	142	0	58	20	39	80	159	0	75	80	0	58	20	61	59	24	0
	Peel N	58	22	238	0	60	81	19	139	426	18	101	79	0	161	60	150	71	41	18
	Peel S	19	0	74	40	0	19	0	40	95	0	44	46	0	23	57	155	81	41	0
	Halton N	21	0	81	0	0	0	0	103	128	0	20	40	0	50	0	41	0	20	0
	Halton S	100	40	833	82	226	119	20	423	784	21	183	163	0	265	125	202	64	79	43
	Hamilton-W	19	38	782	64	66	0	0	472	368	0	86	86	0	65	21	113	0	18	0
	Total	374	158	2922	625	959	709	722	2149	3269	174	1486	1209	100	1868	1100	2010	696	967	218

File: base year production attraction matrix
Worksheet: base year production attraction

2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
0	40	0	0	20	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	40
0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	20	0	0	40	0	0	0	0	20	40	0	0	0	0	20	0	0	0	20	40
0	40	20	0	20	0	0	0	0	40	20	20	0	0	0	0	0	0	0	20	99
0	0	20	0	19	0	0	0	0	60	38	0	0	0	0	0	0	0	0	0	19
0	19	19	18	19	0	0	19	0	38	57	0	0	0	0	0	0	0	19	0	19
0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	20
19	0	0	0	0	0	0	19	0	0	0	0	19	0	0	0	0	0	0	0	0
0	38	19	18	0	0	0	0	21	39	39	0	0	0	0	0	0	0	0	39	19
0	19	20	0	0	0	0	0	0	78	20	0	0	0	0	0	0	20	0	0	59
0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	20	0	0	20	60	20	60	0	0	0	0	0	35	36	0	40
0	0	0	0	0	0	0	0	0	41	0	0	0	0	0	0	0	0	0	0	0
0	0	0	21	20	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	20
18	0	0	0	0	0	0	0	0	63	20	0	0	0	0	0	0	0	0	20	62
74	77	0	18	0	20	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
92	74	18	18	18	18	0	0	0	92	55	0	0	0	0	18	0	0	0	0	0
18	18	0	0	0	20	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	55	0	296	0	0	37	0	18	37	18	0	37	0	0	0	0	0	0	0	0
0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	18	0	38
0	20	20	0	39	99	39	39	0	39	0	40	0	0	0	0	0	0	0	0	58
0	20	20	20	59	79	99	39	20	79	118	0	0	0	20	0	0	0	0	0	39
0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	20
0	0	0	0	20	20	59	0	0	39	39	0	0	0	0	0	0	0	0	0	20
0	0	20	0	40	0	40	61	0	180	140	40	0	0	0	20	0	38	38	20	80
0	0	0	0	0	20	59	20	0	40	60	0	0	0	0	0	0	20	18	0	0
0	0	20	0	0	60	20	20	0	40	80	80	0	20	0	20	0	0	38	0	20
18	0	0	0	35	70	0	0	18	18	18	0	0	0	0	0	18	0	0	0	35
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0
0	0	0	18	18	18	0	18	0	35	35	0	35	0	0	0	18	0	0	0	0
0	0	0	0	35	53	18	0	0	70	35	0	0	0	0	0	0	210	35	0	0
0	18	0	0	18	18	0	0	0	54	105	35	0	0	0	0	0	35	248	0	35
0	0	40	0	0	20	0	0	0	20	0	0	0	0	0	0	0	0	20	0	20
0	41	0	0	20	20	41	20	0	41	20	0	0	20	0	0	0	0	0	20	143
0	0	20	0	41	20	0	82	20	61	0	20	0	0	0	0	18	0	0	20	143
0	0	20	0	0	0	0	0	0	81	81	20	0	0	0	20	0	0	0	0	141
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	18	0	0	18	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0
0	21	20	0	76	0	0	37	0	0	0	0	0	0	0	0	20	0	0	0	0
18	121	161	21	480	20	0	105	0	320	179	0	0	0	0	41	18	20	0	20	124
0	219	507	79	1146	0	99	240	0	683	141	0	0	18	23	117	18	36	0	0	217
60	80	137	18	227	20	41	78	0	308	120	0	0	0	0	18	0	19	0	65	19
0	21	67	20	70	0	63	20	0	206	26	0	0	0	0	44	0	0	0	20	21
0	186	531	0	234	0	78	196	18	455	280	18	43	19	0	67	0	42	42	41	177
0	102	148	0	186	0	43	285	0	343	144	20	19	0	0	91	0	0	0	31	92
353	1249	1867	565	2900	635	756	1357	135	3798	1984	373	153	77	43	496	130	475	512	336	1920

File: base year production attraction matrix
Worksheet: base year production attraction

2041	2042	2043	2044	2045	2046	2047	2048	2049	Durham	York	Toronto	Peel N	Peel S	Halton N	Halton S	Hamilton-W	Total
0	20	0	0	0	0	0	0	0	0	0	260	180	120	60	138	80	1378
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	39
0	0	0	0	0	0	0	0	0	0	0	63	19	18	0	40	41	316
0	0	0	0	0	0	0	0	0	0	0	360	302	102	60	180	120	2331
40	20	0	0	0	0	20	0	0	0	0	139	240	179	60	183	60	2158
0	0	0	0	0	0	0	0	0	0	0	171	98	38	19	38	19	790
38	19	0	0	0	0	0	0	0	19	19	152	152	58	76	95	57	1466
0	0	0	0	0	0	0	0	0	0	0	0	19	40	0	20	20	139
20	20	0	0	0	0	0	0	0	0	0	41	0	0	21	60	22	264
0	19	0	0	0	0	0	0	0	0	19	114	76	19	38	20	0	743
57	59	0	0	0	0	0	0	19	0	19	190	95	191	0	97	96	1686
0	19	0	19	0	0	0	0	0	0	0	136	235	60	59	39	39	1484
0	0	0	0	0	0	0	0	0	0	0	40	80	20	40	20	0	460
19	18	0	0	0	0	0	0	0	0	0	20	98	33	0	0	40	659
0	0	0	0	0	0	0	0	0	0	21	105	126	36	0	21	18	598
20	0	0	0	0	0	0	0	0	0	0	100	60	20	20	40	20	665
21	0	0	0	0	0	0	0	42	21	21	226	337	82	0	42	41	1330
0	0	0	0	0	0	0	0	21	0	63	207	102	41	0	63	63	1311
0	21	0	0	0	0	0	0	0	0	0	18	0	21	0	0	0	123
0	18	0	0	0	0	0	0	18	0	0	272	364	238	18	54	54	1862
0	0	0	0	0	0	0	0	0	20	0	132	72	39	0	0	18	466
0	0	0	0	0	0	0	0	0	0	0	20	22	22	19	0	38	121
0	0	0	0	0	0	0	0	0	0	18	563	546	237	38	73	54	2285
0	0	0	0	0	0	0	0	0	0	0	59	57	0	0	0	18	231
0	0	0	0	0	0	0	0	0	0	0	280	239	118	20	40	38	1344
20	0	0	0	0	0	0	0	20	0	20	338	158	123	20	79	20	1726
0	0	0	0	0	0	0	0	0	0	0	76	100	0	0	20	20	256
0	0	0	0	0	0	0	0	0	0	0	140	140	38	0	20	38	751
40	0	0	0	0	0	0	0	20	0	0	240	500	140	20	103	116	2394
0	0	0	0	0	0	0	0	0	0	40	138	258	100	20	60	20	1169
20	40	0	0	0	0	0	20	0	0	20	240	218	120	0	20	20	1456
0	0	0	0	0	0	18	0	0	0	0	163	216	36	0	72	36	912
0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	19	0	59
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0	62
70	0	0	0	0	0	0	0	0	18	18	288	215	72	0	89	0	1001
0	0	0	0	0	0	0	0	0	0	0	286	398	89	18	53	18	1602
35	0	0	0	0	0	0	0	0	0	0	341	214	71	18	18	72	1514
0	20	0	0	0	0	0	0	0	0	0	203	140	40	39	40	80	902
164	81	0	0	0	20	0	0	0	0	20	399	344	181	60	79	80	2323
388	41	0	0	0	0	20	0	0	0	40	503	244	60	0	101	80	2609
101	246	0	0	20	0	0	0	0	0	40	480	499	163	60	83	20	2235
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	20	0	41	0	0	81
0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	40
0	0	0	0	0	0	0	0	0	0	0	18	18	0	0	20	0	56
0	0	0	0	0	0	0	0	0	0	0	18	0	36	0	0	0	90
0	0	0	0	0	0	0	0	0	0	0	37	0	21	0	21	0	157
0	0	0	0	0	0	0	0	0	98778	10701	34088	1646	247	19	126	125	145819
21	0	0	0	0	0	0	37	0	2464	115451	79074	8840	762	118	114	180	207331
60	42	0	0	0	0	44	0	19	7661	60061	445296	42286	5633	851	641	975	566092
103	77	0	0	0	0	0	0	0	738	11255	62438	145840	12919	2841	1374	1125	243995
59	63	0	0	0	0	0	0	0	101	991	12984	14165	13130	180	397	361	44375
21	41	0	0	61	20	20	0	0	45	577	3191	7698	466	13334	1100	609	28265
139	168	0	20	0	0	0	39	19	22	387	3399	3911	1371	1091	23572	7428	47765
128	133	0	0	0	31	24	40	19	75	250	3418	3091	740	1135	11298	103706	127790
1584	1185	0	39	81	71	146	136	197	109962	200051	651464	234678	38310	20457	40801	116085	1457076

SHORTEST PATH MATRIX (ALL DISTANCES IN KILOMETRES)

	Traffic Zones	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Traffic	2001	0.00	1.49	4.33	2.75	2.22	3.71	4.90	5.94	7.55	6.43	6.79	8.20	8.45	9.53	9.12	8.17	9.72	11.32
Zones	2002	1.49	0.00	3.61	2.02	2.27	3.90	4.21	5.22	6.93	6.04	6.69	7.74	8.38	9.07	9.18	8.28	9.83	11.42
	2003	4.33	3.61	0.00	2.76	3.80	3.88	3.13	2.06	3.83	4.57	5.91	5.72	6.59	7.05	7.16	7.62	8.57	9.60
	2004	2.75	2.02	2.76	0.00	1.04	2.42	2.19	3.20	4.90	4.02	5.20	5.72	6.42	7.05	7.15	6.79	8.34	9.60
	2005	2.22	2.27	3.80	1.04	0.00	1.67	2.79	4.00	5.68	4.62	5.01	6.42	6.70	7.76	7.50	6.58	8.13	9.72
	2006	3.71	3.90	3.88	2.42	1.67	0.00	1.52	3.82	4.41	3.35	3.74	5.15	5.43	6.48	6.23	5.33	6.88	8.48
	2007	4.90	4.21	3.13	2.19	2.79	1.52	0.00	3.08	2.89	1.83	3.17	3.70	4.23	5.03	5.14	4.89	6.44	7.58
	2008	5.94	5.22	2.06	3.20	4.00	3.82	3.08	0.00	1.78	2.52	3.86	3.66	4.54	5.00	5.10	5.57	6.51	7.54
	2009	7.55	6.93	3.83	4.90	5.68	4.41	2.89	1.78	0.00	2.09	2.27	1.88	2.76	3.22	3.32	3.98	4.74	5.77
	2010	6.43	6.04	4.57	4.02	4.62	3.35	1.83	2.52	2.09	0.00	1.34	2.08	2.44	3.41	3.52	3.05	4.61	5.96
	2011	6.79	6.69	5.91	5.20	5.01	3.74	3.17	3.86	2.27	1.34	0.00	1.73	1.79	3.06	2.55	1.77	3.32	4.91
	2012	8.20	7.74	5.72	5.72	6.42	5.15	3.70	3.66	1.88	2.08	1.73	0.00	1.19	1.65	1.76	2.54	3.17	4.20
	2013	8.45	8.38	6.59	6.42	6.70	5.43	4.23	4.54	2.76	2.44	1.79	1.19	0.00	1.97	2.07	2.14	3.48	4.51
	2014	9.53	9.07	7.05	7.05	7.76	6.48	5.03	5.00	3.22	3.41	3.06	1.65	1.97	0.00	0.93	1.90	2.34	3.37
	2015	9.05	8.99	7.16	7.15	7.31	6.04	5.14	5.10	3.32	3.52	2.35	1.76	2.07	0.93	0.00	1.10	1.41	2.80
	2016	8.17	8.28	7.61	6.79	6.58	5.33	4.88	5.56	3.96	3.04	1.76	2.53	1.99	1.90	1.10	0.00	1.70	3.29
	2017	9.72	9.83	8.57	8.34	8.13	6.88	6.43	6.51	4.74	4.59	3.31	3.17	3.48	2.34	1.41	1.70	0.00	2.34
	2018	11.32	11.42	9.60	9.60	9.72	8.48	7.58	7.54	5.77	5.96	4.90	4.20	4.51	3.37	2.80	3.29	2.34	0.00
	2019	12.82	12.36	10.34	10.34	11.04	9.77	8.32	8.28	6.51	6.70	6.19	4.94	5.26	4.11	3.83	4.93	3.47	1.68
	2020	12.44	12.55	11.19	11.06	10.85	9.60	9.15	9.14	7.36	7.31	6.03	5.79	6.11	4.97	4.39	4.42	3.93	1.73
	2021	13.07	12.61	10.59	10.59	11.29	10.02	8.57	8.53	6.75	6.95	6.43	5.19	5.50	4.36	4.08	5.18	3.72	1.93
	2022	13.10	12.64	10.16	10.62	11.32	10.05	8.60	8.11	6.33	6.98	6.47	5.22	5.54	3.90	4.11	5.21	3.75	4.72
	2023	14.66	14.20	11.72	12.18	12.89	11.61	10.16	9.67	7.89	8.54	8.03	6.78	7.10	5.46	5.68	6.77	5.32	4.38
	2024	17.03	16.57	13.99	14.54	15.25	13.98	12.53	11.93	10.16	10.91	10.56	9.15	9.46	7.77	8.43	9.39	8.41	7.31
	2025	14.16	13.70	10.82	11.68	12.38	11.11	9.66	9.17	7.40	8.04	7.69	6.28	6.59	4.91	5.56	6.53	6.97	6.48
	2026	13.01	12.55	10.08	10.53	11.23	9.96	8.51	8.02	6.25	6.89	6.54	5.13	5.44	3.76	4.41	5.38	5.82	6.85
	2027	10.82	10.36	7.89	8.34	9.04	7.77	6.32	5.84	4.06	4.70	4.35	2.94	3.26	1.57	2.22	3.19	3.63	4.66
	2028	11.92	11.46	8.99	9.44	10.14	8.87	7.42	6.94	5.16	5.80	5.45	4.04	4.36	2.67	3.32	4.29	4.73	5.76
	2029	11.52	11.06	8.59	9.04	9.74	8.47	7.02	6.53	4.76	5.40	5.05	3.64	3.95	2.27	2.92	3.89	4.33	5.36
	2030	11.05	10.59	8.11	8.56	9.27	8.00	6.54	6.06	4.28	4.92	4.58	3.16	3.48	1.79	2.45	3.41	3.86	4.89
	2031	11.51	10.79	7.62	8.76	9.56	8.97	7.45	6.34	5.91	6.59	6.24	4.83	5.14	3.46	4.11	5.08	5.52	6.55
	2032	12.75	12.30	9.28	10.27	10.98	9.71	8.25	7.77	5.99	6.63	6.28	4.87	5.19	3.50	4.15	5.12	5.57	6.60
	2033	14.71	14.26	11.28	12.23	12.94	11.67	10.21	9.73	7.95	8.59	8.24	6.83	7.15	5.46	6.11	7.08	7.52	7.17
	2034	13.80	13.20	10.04	11.18	11.98	10.75	9.30	8.75	7.03	7.68	7.33	5.92	6.23	4.54	5.20	6.16	6.61	7.64
	2035	13.06	12.34	9.17	10.31	11.11	10.52	9.00	7.89	6.84	7.48	7.13	5.72	6.04	4.35	5.00	5.97	6.41	7.44
	2036	12.02	11.29	8.13	9.27	10.07	9.47	7.95	6.84	6.40	7.04	6.69	5.28	5.59	3.91	4.56	5.53	5.97	7.00
	2037	11.85	11.12	7.96	9.10	9.90	9.30	7.78	6.67	6.25	6.99	7.79	7.04	7.35	5.67	6.32	7.29	7.73	8.76
	2038	10.94	10.21	7.05	8.19	8.99	8.39	6.87	5.76	5.34	6.08	6.88	5.89	6.21	4.52	5.17	6.14	6.58	7.61
	2039	8.72	8.00	4.84	5.98	6.78	6.60	5.86	4.78	4.66	5.40	6.47	5.78	6.62	6.95	7.06	8.00	8.47	9.50
	2040	8.28	7.56	4.40	5.54	6.33	5.26	3.74	2.63	2.21	2.95	3.97	3.28	4.12	4.46	4.56	5.51	5.98	7.01
	2041	6.89	6.16	3.00	4.14	4.94	4.76	4.02	2.94	2.72	3.46	4.80	4.60	5.48	5.86	5.96	6.51	7.37	8.40
	2042	6.91	6.19	3.02	4.16	4.96	4.78	4.04	2.96	4.17	4.91	6.25	6.05	6.93	7.29	7.40	7.96	8.81	9.84
	2043	6.41	5.69	4.11	4.84	5.87	7.25	6.83	5.75	6.71	7.45	8.79	8.32	9.16	9.50	9.60	10.51	11.01	12.04
	2044	6.95	6.12	6.34	7.07	7.73	9.36	8.91	7.84	9.61	10.35	11.69	11.39	12.26	12.35	12.83	13.40	14.24	15.27
	2045	6.36	5.64	4.06	4.79	5.82	7.20	6.78	5.70	6.66	7.40	8.74	8.27	9.11	9.45	9.55	10.46	10.96	11.99
	2046	8.54	7.82	6.24	6.97	8.01	9.39	8.69	7.61	8.58	9.32	10.66	10.06	10.90	11.23	11.34	12.29	12.75	13.78
	2047	10.03	9.30	6.14	7.28	8.08	7.90	7.16	6.08	6.83	7.57	8.64	7.95	8.79	8.93	9.23	10.17	10.64	11.67
	2048	15.70	14.97	11.81	12.95	13.75	13.15	11.63	10.52	10.10	10.84	11.24	9.83	10.15	8.46	9.11	10.08	10.52	11.55
	2049	15.50	15.04	11.89	13.01	13.72	12.45	10.99	10.51	8.73	9.37	9.03	7.61	7.93	6.24	6.90	7.86	8.31	8.65
	Durham	97.00	97.11	94.86	95.41	95.41	94.16	93.40	92.80	91.03	91.78	90.59	90.02	90.33	88.64	89.16	88.97	88.59	87.23
	York	70.91	71.01	68.76	69.32	69.31	68.06	67.30	66.71	64.93	65.68	64.49	63.92	64.24	62.55	63.06	62.88	62.50	61.13
	Toronto	47.35	47.46	45.20	45.76	45.75	44.51	43.74	43.15	41.37	42.12	40.93	40.36	40.68	38.99	39.50	39.32	38.94	37.58
	Peel N	52.33	52.44	50.19	50.75	50.74	49.49	48.73	48.13	46.36	47.11	45.92	45.35	45.66	43.98	44.49	44.31	43.93	42.56
	Peel S	22.10	22.21	19.95	20.51	20.50	19.26	18.49	17.90	16.12	16.87	15.68	15.11	15.43	13.74	14.25	14.07	13.69	12.33
	Halton N	27.45	26.72	25.15	25.88	26.91	27.66	26.91	25.84	25.64	26.38	27.26	26.43	26.75	25.06	25.71	26.68	27.12	28.15
	Halton S	9.03	8.46	9.96	9.82	10.07	11.70	12.01	11.45	13.22	13.84	14.48	15.00	15.87	15.96	16.44	16.08	17.63	18.88
	Hamilton-W	30.24	29.67	31.17	31.04	31.28	32.91	33.22	32.66	34.44	35.05	35.70	36.21	37.09	37.17	37.65	37.29	38.84	40.09

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
12.82	12.44	13.07	13.10	14.66	17.16	14.16	13.01	10.82	11.92	11.52	11.05	11.51	12.75	14.71	13.80	13.06	12.02	11.85	10.94
12.36	12.55	12.61	12.64	14.20	16.70	13.70	12.55	10.36	11.46	11.06	10.59	10.79	12.30	14.26	13.20	12.34	11.29	11.12	10.21
10.34	11.19	10.59	10.62	11.82	14.00	10.82	9.90	7.71	8.81	8.41	7.93	7.62	9.28	11.28	10.04	9.17	8.13	7.96	7.05
10.34	11.06	10.59	10.62	12.18	14.67	11.68	10.53	8.34	9.44	9.04	8.56	8.76	10.27	12.23	11.18	10.31	9.27	9.10	8.19
11.04	10.85	11.29	11.32	12.89	15.38	12.38	11.23	9.04	10.14	9.74	9.27	9.56	10.98	12.94	11.98	11.11	10.07	9.90	8.99
9.77	9.60	10.02	10.05	11.61	14.11	11.11	9.96	7.77	8.87	8.47	8.00	8.97	9.71	11.67	10.75	10.52	9.47	9.30	8.39
8.32	9.16	8.57	8.60	10.16	12.65	9.66	8.51	6.32	7.42	7.02	6.54	7.45	8.25	10.21	9.30	9.00	7.95	7.78	6.87
8.28	9.14	8.53	8.56	9.83	12.01	9.05	7.90	5.71	6.81	6.41	5.94	6.34	7.65	9.60	8.69	7.89	6.84	6.67	5.76
6.51	7.36	6.75	6.79	8.05	10.23	7.27	6.12	3.93	5.03	4.63	4.16	5.82	5.87	7.83	6.91	6.71	6.27	6.25	5.34
6.70	7.33	6.95	6.98	8.54	11.03	8.04	6.89	4.70	5.80	5.40	4.92	6.59	6.63	8.59	7.68	7.48	7.04	6.99	6.08
6.35	6.04	6.60	6.63	8.19	10.69	7.69	6.54	4.35	5.45	5.05	4.58	6.24	6.28	8.24	7.33	7.13	6.69	7.79	6.88
4.94	5.79	5.19	5.22	6.78	9.27	6.28	5.13	2.94	4.04	3.64	3.16	4.83	4.87	6.83	5.92	5.72	5.28	7.04	5.89
5.26	6.11	5.50	5.54	7.10	9.59	6.59	5.44	3.26	4.36	3.95	3.48	5.14	5.19	7.15	6.23	6.04	5.59	7.35	6.21
4.11	4.97	4.36	3.90	5.48	7.90	4.91	3.76	1.57	2.67	2.27	1.79	3.46	3.50	5.46	4.54	4.35	3.91	5.67	4.52
3.83	4.39	4.08	4.11	5.68	8.56	5.56	4.41	2.22	3.32	2.92	2.45	4.11	4.15	6.11	5.20	5.00	4.56	6.32	5.17
4.93	4.42	5.18	5.21	6.77	9.52	6.53	5.38	3.19	4.29	3.89	3.41	5.08	5.12	7.08	6.16	5.97	5.53	7.29	6.14
3.47	3.93	3.72	3.75	5.32	8.41	6.97	5.82	3.63	4.73	4.33	3.86	5.52	5.57	7.52	6.61	6.41	5.97	7.73	6.58
1.68	1.73	1.93	4.72	4.38	7.31	6.48	6.85	4.66	5.76	5.36	4.89	6.55	6.60	7.17	7.64	7.44	7.00	8.76	7.61
0.00	1.91	0.98	3.83	3.43	6.37	5.53	6.30	5.40	6.50	6.10	5.63	7.29	7.08	6.22	7.90	8.11	7.74	9.50	8.36
1.91	0.00	1.94	3.66	3.26	6.19	5.35	6.13	6.26	6.81	6.95	6.48	8.14	6.90	6.05	7.72	7.94	7.95	9.98	9.04
0.98	1.94	0.00	2.89	2.49	5.42	4.59	5.36	5.65	6.04	6.21	5.88	7.54	6.13	5.28	6.96	7.17	7.18	9.22	8.27
3.83	3.66	2.89	0.00	1.56	4.66	3.42	4.20	3.94	4.87	4.64	4.16	5.83	4.97	4.12	5.79	6.01	6.02	8.04	6.89
3.43	3.26	2.49	1.56	0.00	3.12	3.26	4.03	5.50	4.71	4.88	5.73	7.23	4.80	3.95	5.62	5.84	5.85	7.89	6.94
6.37	6.19	5.42	4.66	3.12	0.00	4.01	4.79	6.56	5.46	5.64	7.55	7.98	5.56	4.71	5.28	6.36	6.61	8.24	7.70
5.53	5.35	4.59	3.42	3.26	4.01	0.00	1.79	3.57	2.47	2.64	4.55	4.76	1.55	2.51	2.52	2.59	3.11	4.63	4.03
6.30	6.13	5.36	4.20	4.03	4.79	1.79	0.00	2.24	1.14	1.73	3.40	4.56	2.48	3.29	3.57	3.63	3.23	5.49	4.32
5.40	6.26	5.65	5.19	5.81	6.56	3.57	2.24	0.00	1.15	1.69	1.22	2.88	2.92	4.40	3.97	3.77	3.33	5.09	3.94
6.50	6.81	6.04	4.87	4.71	5.46	2.47	1.14	1.15	0.00	1.34	2.31	3.98	2.09	3.26	3.27	3.28	2.84	5.10	3.93
6.10	6.95	6.21	5.05	4.88	5.64	2.64	1.73	1.69	1.34	0.00	1.91	2.82	1.34	3.19	2.38	2.19	1.74	3.96	2.79
5.63	6.48	5.88	5.41	6.79	7.55	4.55	3.40	1.22	2.31	1.91	0.00	1.84	3.15	5.11	4.19	4.00	3.08	4.05	2.90
7.29	8.14	7.54	7.08	7.23	7.98	4.76	4.56	2.88	3.98	2.82	1.84	0.00	3.22	5.22	4.25	3.67	2.34	2.55	1.39
7.08	6.90	6.13	4.97	4.80	5.56	1.55	2.48	2.92	2.09	1.34	3.15	3.22	0.00	2.01	1.43	1.24	1.79	3.28	2.68
6.22	6.05	5.28	4.12	3.95	4.71	2.51	3.29	4.40	3.26	3.19	5.11	5.22	2.01	0.00	1.68	3.05	3.58	4.73	4.49
7.90	7.72	6.96	5.79	5.62	5.28	2.52	3.57	3.97	3.27	2.38	4.19	4.25	1.43	1.68	0.00	1.64	2.20	3.05	3.00
8.11	7.94	7.17	6.01	5.84	6.36	2.59	3.63	3.77	3.28	2.19	4.00	3.67	1.24	3.05	1.64	0.00	2.00	2.04	2.42
7.74	7.95	7.18	6.02	5.85	6.61	3.11	3.23	3.33	2.84	1.74	3.08	2.34	1.79	3.58	2.20	2.00	0.00	2.26	1.09
9.50	9.98	9.22	8.05	7.89	8.24	4.63	5.49	5.09	5.10	3.96	4.05	2.55	3.28	4.73	3.05	2.04	2.26	0.00	1.17
8.36	9.04	8.27	7.11	6.94	7.70	4.03	4.32	3.94	3.93	2.79	2.90	1.39	2.68	4.49	3.00	2.42	1.09	1.17	0.00
10.24	11.09	10.49	10.11	9.95	10.70	7.48	7.32	6.83	6.93	5.78	5.80	4.28	5.93	7.94	6.70	5.83	4.79	4.62	3.71
7.75	8.60	7.99	8.03	9.37	10.13	6.90	6.75	5.41	6.35	5.20	5.22	3.71	5.36	7.37	6.12	5.26	4.21	4.04	3.13
9.14	10.00	9.39	9.42	10.29	11.05	7.82	7.67	6.65	7.27	6.12	6.14	4.63	6.28	8.29	7.04	6.18	5.13	4.96	4.05
10.58	11.43	10.83	10.86	11.03	11.79	8.57	8.41	7.92	8.01	6.87	6.88	5.37	7.02	9.03	7.78	6.92	5.87	5.70	4.79
12.79	13.64	13.03	12.88	12.71	13.47	10.24	10.09	9.60	9.69	8.54	8.56	7.05	8.70	10.71	9.46	8.60	7.55	7.38	6.47
16.01	16.86	16.26	15.97	17.10	19.28	16.28	15.17	12.99	14.08	13.68	13.21	13.08	14.73	16.74	15.49	14.63	13.58	13.41	12.50
12.74	13.59	12.98	12.83	12.66	13.42	10.19	10.04	9.55	9.64	8.49	8.51	7.00	8.65	10.66	9.41	8.55	7.50	7.33	6.42
14.52	15.37	14.77	13.83	13.66	13.29	10.40	11.43	11.02	11.04	9.90	9.99	8.48	9.05	10.30	8.83	7.82	8.20	5.94	7.11
12.41	13.09	12.32	11.16	10.99	10.62	7.73	8.76	8.35	8.37	7.23	7.32	5.81	6.38	7.63	6.16	5.15	5.53	3.27	4.44
12.22	12.05	11.28	10.12	9.95	9.39	6.70	7.75	7.88	7.39	6.30	7.05	6.31	5.35	6.42	5.07	4.11	5.21	4.68	5.05
7.70	7.53	6.76	5.59	5.43	3.88	3.29	4.34	5.19	4.04	3.98	5.89	6.01	2.79	2.45	1.85	2.94	4.05	4.81	4.85
86.47	85.56	85.53	85.04	83.48	83.51	85.65	86.42	88.20	87.10	87.27	88.86	89.62	87.19	86.34	86.77	87.86	88.25	89.74	89.33
60.38	59.46	59.44	58.95	57.38	57.41	59.55	60.33	62.10	61.00	61.18	62.77	63.52	61.10	60.24	60.68	61.76	62.15	63.64	63.24
36.82	35.91	35.88	35.39	33.83	33.86	36.00	36.77	38.55	37.45	37.62	39.21	39.97	37.54	36.69	37.12	38.21	38.59	40.08	39.68
41.80	40.89	40.86	40.37	38.81	38.84	40.98	41.75	43.53	42.43	42.60	44.19	44.95	42.52	41.67	42.11	43.19	43.58	45.07	44.67
11.57	10.66	10.63	10.14	8.58	8.61	10.74	11.52	13.30	12.20	12.37	13.96	14.72	12.29	11.44	11.87	12.96	13.34	14.83	14.43
28.83	28.65	27.88	26.72	26.55	25.71	23.30	24.35	24.48	23.99	22.90	23.53	22.02	21.95	22.74	21.39	20.71	21.74	19.48	20.65
19.62	20.35	19.87	19.58	20.71	22.89	19.89	18.78	16.60	17.69	17.29	16.82	16.69	18.34	20.35	19.10	18.24	17.19	17.02	16.11
40.83	41.56	41.08	40.79	41.41	41.04	38.15	39.18	37.81	38.79	37.65	37.74	36.23	36.80	38.05	36.58	35.57	35.95	33.69	34.86

File shortest path and impedance2
Worksheet SHORTEST PATH EXPORT

2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	Durham	York	Toronto	Peel N	Peel S	Halton N	Halton S	Hamilton-W
8 72	8 28	6 89	6 91	6 41	6 95	6 36	8 54	10 03	15.70	15 50	97.00	70 91	47 35	52.33	22 10	27 45	9 03	30 24
8.00	7 56	6 16	6 19	5.69	6 12	5.64	7 82	9 30	14 97	15.04	97 11	71 01	47 46	52 44	22 21	26 72	8.46	29 67
4.84	4.40	3.00	3.02	4 11	6 59	4 06	6 24	6 14	11 81	11 89	94 49	68 39	44 84	49 82	19 59	25 15	10 75	31 97
5.98	5 54	4.14	4 16	4 84	7 32	4.79	6.97	7.28	12 95	13.01	95 22	69 12	45 57	50 55	20.32	25 88	9 82	31 04
6 78	6.33	4 94	4.96	5 87	7 73	5.82	8.01	8 08	13 75	13.72	95 41	69 31	45 75	50 74	20.50	26 91	10.07	31 28
6.60	5.26	4 76	4 78	7.25	9 36	7.20	9.39	7 90	13.15	12.45	94 16	68.06	44 51	49 49	19.26	27 66	11 70	32 91
5 86	3.74	4.02	4.04	6 83	8 83	6 78	8 69	7 16	11 63	10 99	93 20	67 11	43 55	48 53	18 30	26 91	12 01	33 22
4 78	2 63	2 94	2 96	5.75	7 75	5 70	7 61	6 08	10 52	10.39	92 49	66 40	42 84	47 82	17 59	25 84	11.91	33 13
4.66	2 21	2.72	4 17	6.71	9 53	6 66	8 58	6.83	10 10	8 61	90 72	64 62	41.06	46.05	15 81	25 64	13 69	34 90
5.40	2 95	3.46	4.91	7 45	10.26	7 40	9 32	7.57	10.84	9.37	91 58	65.49	41 93	46 91	16.68	26 38	13 84	35 05
6 47	3.97	4.80	6 25	8 79	11 59	8 74	10 66	8 64	11 24	9 03	90.60	64 50	40 95	45 93	15 69	27 26	14 48	35 70
5 78	3.28	4.60	6 05	8 32	11.21	8 27	10.06	7.95	9 83	7 61	89 82	63 72	40 17	45 15	14 92	26 43	15 37	36 59
6.62	4 12	5 48	6 93	9 16	12 08	9 11	10 90	8 79	10 15	7 93	90.14	64.04	40.49	45 47	15.24	26 75	16 18	37 39
6 95	4.46	5.86	7 29	9 50	12 17	9 45	11.23	8 93	8.46	6 24	88 45	62.35	38 80	43 78	13 55	25 06	16 33	37 54
7 06	4 56	5 96	7.40	9.60	12.65	9 55	11.34	9 23	9.11	6.90	89 10	63.01	39 45	44.43	14.20	25 71	16 78	38 00
7.99	5.49	6.50	7.95	10.49	13 29	10 44	12 27	10 16	10.08	7.86	88.97	62 88	39.32	44.31	14 07	26 68	16 08	37.29
8.47	5 98	7.37	8 81	11 01	14.06	10 96	12.75	10.64	10 52	8 31	88 59	62 50	38 94	43 93	13 69	27 12	17.63	38.84
9.50	7 01	8.40	9.84	12 04	15.09	11 99	13.78	11 67	11 55	8.65	87.23	61 13	37 58	42.56	12 33	28 15	19 22	40 44
10.24	7 75	9 14	10.58	12 79	15.83	12 74	14 52	12.41	12 22	7 70	86.47	60.38	36 82	41 80	11 57	28 83	19 99	41 21
11.09	8 60	10 00	11.43	13.64	16.69	13.59	15.37	13.09	12.05	7 53	85.56	59 46	35 91	40.89	10 66	28 65	20 35	41 56
10.49	7 99	9.39	10.83	13 03	16 08	12.98	14.77	12 32	11 28	6 76	85.53	59.44	35.88	40.86	10.63	27 88	20 24	41.46
9.47	6.98	8.38	9.81	12 02	14.52	11.97	13 76	11 16	10 12	5 59	85 01	58 92	35.36	40.34	10.11	26 72	18 68	39 89
9 95	8 54	9.94	11.03	12 71	16 08	12.66	13.66	10.99	9.95	5 43	83.45	57 36	33 80	38 78	8 55	26 55	20 24	41 41
10 70	10 13	11.05	11 79	13 47	18.35	13.42	13.29	10 62	9 39	3.88	83 51	57 41	33 86	38 84	8 61	25 71	22 51	41 04
7 48	6.90	7 82	8 57	10 24	15.38	10.19	10 40	7 73	6 70	3 29	85 98	59.88	36.32	41.31	11 07	23 30	19 54	38.15
7 32	6 75	7 67	8.41	10.09	14.44	10.04	11 43	8 76	7 75	4 34	86.75	60 65	37 10	42.08	11 85	24 35	18 60	39 18
6 83	4.71	6.11	7.54	9 60	12 25	9 55	11 02	8.35	7 88	5.19	88.53	62 43	38 88	43.86	13.63	24 48	16 41	37 62
6 93	5.81	7.21	8.01	9 69	13.35	9 64	11.04	8 37	7.39	4 04	87 43	61 33	37 78	42 76	12.53	23 99	17 51	38 72
5 78	5.20	6 12	6.87	8 54	12.95	8 49	9 90	7 23	6 30	3 98	87 60	61 50	37 95	42 93	12 70	22 90	17 11	37 65
5 80	4 93	6 14	6.88	8.56	12 47	8 51	9 99	7.32	7 05	5.89	89 46	63 36	39.81	44 79	14.56	23 53	16.63	37 74
4 28	3 71	4 63	5.37	7.05	12 18	7.00	8 48	5.81	6 31	6 01	89 95	63 85	40.30	45 28	15.05	22 02	16.34	36 23
5.93	5.36	6 28	7 02	8.70	13 83	8.65	9 05	6.38	5.35	2 79	87.52	61 43	37 87	42 85	12 62	21 95	17 99	36 80
7 94	7.37	8 29	9 03	10 71	15.84	10.66	10 30	7.63	6 42	2 45	86 67	60.57	37.02	42 00	11.77	22 74	20.00	38 05
6 70	6 12	7 04	7 78	9 46	14 59	9 41	8 83	6 16	5.07	1 85	86 77	60 68	37 12	42 11	11 87	21 39	18 75	36 58
5 83	5.26	6.18	6 92	8 60	13 73	8.55	7.82	5 15	4 11	2.94	87 86	61.76	38 21	43 19	12 96	20 71	17 89	35 57
4 79	4.21	5 13	5.87	7.55	12 68	7.50	8.20	5.53	5.21	4.05	88.57	62 48	38 92	43 90	13.67	21 74	16 84	35 95
4 62	4 04	4.96	5 70	7.38	12 51	7 33	5.94	3.27	4.68	4 81	89 74	63 64	40.08	45 07	14 83	19 48	16 67	33 69
3 71	3 13	4.05	4 79	6 47	11 60	6 42	7 11	4 44	5 05	4 85	89 66	63 57	40 01	44.99	14 76	20 65	15 76	34 86
0.00	2 50	2 59	2 22	3 90	9 39	3 85	4 83	2 72	8 47	8 55	92 67	66 57	43 01	48 00	17.76	22 19	13 55	32 58
2 50	0 00	1.40	2 83	5 04	8 95	4 99	6 78	4 67	7 89	7 97	92 09	65 99	42 44	47 42	17 19	23 48	13 11	34 33
2 59	1.40	0.00	1.45	3 99	7 55	3 94	5 86	4 15	8 81	8 89	93 01	66 91	43.36	48.34	18.11	23 58	11 71	32 93
2.22	2 83	1 45	0.00	2 79	7 58	2 74	4 65	3 52	9 55	9 64	93 75	67 66	44 10	49 08	18 85	23 28	11 74	32 40
3.90	5 04	3 99	2 79	0.00	7 10	0 96	3.14	5.16	11 23	11 31	95.43	69 33	45 78	49 43	20 53	22 05	11 26	30 89
10 29	9 85	8 45	8 48	7 88	0 00	7 83	10 01	11 59	17 26	17 35	99 77	73 67	50 11	55.10	24 86	28 91	8 51	29 72
3 85	4 99	3 94	2 74	0 96	7 05	0 00	3 09	5.11	11 18	11 26	95 38	69 28	45 73	49 38	20 48	22 00	11 21	30 84
4 83	6 78	5.86	4 65	3 14	9 24	3 09	0 00	3 29	9 72	9 86	94 78	68 69	45 13	47 56	19 88	20 17	12 65	29 02
2.72	4 67	4 15	3.52	5 16	10 69	5.11	3.29	0 00	7.05	7 19	92 11	66.02	42 46	47 44	17 21	20 37	14 66	31.04
8.47	7.89	8 81	9.55	11.23	16.37	11 18	9.72	7.05	0.00	5.98	90 89	64.79	41 23	45 54	15.98	18 16	20 53	37 47
8 55	7 97	8 89	9.64	11 31	16 45	11.26	9.86	7 19	5.98	0.00	85 37	59 28	35 72	40 70	10.47	22.30	20 61	37 61
92.34	91 68	92.68	93.42	95 10	99.22	95 05	94.78	92.11	90 89	85.37	0 00	47.94	49 65	81 07	74.90	107 20	103 38	122 53
66.24	65.58	66 59	67 33	69 00	73 12	68.96	68.69	66 02	64.79	59 28	47 94	0.00	23 56	33.13	48 81	60.52	77 28	92 71
42.68	42 03	43 03	43 77	45 45	49 56	45.40	45.13	42.46	41.23	35 72	49.65	23.56	0 00	55 48	25 25	57 55	53 72	72 88
47 67	47 01	48 01	48.75	49.43	54 55	49.38	47.56	47 44	45.54	40 70	81 07	33 13	55 48	0 00	30 23	27 38	56 59	59 57
17 43	16 77	17 78	18 52	20.20	24.31	20 15	19.88	17 21	15.98	10.47	74.90	48 81	25 25	30 23	0 00	32 30	28 47	47 63
22 19	23 48	23 58	23.28	22.05	28 14	22 00	20.17	20.37	18.16	22 30	107.20	60 52	57 55	27.38	32 30	0.00	29 21	32.19
13 90	13 46	12 06	12 09	11 49	10 80	11 44	12 65	14 66	20.87	20 96	103.38	77.28	53 73	56 59	28 47	29 21	0 00	21 21
32 58	34 53	33 28	32.40	30 89	32 02	30.84	29 02	31 04	37 47	37 61	122 53	92.71	72 88	59 57	47 63	32.19	21 21	0 00

OAKVILLE AUTO DRIVER ORIGIN DESTINATION MATRIX (AM Peak Period)																						
		Destination Zone																				
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Origin	2001	2.68	1.21	26.2	1.59	3.43	2.17	2.04	16.18	23.15	0.31	6.25	6.68	0	9.35	4.52	12.72	1.62	2.87	0.8	0.23
Zone	2002	0.02	0.01	0.25	0.01	0.03	0.02	0.02	0.15	0.22	0	0.06	0.06	0	0.09	0.04	0.11	0.01	0.03	0.01	0
	2003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2004	2.84	1.44	34.84	2.25	4.47	2.85	2.88	22.89	32.58	0.43	8.33	9.31	0	13.05	6.14	16.75	2.13	3.85	1.12	0.3
	2005	3.53	1.72	39.82	2.57	5.69	3.57	3.37	26.48	37.75	0.5	10.15	10.83	0	15.17	7.28	20.44	2.6	4.61	1.3	0.37
	2006	1.18	0.57	14.29	0.86	1.88	1.4	1.3	9.63	14.54	0.19	3.91	4.17	0	5.84	2.8	7.86	1	1.77	0.5	0.14
	2007	2.04	1.04	27.46	1.61	3.28	2.4	2.6	18.51	29.1	0.39	7.44	8.32	0	11.66	5.49	14.87	1.89	3.44	1	0.27
	2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2010	0.96	0.48	13.01	0.75	1.52	1.11	1.2	9.73	15.49	0.22	4.18	4.62	0	6.48	3.05	8.36	1.06	1.91	0.55	0.15
	2011	1.5	0.74	19.25	1.12	2.36	1.73	1.78	14.4	24.36	0.32	7.12	7.47	0	10.47	5.09	14.19	1.8	3.2	0.89	0.25
	2012	1.75	0.87	24.36	1.36	2.75	2.01	2.17	18.23	31.14	0.39	8.15	10.25	0	14.12	6.65	17.07	2.28	4.17	1.21	0.32
	2013	0.6	0.3	8.17	0.46	0.95	0.7	0.74	6.11	10.44	0.13	2.85	3.38	0	4.88	2.29	6.12	0.79	1.44	0.42	0.11
	2014	0.03	0.01	0.36	0.02	0.04	0.03	0.03	0.27	0.46	0.01	0.12	0.15	0	0.24	0.11	0.28	0.04	0.07	0.02	0.01
	2015	0.55	0.27	7.49	0.42	0.87	0.64	0.67	5.61	9.58	0.12	2.61	3.1	0	4.86	2.42	6.11	0.83	1.49	0.42	0.12
	2016	0.67	0.33	8.49	0.49	1.05	0.77	0.79	6.35	10.75	0.14	3.13	3.45	0	5.36	2.65	7.5	0.95	1.68	0.46	0.13
	2017	0.89	0.43	11.56	0.65	1.39	1.01	1.04	8.65	14.78	0.19	4.13	4.78	0	7.51	3.73	9.83	1.48	2.53	0.72	0.2
	2018	0.78	0.38	10.44	0.58	1.22	0.89	0.93	7.81	13.35	0.17	3.62	4.32	0	6.78	3.31	8.62	1.25	2.72	0.75	0.21
	2019	0.11	0.05	1.52	0.09	0.17	0.13	0.14	1.14	1.95	0.02	0.51	0.63	0	0.99	0.48	1.2	0.18	0.38	0.12	0.03
	2020	1.33	0.65	17.41	0.98	2.08	1.52	1.55	13.03	22.26	0.28	6.19	7.21	0	11.3	5.52	14.74	2.08	4.51	1.35	0.42
	2021	0.28	0.14	3.88	0.22	0.44	0.32	0.35	2.9	4.96	0.06	1.31	1.61	0	2.52	1.21	3.06	0.45	0.96	0.31	0.08
	2022	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2023	1.51	0.76	21.62	1.18	2.38	1.74	1.88	16.17	27.62	0.34	7.12	8.73	0	14.05	6.58	16.62	2.47	5.01	1.59	0.45
	2024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2025	0.92	0.46	13.36	0.71	1.44	1.06	1.14	9.79	16.72	0.2	4.27	5.29	0	8.53	3.9	9.93	1.34	2.65	0.84	0.24
	2026	1.3	0.65	18.59	1.01	2.05	1.5	1.62	13.91	23.76	0.29	6.07	7.51	0	12.13	5.55	14.11	1.9	3.48	1.08	0.3
	2027	0.22	0.11	3.07	0.17	0.34	0.25	0.27	2.3	3.93	0.05	1	1.24	0	2	0.92	2.33	0.31	0.57	0.17	0.04
	2028	0.43	0.22	6.18	0.34	0.68	0.5	0.54	4.63	7.9	0.1	2.02	2.5	0	4.03	1.85	4.69	0.63	1.16	0.33	0.09
	2029	1.74	0.87	24.9	1.36	2.75	2.01	2.17	18.63	31.83	0.39	8.13	10.06	0	16.24	7.43	18.9	2.55	4.66	1.35	0.36
	2030	0.96	0.48	13.65	0.74	1.51	1.1	1.19	10.22	17.45	0.21	4.46	5.52	0	8.91	4.07	10.36	1.4	2.55	0.74	0.2
	2031	1.15	0.58	17.22	0.91	1.82	1.29	1.39	12.38	19.7	0.24	5.03	6.22	0	10.04	4.59	11.68	1.57	2.88	0.83	0.22
	2032	0.73	0.36	10.69	0.57	1.15	0.84	0.9	7.77	13.27	0.16	3.39	4.2	0	6.78	3.1	7.88	1.06	1.94	0.57	0.16
	2033	0.01	0	0.13	0.01	0.01	0.01	0.01	0.09	0.16	0	0.04	0.05	0	0.08	0.04	0.09	0.01	0.03	0.01	0
	2034	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2036	1.01	0.51	15.15	0.8	1.6	1.13	1.23	10.89	17.36	0.21	4.44	5.49	0	8.86	4.05	10.31	1.39	2.54	0.74	0.2
	2037	1.19	0.61	17.91	0.94	1.9	1.34	1.45	12.87	20.48	0.25	4.9	5.86	0	9.46	4.33	11.01	1.48	2.71	0.79	0.21
	2038	1.26	0.64	18.92	0.99	2	1.42	1.53	13.6	21.64	0.26	5.18	6.27	0	10.12	4.63	11.78	1.59	2.9	0.84	0.23
	2039	0.81	0.41	12.11	0.64	1.28	0.89	0.92	8.16	12.78	0.16	3.02	3.59	0	5.08	2.39	6.09	0.82	1.5	0.43	0.12
	2040	2.12	1.08	31.81	1.67	3.37	2.44	2.64	23.45	37.31	0.45	8.83	10.52	0	14.86	7	17.82	2.4	4.38	1.27	0.34
	2041	3.02	1.53	45.35	2.39	4.8	3.32	3.45	30.57	48.14	0.58	11.21	13.01	0	18.31	8.62	22.4	2.95	5.4	1.56	0.42
	2042	2.01	1.02	30.2	1.59	3.2	2.21	2.3	20.36	29.75	0.36	6.93	8.04	0	11.32	5.33	13.84	1.83	3.34	0.97	0.26
	2043	0.02	0.01	0.34	0.02	0.04	0.02	0.02	0.21	0.31	0	0.07	0.09	0	0.12	0.06	0.15	0.02	0.04	0.01	0
	2044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2045	0.03	0.02	0.46	0.02	0.05	0.03	0.03	0.28	0.42	0.01	0.1	0.11	0	0.16	0.08	0.19	0.03	0.05	0.01	0
	2046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2047	0.03	0.01	0.41	0.02	0.04	0.03	0.03	0.28	0.42	0.01	0.1	0.12	0	0.17	0.08	0.2	0.03	0.05	0.01	0
	2048	0.08	0.04	1.17	0.06	0.12	0.09	0.09	0.84	1.33	0.02	0.33	0.4	0	0.65	0.3	0.76	0.1	0.19	0.05	0.02
	2049	0	0	0.05	0	0.01	0	0	0.04	0.07	0	0.02	0.02	0	0.03	0.02	0.04	0.01	0.01	0	0
	Durham	1.4	0.68	19.2	1.04	2.19	1.6	1.66	14.37	24.54	0.3	6.52	7.71	0	12.45	5.74	15.5	2.18	4.52	1.42	0.42
	York	3.2	1.56	43.87	2.38	4.99	3.65	3.8	32.82	56.07	0.68	14.89	17.63	0	28.45	13.11	35.42	4.98	10.32	3.24	0.95
	Toronto	20.75	10.09	284.53	15.43	32.38	23.69	24.63	212.9	363.64	4.41	96.58	114.32	0	184.55	85.06	229.73	32.32	66.95	20.98	6.16
	Peel N	10.65	5.18	145.98	7.91	16.61	12.15	12.64	109.23	186.56	2.26	49.55	58.65	0	94.68	43.64	117.86	16.58	34.35	10.77	3.16
	Peel S	13.65	6.64	187.16	10.15	21.3	15.58	16.2	140.04	239.2	2.9	63.53	75.2	0	121.4	55.95	151.12	21.26	44.04	13.8	4.05
	Halton N	7.07	3.59	97.76	5.25	10.44	6.88	7.15	63.39	99.66	1.21	23.76	28.52	0	46.04	21.06	53.57	7.22	13.19	3.84	1.08
	Halton S	50.5	25.45	589.66	33.15	68.67	43.21	42.49	366.59	519.91	6.35	126.32	141.29	0	201.9	93.22	254.15	32.32	58.4	16.92	4.56
	Hamilton-\	37.43	18.86	437.04	24.57	50.89	32.02	31.49	271.7	385.34	4.71	93.63	104.72	0	149.64	69.09	188.37	23.95	43.28	12.54	3.38
	Total	186.94	93.06	2377.29	132.05	273.63	185.27	188.46	1616.55	2524.13	30.98	641.50	743.22	0.00	1131.71	524.57	1406.73	189.14	364.72	109.65	30.96

File: shortest path and impedance2
Worksheet: oakville_od4_export

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
5.46	10.32	0.47	13.25	0.79	1.96	8.46	0.35	7.92	6.85	0.48	0.22	0	0.12	2.06	0.11	0.35	0.38	1.19	8.89	6.9	4.65
0.05	0.1	0	0.12	0.01	0.02	0.08	0	0.07	0.06	0	0	0	0	0.02	0	0	0	0.01	0.08	0.07	0.04
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.62	14.4	0.66	18.48	1.1	2.74	11.8	0.49	11.05	9.55	0.68	0.31	0	0.17	2.92	0.16	0.5	0.53	1.68	12.58	9.75	6.58
8.86	16.74	0.77	21.49	1.28	3.18	13.71	0.56	12.84	11.1	0.78	0.36	0	0.2	3.37	0.19	0.58	0.62	1.95	14.56	11.29	7.62
3.41	6.45	0.3	8.28	0.49	1.23	5.28	0.22	4.95	4.28	0.29	0.14	0	0.08	1.25	0.07	0.21	0.23	0.71	5.55	4.11	2.77
6.81	12.86	0.59	16.51	0.98	2.45	10.54	0.43	9.87	8.53	0.58	0.27	0	0.15	2.51	0.14	0.43	0.46	1.36	11.11	7.89	5.32
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.78	7.15	0.33	9.17	0.54	1.36	5.86	0.24	5.48	4.74	0.31	0.15	0	0.08	1.39	0.07	0.23	0.24	0.71	5.91	4.15	2.6
6.11	11.55	0.53	14.83	0.88	2.2	9.46	0.39	8.86	7.66	0.5	0.25	0	0.13	2.24	0.12	0.35	0.37	1.07	8.89	6.14	3.84
8.25	15.58	0.71	20	1.19	2.96	12.77	0.53	11.96	10.34	0.68	0.33	0	0.18	3.03	0.16	0.45	0.49	1.39	11.55	7.77	4.87
2.85	5.38	0.25	6.9	0.41	1.02	4.41	0.18	4.13	3.57	0.23	0.11	0	0.06	1.04	0.06	0.16	0.17	0.47	3.88	2.6	1.63
0.14	0.26	0.01	0.34	0.02	0.05	0.22	0.01	0.2	0.18	0.01	0.01	0	0	0.05	0	0.01	0.01	0.02	0.17	0.12	0.07
2.9	5.47	0.25	6.89	0.41	1.02	4.4	0.18	4.12	3.56	0.23	0.11	0	0.06	1.04	0.06	0.16	0.17	0.43	3.58	2.4	1.5
3.17	6	0.28	7.6	0.45	1.13	4.85	0.2	4.54	3.92	0.26	0.13	0	0.07	1.15	0.06	0.17	0.19	0.48	3.96	2.71	1.7
4.91	9.27	0.43	11.53	0.63	1.58	6.78	0.28	6.35	5.49	0.36	0.18	0	0.1	1.61	0.09	0.24	0.26	0.66	5.53	3.7	2.32
5.13	8.4	0.43	11.64	0.62	1.42	6.13	0.25	5.74	4.96	0.33	0.16	0	0.09	1.45	0.08	0.22	0.24	0.6	4.99	3.34	2.1
0.82	1.34	0.07	1.86	0.1	0.22	0.89	0.04	0.84	0.72	0.05	0.02	0	0.01	0.21	0.01	0.03	0.03	0.09	0.73	0.49	0.31
9.3	16.09	0.82	22.37	1.19	2.68	10.22	0.43	9.57	8.27	0.54	0.28	0	0.16	2.56	0.14	0.37	0.4	1	8.33	5.58	3.5
2.22	3.62	0.18	5.03	0.27	0.6	2.28	0.1	2.15	1.84	0.12	0.06	0	0.04	0.58	0.03	0.08	0.09	0.22	1.86	1.24	0.78
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.53	22.92	1.24	33.52	1.69	3.81	13.56	0.62	13.61	10.98	0.73	0.4	0	0.22	3.65	0.19	0.53	0.56	1.36	10.66	7.14	4.55
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.1	12.26	0.62	18.87	1.18	2.53	8.85	0.41	9.03	6.89	0.49	0.28	0	0.16	2.55	0.13	0.37	0.39	0.91	6.85	4.7	3.06
7.83	15.76	0.79	24.25	1.44	3.72	12.7	0.59	12.66	9.79	0.66	0.36	0	0.2	3.23	0.17	0.47	0.51	1.23	9.24	6.35	4.12
1.14	2.21	0.11	3.26	0.19	0.49	2.1	0.09	1.87	1.62	0.11	0.05	0	0.03	0.47	0.03	0.07	0.08	0.19	1.51	1.01	0.64
2.37	4.78	0.24	7.35	0.44	1.1	4.22	0.2	4.06	3.25	0.21	0.12	0	0.06	1.04	0.06	0.15	0.16	0.39	3.05	2.04	1.32
9.28	18.68	0.94	28.74	1.71	4.21	16.19	0.72	17.18	13.11	0.89	0.47	0	0.26	4.32	0.23	0.63	0.68	1.65	12.41	8.52	5.54
5.05	9.8	0.45	13.91	0.83	2.06	8.88	0.37	8.31	7.75	0.5	0.23	0	0.13	2.1	0.12	0.34	0.36	0.88	6.73	4.55	2.96
5.69	11.04	0.55	16.71	1	2.39	10	0.41	9.74	8.65	0.68	0.28	0	0.15	2.63	0.15	0.45	0.48	1.17	8.82	6.06	3.94
4.15	8.34	0.42	12.84	0.8	1.8	6.75	0.31	7.13	5.47	0.39	0.23	0	0.12	2.02	0.1	0.29	0.31	0.73	5.48	3.76	2.44
0.06	0.12	0.01	0.18	0.01	0.02	0.08	0	0.09	0.07	0	0	0	0	0.02	0	0	0	0.01	0.07	0.05	0.03
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.24	10.55	0.53	16.23	0.99	2.31	8.83	0.4	9.32	7.32	0.54	0.28	0	0.16	2.59	0.15	0.41	0.44	1.03	7.77	5.33	3.47
5.52	11.11	0.56	17.45	1.07	2.4	9.43	0.41	9.71	8.15	0.63	0.3	0	0.17	3.03	0.16	0.54	0.52	1.22	9.18	6.3	4.1
5.84	11.75	0.59	18.09	1.11	2.58	10.09	0.44	10.41	8.72	0.68	0.31	0	0.18	2.99	0.17	0.51	0.55	1.29	9.69	6.66	4.33
2.97	5.73	0.29	8.81	0.53	1.25	4.94	0.21	5.07	4.27	0.33	0.15	0	0.08	1.43	0.08	0.24	0.26	0.89	5.71	4.1	2.82
8.68	16.4	0.76	23.32	1.4	3.32	13.67	0.57	13.42	11.31	0.88	0.39	0	0.22	3.78	0.21	0.65	0.69	2.01	16.71	11.2	7.02
10.69	20.2	0.96	29.45	1.77	4.19	16.98	0.72	16.95	14.28	1.11	0.5	0	0.28	4.77	0.27	0.82	0.87	2.65	20.59	15.96	10
6.61	12.49	0.62	18.88	1.13	2.69	10.59	0.46	10.87	9.16	0.71	0.32	0	0.18	3.06	0.17	0.52	0.56	1.8	12.73	9.87	7.19
0.07	0.14	0.01	0.21	0.01	0.03	0.12	0.01	0.12	0.1	0.01	0	0	0	0.03	0	0.01	0.01	0.02	0.14	0.1	0.07
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.09	0.18	0.01	0.28	0.02	0.04	0.16	0.01	0.16	0.13	0.01	0	0	0	0.04	0	0.01	0.01	0.03	0.18	0.14	0.1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.1	0.2	0.01	0.32	0.02	0.04	0.17	0.01	0.17	0.14	0.01	0.01	0	0	0.05	0	0.01	0.01	0.03	0.19	0.14	0.1
0.39	0.79	0.04	1.31	0.08	0.17	0.65	0.03	0.68	0.56	0.04	0.02	0	0.01	0.22	0.01	0.03	0.03	0.08	0.6	0.41	0.27
0.02	0.05	0	0.08	0	0.01	0.04	0	0.04	0.03	0	0	0	0	0.01	0	0	0	0	0.03	0.02	0.01
10.29	19.99	1.08	34.37	1.56	3.52	12.32	0.57	12.57	9.75	0.67	0.37	0	0.22	3.44	0.18	0.5	0.52	1.25	9.46	6.47	4.21
23.52	45.68	2.47	78.54	3.57	8.05	28.16	1.3	28.71	22.28	1.53	0.85	0	0.5	7.86	0.41	1.14	1.19	2.86	21.63	14.79	9.61
152.55	296.29	16	509.4	23.13	52.19	182.64	8.44	186.24	144.51	9.94	5.54	0	3.27	50.96	2.63	7.41	7.7	18.56	140.26	95.93	62.34
78.26	152.01	8.21	261.35	11.87	26.78	93.7	4.33	95.55	74.14	5.1	2.84	0	1.68	26.15	1.35	3.8	3.95	9.52	71.96	49.21	31.98
100.35	194.9	10.53	335.08	15.21	34.33	120.14	5.55	122.51	95.06	6.54	3.65	0	2.15	33.52	1.73	4.88	5.07	12.21	92.26	63.1	41.01
27.9	56.13	2.82	93.9	5.41	12.03	45.88	2.05	48.42	39.51	3.06	1.51	0	0.9	15.32	0.77	2.62	2.51	6.53	44.54	31.94	21.92
115.6	222.17	10.42	296.5	17.61	43.85	188.84	7.78	176.85	152.87	11.01	4.96	0	2.75	47.49	2.64	8.12	8.67	27.43	204.93	158.91	107.23
85.68	164.66	7.94	257.97	15.23	33.92	139.96	5.8	137.09	115.08	8.91	4.25	0	2.48	43.13	2.23	7.64	7.31	23.21	153.06	117.78	83.31
775.36	1498.31	76.30	2357.46	122.37	283.65	1088.78	47.69	1079.18	880.57	62.80	31.76	0.00	18.26	300.38	15.89	47.70	49.28	135.18	998.59	722.79	481.89

File: shortest path and impedance2
Worksheet: oakville_od4_export

2043	2044	2045	2046	2047	2048	2049	Durham	York	Toronto	Peel N	Peel S	Halton N	Halton S	Hamilton-W	Total
0	0.34	0	0.37	0.82	0.42	0.19	7.48	53.06	440.41	193.2	72.46	254.38	177.12	287.42	1692.85
0	0	0	0	0.01	0	0	0.07	0.48	3.98	1.75	0.65	2.4	1.66	2.69	15.56
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
0	0.41	0	0.49	1.16	0.6	0.26	10.06	71.35	592.25	259.81	97.44	338.31	208.18	337.83	2200.35
0	0.49	0	0.56	1.34	0.69	0.31	12.02	85.25	707.58	310.4	116.41	386.62	247.93	402.34	2601.74
0	0.16	0	0.19	0.49	0.26	0.12	4.62	32.79	272.16	119.39	44.78	134.02	82.03	133.12	948.26
0	0.31	0	0.36	0.94	0.51	0.23	8.99	63.74	529.06	232.09	87.04	257.6	149.26	242.22	1814.95
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
0	0.15	0	0.18	0.47	0.27	0.13	4.99	35.42	294	128.97	48.37	135.24	69.24	112.36	959.11
0	0.22	0	0.26	0.7	0.43	0.21	8.34	59.19	491.27	215.51	80.82	204.95	106.25	172.42	1544.98
0	0.28	0	0.34	0.91	0.57	0.28	10.89	77.23	641.05	281.21	105.47	268.23	127.09	206.24	1984.23
0	0.09	0	0.11	0.31	0.2	0.1	3.76	26.66	221.26	97.06	36.4	92.58	42.76	69.38	681.06
0	0	0	0.01	0.01	0.01	0	0.19	1.31	10.9	4.78	1.79	4.56	1.91	3.1	32.77
0	0.08	0	0.1	0.28	0.2	0.1	3.75	26.59	220.68	96.81	36.31	92.34	39.14	63.52	667.02
0	0.1	0	0.12	0.31	0.22	0.11	4.38	31.05	257.76	113.07	42.41	101.85	47.12	76.47	773.13
0	0.13	0	0.16	0.44	0.3	0.15	6.4	45.38	376.63	165.22	61.96	142.54	62.24	101	1100.35
0	0.12	0	0.15	0.39	0.28	0.14	6.55	46.44	385.47	169.1	63.42	128.72	54.57	88.55	1070.35
0	0.02	0	0.02	0.06	0.04	0.02	1.03	7.34	60.89	26.71	10.02	18.87	7.96	12.91	164.61
0	0.2	0	0.24	0.66	0.49	0.27	12.95	91.87	762.52	334.5	125.45	227.35	93.27	151.35	2019.33
0	0.04	0	0.05	0.15	0.11	0.06	2.8	19.86	164.85	72.32	27.12	51.09	20.24	32.85	439.99
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
0	0.26	0	0.34	0.95	0.69	0.39	18.45	130.87	1086.28	476.53	178.72	323.69	119.65	194.61	2812.72
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
0	0.16	0	0.24	0.66	0.48	0.26	9.54	67.66	561.55	246.34	92.39	226.4	73.22	136.12	1584.44
0	0.22	0	0.3	0.84	0.61	0.32	12.26	86.94	721.62	316.56	118.72	286.78	102.93	172.64	2053.62
0	0.04	0	0.05	0.13	0.09	0.05	1.65	11.68	96.91	42.51	15.94	41.97	17.01	27.6	292.19
0	0.07	0	0.1	0.27	0.2	0.1	3.72	26.36	218.78	95.97	35.99	91.77	34.23	55.54	638.53
0	0.3	0	0.4	1.13	0.82	0.41	14.53	103.03	855.16	375.14	140.69	383.25	137.85	231.69	2547.09
0	0.16	0	0.22	0.6	0.42	0.2	7.05	50	415	182.05	68.28	198.35	75.58	123.36	1283.30
0	0.2	0	0.29	0.8	0.54	0.24	8.45	59.91	497.26	218.14	81.81	263.76	94.35	164.04	1580.52
0	0.13	0	0.19	0.52	0.38	0.19	6.49	46.03	382.03	167.59	62.85	179.21	58.56	107.75	1141.32
0	0	0	0	0.01	0	0	0.09	0.64	5.32	2.33	0.87	2.29	0.7	1.34	15.19
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
0	0.18	0	0.26	0.73	0.52	0.24	8.2	58.18	482.87	211.82	79.44	241.91	83.04	150.45	1489.64
0	0.21	0	0.35	0.96	0.62	0.27	9.04	64.11	532.15	233.44	87.55	318.93	98.12	198.35	1735.75
0	0.23	0	0.33	0.91	0.61	0.27	9.14	64.84	538.2	236.09	88.55	302.19	103.67	187.94	1735.75
0	0.14	0	0.21	0.57	0.29	0.13	4.45	31.59	262.19	115.01	43.14	158.94	66.34	120.71	915.07
0	0.38	0	0.49	1.32	0.77	0.34	11.78	83.59	693.77	304.34	114.14	381.43	174.31	282.86	2359.89
0	0.54	0	0.68	1.8	0.98	0.43	14.88	105.57	876.22	384.38	144.16	502.92	248.51	403.29	3085.40
0	0.36	0	0.48	1.24	0.63	0.28	9.54	67.7	561.89	246.49	92.44	340.59	165.47	276.37	2018.95
0	0	0	0.01	0.01	0.01	0	0.11	0.75	6.2	2.91	1.02	4.37	2.04	3.6	23.79
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
0	0.01	0	0.01	0.02	0.01	0	0.14	0.99	8.23	3.87	1.35	5.8	2.71	4.78	31.60
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
0	0	0	0.01	0.02	0.01	0.01	0.17	1.18	9.83	4.31	1.62	6.37	2.28	4.77	34.35
0	0.01	0	0.02	0.06	0.06	0.02	0.68	4.81	39.91	18.13	6.57	27.21	6.39	12.96	129.89
0	0	0	0	0	0	0	0.04	0.3	2.52	1.1	0.41	1.04	0.3	0.61	6.98
0	0.23	0	0.34	0.93	0.69	0.41	99630.81	14708.02	32564.51	3583.98	381.86	327.44	106.28	192.06	151754.31
0	0.53	0	0.77	2.13	1.58	0.93	4737.89	105341.7	74405.56	25669.16	872.5	2196.29	242.84	533.4	214591.93
0	3.42	0	4.97	13.84	10.22	6.02	8197.11	58142.12	482590.25	15088.83	5658.99	4852.44	1575.05	2846.25	582794.54
0	1.75	0	2.92	7.1	5.43	3.09	1055.1	23459.07	17646.93	182911.92	2903.34	15650.2	902.68	3800.9	250302.58
0	2.25	0	3.27	9.1	6.72	3.96	384.31	2725.94	22625.77	9925.41	3722.47	3191.93	1036.07	1872.26	48012.41
0	1.26	0	2.21	5.29	4.11	1.46	48.64	1012.8	2863.58	7896.88	471.13	11848.98	683.43	2877.72	28683.84
0	8.51	0	8.92	19.43	9.72	4.27	161.9	1148.33	9531.32	4670.91	1568.13	7008.53	8578.83	13921.63	51132.12
0	6.31	0	8.51	18.55	9.17	4.02	133.62	1152.06	7866.91	8982.66	1294.29	13478.16	6358.28	94909.88	137621.71
0.00	31.00	0.00	40.60	99.37	61.98	30.99	114609.05	209531.77	665381.44	265436.70	19387.68	65684.79	22688.69	126311.25	1513120.06

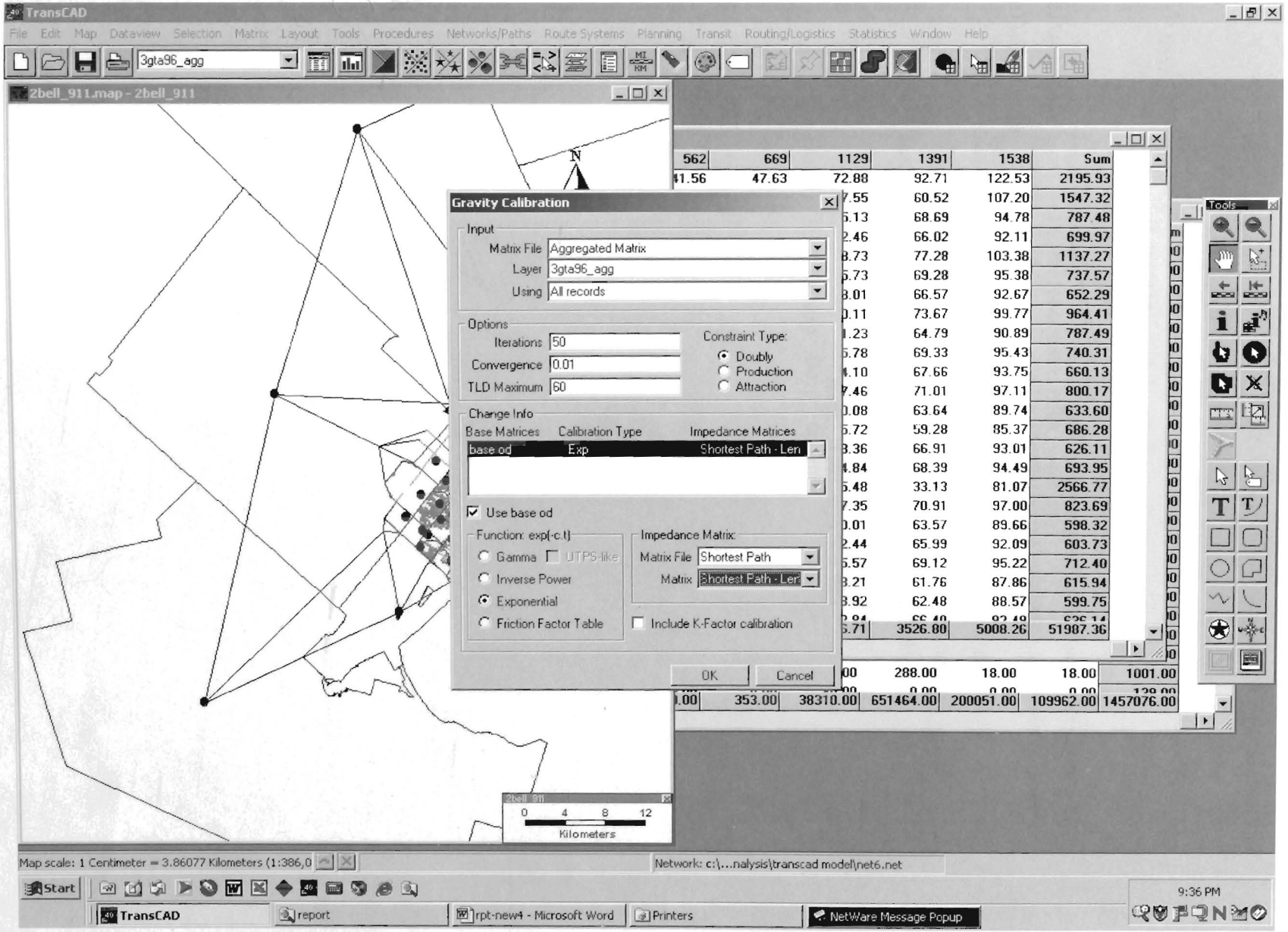
OAKVILLE AUTO DRIVER ORIGIN DESTINATION MATRIX (AM Peak Hour)																					
		Destination Zone																			
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Origin	2001	1.20	0.54	11.74	0.71	1.54	0.97	0.91	7.25	10.37	0.14	2.80	2.99	0.00	4.19	2.02	5.70	0.73	1.29	0.36	0.10
Zone	2002	0.01	0.00	0.11	0.00	0.01	0.01	0.01	0.07	0.10	0.00	0.03	0.03	0.00	0.04	0.02	0.05	0.00	0.01	0.00	0.00
	2003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2004	1.27	0.65	15.61	1.01	2.00	1.28	1.29	10.25	14.60	0.19	3.73	4.17	0.00	5.85	2.75	7.50	0.95	1.72	0.50	0.13
	2005	1.58	0.77	17.84	1.15	2.55	1.60	1.51	11.86	16.91	0.22	4.55	4.85	0.00	6.80	3.26	9.16	1.16	2.07	0.58	0.17
	2006	0.53	0.26	6.40	0.39	0.84	0.63	0.58	4.31	6.51	0.09	1.75	1.87	0.00	2.62	1.25	3.52	0.45	0.79	0.22	0.06
	2007	0.91	0.47	12.30	0.72	1.47	1.08	1.16	8.29	13.04	0.17	3.33	3.73	0.00	5.22	2.46	6.66	0.85	1.54	0.45	0.12
	2008	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2009	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2010	0.43	0.22	5.83	0.34	0.68	0.50	0.54	4.36	6.94	0.10	1.87	2.07	0.00	2.90	1.37	3.75	0.47	0.86	0.25	0.07
	2011	0.67	0.33	8.62	0.50	1.06	0.78	0.80	6.45	10.91	0.14	3.19	3.35	0.00	4.69	2.28	6.36	0.81	1.43	0.40	0.11
	2012	0.78	0.39	10.91	0.61	1.23	0.90	0.97	8.17	13.95	0.17	3.65	4.59	0.00	6.33	2.98	7.65	1.02	1.87	0.54	0.14
	2013	0.27	0.13	3.66	0.21	0.43	0.31	0.33	2.74	4.68	0.06	1.28	1.51	0.00	2.19	1.03	2.74	0.35	0.65	0.19	0.05
	2014	0.01	0.00	0.16	0.01	0.02	0.01	0.01	0.12	0.21	0.00	0.05	0.07	0.00	0.11	0.05	0.13	0.02	0.03	0.01	0.00
	2015	0.25	0.12	3.36	0.19	0.39	0.29	0.30	2.51	4.29	0.05	1.17	1.39	0.00	2.18	1.08	2.74	0.37	0.67	0.19	0.05
	2016	0.30	0.15	3.80	0.22	0.47	0.34	0.35	2.84	4.82	0.06	1.40	1.55	0.00	2.40	1.19	3.36	0.43	0.75	0.21	0.06
	2017	0.40	0.19	5.18	0.29	0.62	0.45	0.47	3.88	6.62	0.09	1.85	2.14	0.00	3.36	1.67	4.40	0.66	1.13	0.32	0.09
	2018	0.35	0.17	4.68	0.26	0.55	0.40	0.42	3.50	5.98	0.08	1.62	1.94	0.00	3.04	1.48	3.86	0.56	1.22	0.34	0.09
	2019	0.05	0.02	0.68	0.04	0.08	0.06	0.06	0.51	0.87	0.01	0.23	0.28	0.00	0.44	0.22	0.54	0.08	0.17	0.05	0.01
	2020	0.60	0.29	7.80	0.44	0.93	0.68	0.69	5.84	9.97	0.13	2.77	3.23	0.00	5.06	2.47	6.60	0.93	2.02	0.60	0.19
	2021	0.13	0.06	1.74	0.10	0.20	0.14	0.16	1.30	2.22	0.03	0.59	0.72	0.00	1.13	0.54	1.37	0.20	0.43	0.14	0.04
	2022	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2023	0.68	0.34	9.69	0.53	1.07	0.78	0.84	7.24	12.37	0.15	3.19	3.91	0.00	6.29	2.95	7.45	1.11	2.24	0.71	0.20
	2024	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2025	0.41	0.21	5.99	0.32	0.65	0.47	0.51	4.39	7.49	0.09	1.91	2.37	0.00	3.82	1.75	4.45	0.60	1.19	0.38	0.11
	2026	0.58	0.29	8.33	0.45	0.92	0.67	0.73	6.23	10.64	0.13	2.72	3.36	0.00	5.43	2.49	6.32	0.85	1.56	0.48	0.13
	2027	0.10	0.05	1.38	0.08	0.15	0.11	0.12	1.03	1.76	0.02	0.45	0.56	0.00	0.90	0.41	1.04	0.14	0.26	0.08	0.02
	2028	0.19	0.10	2.77	0.15	0.30	0.22	0.24	2.07	3.54	0.04	0.90	1.12	0.00	1.81	0.83	2.10	0.28	0.52	0.15	0.04
	2029	0.78	0.39	11.16	0.61	1.23	0.90	0.97	8.35	14.26	0.17	3.64	4.51	0.00	7.28	3.33	8.47	1.14	2.09	0.60	0.16
	2030	0.43	0.22	6.12	0.33	0.68	0.49	0.53	4.58	7.82	0.09	2.00	2.47	0.00	3.99	1.82	4.64	0.63	1.14	0.33	0.09
	2031	0.52	0.26	7.71	0.41	0.82	0.58	0.62	5.55	8.83	0.11	2.25	2.79	0.00	4.50	2.06	5.23	0.70	1.29	0.37	0.10
	2032	0.33	0.16	4.79	0.26	0.52	0.38	0.40	3.48	5.94	0.07	1.52	1.88	0.00	3.04	1.39	3.53	0.47	0.87	0.26	0.07
	2033	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.04	0.07	0.00	0.02	0.02	0.00	0.04	0.02	0.04	0.00	0.01	0.00	0.00
	2034	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2035	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2036	0.45	0.23	6.79	0.36	0.72	0.51	0.55	4.88	7.78	0.09	1.99	2.46	0.00	3.97	1.81	4.62	0.62	1.14	0.33	0.09
	2037	0.53	0.27	8.02	0.42	0.85	0.60	0.65	5.77	9.18	0.11	2.20	2.63	0.00	4.24	1.94	4.93	0.66	1.21	0.35	0.09
	2038	0.56	0.29	8.48	0.44	0.90	0.64	0.69	6.09	9.69	0.12	2.32	2.81	0.00	4.53	2.07	5.28	0.71	1.30	0.38	0.10
	2039	0.36	0.18	5.43	0.29	0.57	0.40	0.41	3.66	5.73	0.07	1.35	1.61	0.00	2.28	1.07	2.73	0.37	0.67	0.19	0.05
	2040	0.95	0.48	14.25	0.75	1.51	1.09	1.18	10.51	16.71	0.20	3.96	4.71	0.00	6.66	3.14	7.98	1.08	1.96	0.57	0.15
	2041	1.35	0.69	20.32	1.07	2.15	1.49	1.55	13.70	21.57	0.26	5.02	5.83	0.00	8.20	3.86	10.04	1.32	2.42	0.70	0.19
	2042	0.90	0.46	13.53	0.71	1.43	0.99	1.03	9.12	13.33	0.16	3.10	3.60	0.00	5.07	2.39	6.20	0.82	1.50	0.43	0.12
	2043	0.01	0.00	0.15	0.01	0.02	0.01	0.01	0.09	0.14	0.00	0.03	0.04	0.00	0.05	0.03	0.07	0.01	0.02	0.00	0.00
	2044	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2045	0.01	0.01	0.21	0.01	0.02	0.01	0.01	0.13	0.19	0.00	0.04	0.05	0.00	0.07	0.04	0.09	0.01	0.02	0.00	0.00
	2046	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2047	0.01	0.00	0.18	0.01	0.02	0.01	0.01	0.13	0.19	0.00	0.04	0.05	0.00	0.08	0.04	0.09	0.01	0.02	0.00	0.00
	2048	0.04	0.02	0.52	0.03	0.05	0.04	0.04	0.38	0.60	0.01	0.15	0.18	0.00	0.29	0.13	0.34	0.04	0.09	0.02	0.01
	2049	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.02	0.03	0.00	0.01	0.01	0.00	0.01	0.01	0.02	0.00	0.00	0.00	0.00
	Durham	0.63	0.30	8.60	0.47	0.98	0.72	0.74	6.44	10.99	0.13	2.92	3.45	0.00	5.58	2.57	6.94	0.98	2.02	0.64	0.19
	York	1.43	0.70	19.65	1.07	2.24	1.64	1.70	14.70	25.12	0.30	6.67	7.90	0.00	12.75	5.87	15.87	2.23	4.62	1.45	0.43
	Toronto	9.30	4.52	127.47	6.91	14.51	10.61	11.03	95.38	162.91	1.98	43.27	51.22	0.00	82.68	38.11	102.92	14.48	29.99	9.40	2.76
	Peel N	4.77	2.32	65.40	3.54	7.44	5.44	5.66	48.94	83.58	1.01	22.20	26.28	0.00	42.42	19.55	52.80	7.43	15.39	4.82	1.42
	Peel S	6.12	2.97	83.85	4.55	9.54	6.98	7.26	62.74	107.16	1.30	28.46	33.69	0.00	54.39	25.07	67.70	9.52	19.73	6.18	1.81
	Halton N	3.17	1.61	43.80	2.35	4.68	3.08	3.20	28.40	44.65	0.54	10.64	12.78	0.00	20.63	9.43	24.00	3.23	5.91	1.72	0.48
	Halton S	22.62	11.40	264.17	14.85	30.76	19.36	19.04	164.23	232.92	2.84	56.59	63.30	0.00	90.45	41.76	113.86	14.48	26.16	7.58	2.04
	Hamilton-'	16.77	8.45	195.79	11.01	22.80	14.34	14.11	121.72	172.63	2.11	41.95	46.91	0.00	67.04	30.95	84.39	10.73	19.39	5.62	1.51
	Total	83.75	41.69	1065.03	59.16	122.59	83.00	84.43	724.21	1130.81	13.88	287.39	332.96	0.00	507.01	235.01	630.22	84.73	163.39	49.12	13.87

File: shortest path and impedance2
Worksheet: oakville_od4_export_AM_Pk_Hr

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
2.45	4.62	0.21	5.94	0.35	0.88	3.79	0.16	3.55	3.07	0.22	0.10	0.00	0.05	0.92	0.05	0.16	0.17	0.53	3.98	3.09	2.08
0.02	0.04	0.00	0.05	0.00	0.01	0.04	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.04	0.03	0.02
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.41	6.45	0.30	8.28	0.49	1.23	5.29	0.22	4.95	4.28	0.30	0.14	0.00	0.08	1.31	0.07	0.22	0.24	0.75	5.64	4.37	2.95
3.97	7.50	0.34	9.63	0.57	1.42	6.14	0.25	5.75	4.97	0.35	0.16	0.00	0.09	1.51	0.09	0.26	0.28	0.87	6.52	5.06	3.41
1.53	2.89	0.13	3.71	0.22	0.55	2.37	0.10	2.22	1.92	0.13	0.06	0.00	0.04	0.56	0.03	0.09	0.10	0.32	2.49	1.84	1.24
3.05	5.76	0.26	7.40	0.44	1.10	4.72	0.19	4.42	3.82	0.26	0.12	0.00	0.07	1.12	0.06	0.19	0.21	0.61	4.98	3.53	2.38
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.69	3.20	0.15	4.11	0.24	0.61	2.63	0.11	2.46	2.12	0.14	0.07	0.00	0.04	0.62	0.03	0.10	0.11	0.32	2.65	1.86	1.16
2.74	5.17	0.24	6.64	0.39	0.99	4.24	0.17	3.97	3.43	0.22	0.11	0.00	0.06	1.00	0.05	0.16	0.17	0.48	3.98	2.75	1.72
3.70	6.98	0.32	8.96	0.53	1.33	5.72	0.24	5.36	4.63	0.30	0.15	0.00	0.08	1.36	0.07	0.20	0.22	0.62	5.17	3.48	2.18
1.28	2.41	0.11	3.09	0.18	0.46	1.98	0.08	1.85	1.60	0.10	0.05	0.00	0.03	0.47	0.03	0.07	0.08	0.21	1.74	1.16	0.73
0.06	0.12	0.00	0.15	0.01	0.02	0.10	0.00	0.09	0.08	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.08	0.05	0.03
1.30	2.45	0.11	3.09	0.18	0.46	1.97	0.08	1.85	1.59	0.10	0.05	0.00	0.03	0.47	0.03	0.07	0.08	0.19	1.60	1.08	0.67
1.42	2.69	0.13	3.40	0.20	0.51	2.17	0.09	2.03	1.76	0.12	0.06	0.00	0.03	0.52	0.03	0.08	0.09	0.22	1.77	1.21	0.76
2.20	4.15	0.19	5.17	0.28	0.71	3.04	0.13	2.84	2.46	0.16	0.08	0.00	0.04	0.72	0.04	0.11	0.12	0.30	2.48	1.66	1.04
2.30	3.76	0.19	5.21	0.28	0.64	2.75	0.11	2.57	2.22	0.15	0.07	0.00	0.04	0.65	0.04	0.10	0.11	0.27	2.24	1.50	0.94
0.37	0.60	0.03	0.83	0.04	0.10	0.40	0.02	0.38	0.32	0.02	0.01	0.00	0.00	0.09	0.00	0.01	0.01	0.04	0.33	0.22	0.14
4.17	7.21	0.37	10.02	0.53	1.20	4.58	0.19	4.29	3.70	0.24	0.13	0.00	0.07	1.15	0.06	0.17	0.18	0.45	3.73	2.50	1.57
0.99	1.62	0.08	2.25	0.12	0.27	1.02	0.04	0.96	0.82	0.05	0.03	0.00	0.02	0.26	0.01	0.04	0.04	0.10	0.83	0.56	0.35
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.17	10.27	0.56	15.02	0.76	1.71	6.07	0.28	6.10	4.92	0.33	0.18	0.00	0.10	1.64	0.09	0.24	0.25	0.61	4.78	3.20	2.04
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.73	5.49	0.28	8.45	0.53	1.13	3.96	0.18	4.05	3.09	0.22	0.13	0.00	0.07	1.14	0.06	0.17	0.17	0.41	3.07	2.11	1.37
3.51	7.06	0.35	10.86	0.65	1.67	5.69	0.26	5.67	4.39	0.30	0.16	0.00	0.09	1.45	0.08	0.21	0.23	0.55	4.14	2.84	1.85
0.51	0.99	0.05	1.46	0.09	0.22	0.94	0.04	0.84	0.73	0.05	0.02	0.00	0.01	0.21	0.01	0.03	0.04	0.09	0.68	0.45	0.29
1.06	2.14	0.11	3.29	0.20	0.49	1.89	0.09	1.82	1.46	0.09	0.05	0.00	0.03	0.47	0.03	0.07	0.07	0.17	1.37	0.91	0.59
4.16	8.37	0.42	12.88	0.77	1.89	7.25	0.32	7.70	5.87	0.40	0.21	0.00	0.12	1.94	0.10	0.28	0.30	0.74	5.56	3.82	2.48
2.26	4.39	0.20	6.23	0.37	0.92	3.98	0.17	3.72	3.47	0.22	0.10	0.00	0.06	0.94	0.05	0.15	0.16	0.39	3.02	2.04	1.33
2.55	4.95	0.25	7.49	0.45	1.07	4.48	0.18	4.36	3.88	0.30	0.13	0.00	0.07	1.18	0.07	0.20	0.22	0.52	3.95	2.71	1.77
1.86	3.74	0.19	5.75	0.36	0.81	3.02	0.14	3.19	2.45	0.17	0.10	0.00	0.05	0.90	0.04	0.13	0.14	0.33	2.46	1.68	1.09
0.03	0.05	0.00	0.08	0.00	0.01	0.04	0.00	0.04	0.03	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.03	0.02	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.35	4.73	0.24	7.27	0.44	1.03	3.96	0.18	4.18	3.28	0.24	0.13	0.00	0.07	1.16	0.07	0.18	0.20	0.46	3.48	2.39	1.55
2.47	4.98	0.25	7.82	0.48	1.08	4.22	0.18	4.35	3.65	0.28	0.13	0.00	0.08	1.36	0.07	0.24	0.23	0.55	4.11	2.82	1.84
2.62	5.26	0.26	8.10	0.50	1.16	4.52	0.20	4.66	3.91	0.30	0.14	0.00	0.08	1.34	0.08	0.23	0.25	0.58	4.34	2.98	1.94
1.33	2.57	0.13	3.95	0.24	0.56	2.21	0.09	2.27	1.91	0.15	0.07	0.00	0.04	0.64	0.04	0.11	0.12	0.40	2.56	1.84	1.26
3.89	7.35	0.34	10.45	0.63	1.49	6.12	0.26	6.01	5.07	0.39	0.17	0.00	0.10	1.69	0.09	0.29	0.31	0.90	7.49	5.02	3.14
4.79	9.05	0.43	13.19	0.79	1.88	7.61	0.32	7.59	6.40	0.50	0.22	0.00	0.13	2.14	0.12	0.37	0.39	1.19	9.22	7.15	4.48
2.96	5.60	0.28	8.46	0.51	1.21	4.74	0.21	4.67	4.10	0.32	0.14	0.00	0.08	1.37	0.08	0.23	0.25	0.81	5.70	4.42	3.22
0.03	0.06	0.00	0.09	0.00	0.01	0.05	0.00	0.05	0.04	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.06	0.04	0.03
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.04	0.08	0.00	0.13	0.01	0.02	0.07	0.00	0.07	0.06	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.08	0.06	0.04
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.04	0.09	0.00	0.14	0.01	0.02	0.08	0.00	0.08	0.06	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.09	0.06	0.04
0.17	0.35	0.02	0.59	0.04	0.08	0.29	0.01	0.30	0.25	0.02	0.01	0.00	0.00	0.10	0.00	0.01	0.01	0.04	0.27	0.18	0.12
0.01	0.02	0.00	0.04	0.00	0.00	0.02	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
4.61	8.96	0.48	15.40	0.70	1.58	5.52	0.26	5.63	4.37	0.30	0.17	0.00	0.10	1.54	0.08	0.22	0.23	0.56	4.24	2.90	1.89
10.54	20.46	1.11	35.19	1.60	3.61	12.62	0.58	12.86	9.98	0.69	0.38	0.00	0.22	3.52	0.18	0.51	0.53	1.28	9.69	6.63	4.31
68.34	132.74	7.17	228.21	10.36	23.38	81.82	3.78	83.44	64.74	4.45	2.48	0.00	1.46	22.83	1.18	3.32	3.45	8.31	62.84	42.98	27.93
35.06	68.10	3.68	117.08	5.32	12.00	41.98	1.94	42.81	33.21	2.28	1.27	0.00	0.75	11.72	0.60	1.70	1.77	4.26	32.24	22.05	14.33
44.96	87.32	4.72	150.12	6.81	15.38	53.82	2.49	54.88	42.59	2.93	1.64	0.00	0.96	15.02	0.78	2.19	2.27	5.47	41.33	28.27	18.37
12.50	25.15	1.26	42.07	2.42	5.39	20.55	0.92	21.69	17.70	1.37	0.68	0.00	0.40	6.86	0.34	1.17	1.12	2.93	19.95	14.31	9.82
51.79	99.53	4.67	132.83	7.89	19.64	84.60	3.49	79.23	68.49	4.93	2.22	0.00	1.23	21.28	1.18	3.64	3.88	12.29	91.81	71.19	48.04
38.38	73.77	3.56	115.57	6.82	15.20	62.70	2.60	61.42	51.56	3.99	1.90	0.00	1.11	19.32	1.00	3.42	3.27	10.40	68.57	52.77	37.32
347.36	**671.24**	**34.18**	**1056.14**	**54.82**	**127.08**	**487.77**	**21.37**	**483.47**	**394.50**	**28.13**	**14.23**	**0.00**	**8.18**	**134.57**	**7.12**	**21.37**	**22.08**	**60.56**	**447.37**	**323.81**	**215.89**

File: shortest path and impedance2
Worksheet: oakville_od4_export_AM_Pk_Hr

2043	2044	2045	2046	2047	2048	2049	Durham	York	Toronto	Peel N	Peel S	Halton N	Halton S	Hamilton-W	Total
0.00	0.15	0.00	0.17	0.37	0.19	0.09	3.35	23.77	197.30	86.55	32.46	113.96	79.35	128.76	758.40
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.22	1.78	0.78	0.29	1.08	0.74	1.21	6.97
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.18	0.00	0.22	0.52	0.27	0.12	4.51	31.96	265.33	116.39	43.65	151.56	93.26	151.35	985.76
0.00	0.22	0.00	0.25	0.60	0.31	0.14	5.38	38.19	317.00	139.06	52.15	173.21	111.07	180.25	1165.58
0.00	0.07	0.00	0.09	0.22	0.12	0.05	2.07	14.69	121.93	53.49	20.06	60.04	36.75	59.64	424.82
0.00	0.14	0.00	0.16	0.42	0.23	0.10	4.03	28.56	237.02	103.98	38.99	115.40	66.87	108.51	813.10
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.07	0.00	0.08	0.21	0.12	0.06	2.24	15.87	131.71	57.78	21.67	60.59	31.02	50.34	429.68
0.00	0.10	0.00	0.12	0.31	0.19	0.09	3.74	26.52	220.09	96.55	36.21	91.82	47.60	77.24	692.15
0.00	0.13	0.00	0.15	0.41	0.26	0.13	4.88	34.60	287.19	125.98	47.25	120.17	56.94	92.40	888.94
0.00	0.04	0.00	0.05	0.14	0.09	0.04	1.68	11.94	99.12	43.48	16.31	41.48	19.16	31.08	305.11
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.59	4.88	2.14	0.80	2.04	0.86	1.39	14.68
0.00	0.04	0.00	0.04	0.13	0.09	0.04	1.68	11.91	98.86	43.37	16.27	41.37	17.53	28.46	298.82
0.00	0.04	0.00	0.05	0.14	0.10	0.05	1.96	13.91	115.48	50.66	19.00	45.63	21.11	34.26	346.36
0.00	0.06	0.00	0.07	0.20	0.13	0.07	2.87	20.33	168.73	74.02	27.76	63.86	27.88	45.25	492.96
0.00	0.05	0.00	0.07	0.17	0.13	0.06	2.93	20.81	172.69	75.76	28.41	57.67	24.45	39.67	479.52
0.00	0.01	0.00	0.01	0.03	0.02	0.01	0.46	3.29	27.28	11.97	4.49	8.45	3.57	5.78	73.75
0.00	0.09	0.00	0.11	0.30	0.22	0.12	5.80	41.16	341.61	149.86	56.20	101.85	41.78	67.80	904.66
0.00	0.02	0.00	0.02	0.07	0.05	0.03	1.25	8.90	73.85	32.40	12.15	22.89	9.07	14.72	197.12
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.12	0.00	0.15	0.43	0.31	0.17	8.27	58.63	486.65	213.49	80.07	145.01	53.60	87.19	1260.10
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.07	0.00	0.11	0.30	0.22	0.12	4.27	30.31	251.57	110.36	41.39	101.43	32.80	60.98	709.83
0.00	0.10	0.00	0.13	0.38	0.27	0.14	5.49	38.95	323.29	141.82	53.19	128.48	46.11	77.34	920.02
0.00	0.02	0.00	0.02	0.06	0.04	0.02	0.74	5.23	43.42	19.04	7.14	18.80	7.62	12.36	130.90
0.00	0.03	0.00	0.04	0.12	0.09	0.04	1.67	11.81	98.01	42.99	16.12	41.11	15.34	24.88	286.06
0.00	0.13	0.00	0.18	0.51	0.37	0.18	6.51	46.16	383.11	168.06	63.03	171.70	61.76	103.80	1141.10
0.00	0.07	0.00	0.10	0.27	0.19	0.09	3.16	22.40	185.92	81.56	30.59	88.86	33.86	55.27	574.92
0.00	0.09	0.00	0.13	0.36	0.24	0.11	3.79	26.84	222.77	97.73	36.65	118.16	42.27	73.49	708.07
0.00	0.06	0.00	0.09	0.23	0.17	0.09	2.91	20.62	171.15	75.08	28.16	80.29	26.23	48.27	511.31
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.29	2.38	1.04	0.39	1.03	0.31	0.60	6.81
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.08	0.00	0.12	0.33	0.23	0.11	3.67	26.06	216.33	94.90	35.59	108.38	37.20	67.40	667.36
0.00	0.09	0.00	0.16	0.43	0.28	0.12	4.05	28.72	238.40	104.58	39.22	142.88	43.96	88.86	777.62
0.00	0.10	0.00	0.15	0.41	0.27	0.12	4.09	29.05	241.11	105.77	39.67	135.38	46.44	84.20	777.62
0.00	0.06	0.00	0.09	0.26	0.13	0.06	1.99	14.15	117.46	51.52	19.33	71.21	29.72	54.08	409.95
0.00	0.17	0.00	0.22	0.59	0.34	0.15	5.28	37.45	310.81	136.34	51.13	170.88	78.09	126.72	1057.23
0.00	0.24	0.00	0.30	0.81	0.44	0.19	6.67	47.30	392.55	172.20	64.58	225.31	111.33	180.67	1382.26
0.00	0.16	0.00	0.22	0.56	0.28	0.13	4.27	30.33	251.73	110.43	41.41	152.58	74.13	123.81	904.49
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.34	2.78	1.30	0.46	1.96	0.91	1.61	10.66
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.06	0.44	3.69	1.73	0.60	2.60	1.21	2.14	14.16
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.08	0.53	4.40	1.93	0.73	2.85	1.02	2.14	15.39
0.00	0.00	0.00	0.01	0.03	0.03	0.01	0.30	2.15	17.88	8.12	2.94	12.19	2.86	5.81	58.19
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.13	1.13	0.49	0.18	0.47	0.13	0.27	3.13
0.00	0.10	0.00	0.15	0.42	0.31	0.18	44634.60	6589.19	14588.90	1605.62	171.07	146.69	47.61	86.04	67985.93
0.00	0.24	0.00	0.34	0.95	0.71	0.42	2122.57	47193.08	33333.69	11499.78	390.88	983.94	108.79	238.96	96137.18
0.00	1.53	0.00	2.23	6.20	4.58	2.70	3672.31	26047.67	216200.43	6759.80	2535.23	2173.89	705.62	1275.12	261091.95
0.00	0.78	0.00	1.31	3.18	2.43	1.38	472.68	10509.66	7905.82	81944.54	1300.70	7011.29	404.40	1702.80	112135.56
0.00	1.01	0.00	1.46	4.08	3.01	1.77	172.17	1221.22	10136.34	4446.58	1667.67	1429.98	464.16	838.77	21509.56
0.00	0.56	0.00	0.99	2.37	1.84	0.65	21.79	453.73	1282.88	3537.80	211.07	5308.34	306.18	1289.22	12850.36
0.00	3.81	0.00	4.00	8.70	4.35	1.91	72.53	514.45	4270.03	2092.57	702.52	3139.82	3843.32	6236.89	22907.19
0.00	2.83	0.00	3.81	8.31	4.11	1.80	59.86	516.12	3524.38	4024.23	579.84	6038.22	2848.51	42519.63	61654.53
0.00	13.89	0.00	18.19	44.52	27.77	13.88	51344.85	93870.23	298090.89	118915.64	8685.68	29426.79	10164.53	56587.44	677877.79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File Edit Map Dataview Selection Matrix Layout Tools Procedures Networks/Paths Route Systems Planning Transit Routing/Logistics Statistics Window Help
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2bell_911.map - 2bell_911
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Gravity Calibration
Input
Matrix File Aggregated Matrix
Layer 3gta96_agg
Using All records
Options
Iterations 50
Convergence 0.01
TLD Maximum 60
Constraint Type:
Doubly
Production
Attraction
Change Info
Base Matrices Calibration Type Impedance Matrices
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Function: exp(-c.t)
Gamma UTPS-like
Inverse Power
Exponential
Friction Factor Table
Impedance Matrix:
Matrix File Shortest Path
Matrix Shortest Path - Len
Include K-Factor calibration
OK
Cancel
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Tools
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Kilometers
Map scale: 1 Centimeter = 3.86077 Kilometers (1:386,0
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TransCAD
report
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Printers
NetWare Message Popup
9:36 PM

grav_calc6

Starting Procedure Gravity Estimation on May 06, 2003 (09:38 PM)

Model	: Gravity Calibration
Constraint	: Doubly (Productions and Attractions)
Iterations	: 50
Convergence	: 1.00e-002
TLD Max (minutes)	: 60
Base Flow Matrix	: C:\Lukasz\Masters\CV8001\Analysis\TransCad Model\base_od4_agg.mtx
Number of Models	: 1
Matrix	: base od
Calibration Type	: Negative exponential function
Include K-Factors	: No
Cost Matrix	: C:\Lukasz\Masters\CV8001\Analysis\TransCad Model\shortest path net1.mtx(Shortest Path - Length)
Summary file	: C:\Lukasz\Masters\CV8001\Analysis\TransCad Model\grav_calc6.bin
Results	: All models converged
base od	: Converged after 5 iterations. K-Factor not performed Calibrated Negative Exponential = exp(-c.t) c= 0.0522708961
base od	: Mean Cost Error = 0.0081853113 Mean: -0.0000000000 Var: 1617830.8158313804 SDEV: 1271.9397846720 RMSE: 1271.9397846720
Execution Time was	00:00:00.200.

APPENDIX E

TRAFFIC ASSIGNMENT

Starting Procedure Traffic Assignment on May 07, 2003 (03:53 AM)

Iteration	Relative Gap	Max. Flow Change
1	0.121476	14138.995376
2	0.256812	7072.828433
3	0.023381	1433.929309
4	0.015481	909.448079
5	0.011069	1116.728223
6	0.006203	744.485482

INPUT FILES
==========
Network : C:\Lukasz\Masters\CV8001\Analysis\TransCad Model\net6.net
Demand Table : C:\Lukasz\Masters\CV8001\Analysis\TransCad Model\oakville_od4.mtx

OUTPUT FILES
============
Flow Table : C:\Lukasz\Masters\CV8001\Analysis\TransCad Model\assignment_oakville_od4_net6.bin

LINK FIELDS
===========
Cost : time
Capacity : [capacity *]
BPR-Alpha : BPRA
BPR-Beta : BPRB
Probability Function : Normal

OD DEMAND
=========
OD Pairs : 3249
Non zero OD Pairs : 2544
Demand : 677877.76
Intranodal Demand : 443367.92

PARAMETERS
==========
Method : Stochastic User Equilibrium
Maximum Iterations : 20
Iterations : 7
Conv. Criteria : 0.01

Running Results
===============
Relative Gap : 0.00620291003
Max Flow Change : 744.485482
Equilibrium reached : Yes
Total V-Time-T : 86162.4654
Total V-Dist-T : 5219463.81
Centroid V-Time-T : 80316.5778
Centroid V-Dist-T : 4903061.81
V-Time-T w/o Centroids : 5845.88757
V-Dist-T w/o Centroids : 316402.002

Total Running Time 00:00:02.883.