

**THE GREATER TORONTO AREA TRAVEL
DEMAND MODELLING SYSTEM
VERSION 2.0
VOLUME III: USER'S MANUAL**

Eric J. Miller
Bahen-Tanenbaum Professor
Department of Civil Engineering
University of Toronto

Joint Program in Transportation
University of Toronto

January, 2001

ACKNOWLEDGEMENTS

Funding for the development and testing of GTAModel Version 2.0 was provided by TRADMAG and the City of Toronto. The Version 2.0 work built upon earlier work over a number of years which had been funded at various stages by the then Metropolitan Toronto Planning Department and the Ministry of Transportation, Ontario.

Support and advice throughout this project from the GTA Transportation Modelling Group is much appreciated. I would particularly like to thank Loy Cheah, Vince Alfano and Vladimir Livshits for their substantive contributions at various points in the system development and testing.

As always, much thanks goes to the Data Management Group (and especially Susanna Choy) for access to the TTS database and other technical support.

TABLE OF CONTENTS

	Page
Acknowledgements	2
Table of Contents	3
List of Figures	4
List of Tables	4
1. INTRODUCTION	5
2. DATABANK STRUCTURE AND MANIPULATIONS	7
2.1 Introduction	7
2.2 Network Coding Requirements	9
2.2.1 Rail Station "Centroids"	9
2.2.2 Network Extra Attributes	11
2.3 Databank Matrix Definitions & Usage	11
2.4 Zone System Definitions	12
3. THE EXTERNAL FILE SYSTEM	17
3.1 Introduction	17
3.2 Input Files and Parameters	18
3.3 The <u>.temp</u> Directory	20
3.4 Output (Permanent Results) Files	20
4. RUNNING THE MODEL	22
4.1 Introduction	22
4.2 The "Front End Program" (<i>gtamodel.out</i>)	22
4.3 Setting Up the Modelling System/Initializing a New Databank	27
4.4 Steps in Running the Model	28
4.5 Preparing a New Network Scenario	28
4.6 Input Data Preparation	29
4.7 Post-Processing Results	30
4.8 Trouble-Shooting Abnormal Run Terminations	31
References	34
APPENDICES	
A. EMME/2 Matrices	35
B. GTAModel Zone Ensemble Definitions	36
C. GTAModel Input File and Parameter Definitions	41
D. <u>.temp</u> Intermediate Files	52
E. <u>MR.runname</u> Files	54
F. Sample <u>modelrun.doc</u> File	56

LIST OF FIGURES

	Page
2.1 Extended O-D Matrix Definition	15
3.1 GTAModel Directory Structure	19
4.1 <i>gtamain.out</i> Flowchart	23

LIST OF TABLES

	Page
2.1 Version 2.0 Databank Dimensions	8
2.2 Station Centroid User Field Definitions	10
2.3 Network Extra Attributes	11
2.4 External Zones	13
2.5 Matrices Using "Extended" Portions of Their Array Space	14
2.6 Summary of GTAModel Zone System	16
4.1 GTAModel Tasks Which Can Be Selected for Individual Execution	26
4.2 Input Files Containing Rail Station Information	29
4.3 Post-Run Processing Procedures Available within GTAModel	30
4.4 Sample Post-Run Report	32
4.5 Base 1996 Files for Use in Post-Run Utilities	33

CHAPTER 1 INTRODUCTION

This is the third in a three-volume report series documenting Version 2.0 of the Greater Toronto Area Travel Demand Modelling System. This volume is the modelling system's user's manual, which provides detailed instructions concerning how to prepare and execute a model run. Detailed documentation of the modelling system is provided in Volume II (*Model Documentation*). Volume I of the report series (*Model Overview*) provides a brief, largely non-technical, overview of the modelling system and its evolution to date. The presentation in this volume assumes that the user is familiar with the overall structure of the modelling system as described in Volumes I and II.

"GTAModel" (as it will hereafter be referred to) consists of an interconnected set of Fortran and C programs, and EMME/2 (Release 9) macros. EMME/2 macros are used to perform network calculations, in particular, road and transit assignments. All other model activities are performed by Fortran programs, with the exception of post-model-run screenline calculations which are controlled by a C program. For further discussion of sub-model logic, contents and development, see Volumes 1 and II.

Given the need for input scenario specification as well as for post-modelling analysis of results, it is assumed that the user has a working familiarity with the EMME/2 modelling system; in particular, EMME/2 terminology (e.g., "batchin/batchout") and notation (e.g., the "mfxx" notation for databank arrays) are used throughout this volume without detailed explanations.¹

EMME/2 and GTAModel run on Sun workstations operated by the Data Management Group, University of Toronto Joint Program in Transportation, within the Unix operating system. This volume assumes that the user has at least a minimal familiarity with Unix commands, knows how to log into the Data Management Group computer system, can execute EMME/2 within this system, etc. Thus, this manual focusses on the tasks and procedures actually required to setup and run GTAModel within this computing environment, rather than on the rudiments of using the computing environment *per se*.

The information used and/or generated by GTAModel is physically stored in two locations within the computing system. Data required for network and flow assignment calculations within EMME/2 are stored within the EMME/2 databank. All other information required/generated by GTAMODEL programs exists within "external" (i.e., to the databank) disk files.

Chapter 2 describes the GTAModel EMME/2 databank and network structure at a level of detail sufficient for the user to understand what is involved in "setting up" a model run, as well as how to access and use the information generated once the model has been run. Chapter 3 similarly

¹ For detailed documentation of the EMME/2 network modelling package, see Inro Consultants [1998].

describes the contents of the external data files. Chapter 4 then describes in detail the procedure involved in executing a GTAModel run.

Throughout the manual, the following notation conventions are maintained:

- computer procedures (EMME/2 macros, Fortran or C programs) are always written in *italics*;
- EMME/2 databank arrays are always written in **bold**; and
- external disc files are always written in double underline.

CHAPTER 2

DATABANK STRUCTURE AND MANIPULATIONS

2.1 INTRODUCTION

Three fundamental differences in the EMME/2 databank used by GTAModel exist between Version 2.0 and the previous Version 1.0:

1. Version 2.0 uses a single, integrated network scenario to represent all road and transit services within the GTA, replacing Version 1.0's use of separate road and transit network scenarios. The coding standard for the integrated networks used in Version 2.0 is defined in DMG [1998b].
2. Version 2.0 uses the 1996 TTS zone system, replacing the 1991 TTS zone system used in Version 1.0. See DMG [1998a] for detailed description of the 1996 zone system.
3. Version 2.0 runs under EMME/2 Release 9; Version 1.0 ran under Release 7.

Given the major changes in coding standards, and zone definitions involved in the shifts to the integrated network format and to the 1996 traffic zone system, networks developed to run under Version 1.0 can not be used in Version 2.0. Similarly, the Version 2.0 EMME/2 macros and Fortran and C programs have been extensively modified relative their Version 1.0 forms to accommodate the changes in network, zone system and EMME/2 release version.

As in Version 1.0, however, extensions to the DMG network coding standard are required to accommodate special features of GTAModel calculations, specifically modelling "mixed modes" of travel involving auto access to rail (GO-Rail and subway) services and toll roads. In order to model mixed modes in detail, special treatment of GO-Rail and subway "park & ride" stations in the network scenario is required. In addition, toll road, emissions and screenline related calculations in the model assume the existence of non-standard network extra attributes. Section 2.2 deals with these special network coding issues and definitions in detail.

Table 2.1 contains the dimensions of the Version 2.0 EMME/2 databank. This databank largely consists of a number of scalars, vectors and two-dimensional origin-destination-based arrays, which are collectively and generically referred to within EMME/2 as "matrices". Section 2.3 defines these matrices and their use within the model, while Appendix A provides a complete listing of all matrices contained in the databank.

Finally, Section 2.4 discusses in detail the zone system used in the GTAModel (the 1996 TTS traffic zone system), the treatment of "external zones" within the model, and the "extended O-D matrix" concept used to facilitate mixed-mode calculations within the model.

Table 2.1
Version 2.0 Databank Dimensions

Quantity¹	Description
31	Scenarios ²
2000	Zones or centroids
13000	Nodes (including centroids)
35000	Directional links
5000	Turn table entries
50	Transit vehicle types
1000	Transit lines or routes
35000	Transit line segments
20	2-dimensional matrices (type mf) ³
99	Origin vectors (type mo)
99	Destination vectors (type md)
99	Scalars (type ms)
99	Functions per class
2000	Operators per function class
2000	Log book entries
40000	Demarcation entries per set
250000	Words for extra attributes ⁴
+	Node labels (yes)
+	User data on transit segments (yes)
+	Class specific auto volumes (yes)

Module 1.23 Parameter Settings

- 3. Unit of length = km
- 4. Unit of cost = \$
- 5. Unit of energy = mj
- 6. Length of coord. unit = 0.001 km
- 7. Node number digits = 6
- 8. Size of link arrowheads = 0.0

Notes

1. Approximate size of the databank (25 2-d arrays) = 575 MB.
2. 30 scenarios are available for use. Scenario 31 is reserved for internal GTAModel calculations and should never be used by the user.
3. GTAModel requires 20 two-dimensional arrays to run. The user can specify as many arrays as desired.
4. Minimum required for 7 GTAModel-related extra attributes. The user may wish to request more space.

2.2 NETWORK CODING REQUIREMENTS

GTAModel assumes the existence within the EMME/2 databank of an integrated road and transit network for a given forecast year which has been developed by the user according to standard GTA coding conventions and notation. This section deals with two specific network coding issues which reflect special requirements of GTAModel. The first is the coding of rail station "centroids" (including node user field definitions for these "station centroids"), and the second is the definition of network link extra attributes required by GTAModel.

2.2.1 Rail Station "Centroids"

As is discussed in more detail in Volume II, the detailed modelling of mixed modes such as auto access to GO-Rail or subway requires computing explicit origin-to-access-station and egress-station-to-destination travel times and costs. Such times and costs can only be computed and stored for general use within EMME/2 if the GO-Rail and subway access/egress stations are coded as "centroids" (i.e., as "origins" or "destinations" of trips in their own right). This means that each station must be "double-coded" within the network, once as a "normal" node within the network, and once as a "centroid". Conventions for coding "station centroids" into the network are as follows:

1. All GO-Rail stations must have station centroids coded. Centroid numbers 7000-7999 are reserved for GO-Rail station centroids. Note that while this coding convention implies that up to 1000 GO-Rail station centroids can be specified, GTAModel software dimensioning currently limits the total number of GO-Rail stations in the GTA to 100.
2. Only subway stations with "park and ride" facilities are allowed within the model to have auto access; hence, only such "park & ride" stations have station centroids. Centroid numbers 6000-6999 are reserved for subway park & ride stations. As with GO-Rail station centroids, current software dimensioning limits the total number of subway park & ride stations in the GTA to 100.
3. For convenience of display, the station centroid is usually coded with a slight, arbitrary offset from the "true" station node. It is connected to the true station node by an auxiliary transit link of zero length/travel time. The station centroid must also be connected to an appropriate adjacent road network node.
4. The GO-Rail and subway park & ride station centroids have node user fields associated with them. These are specified in Table 2.2.
5. The GO-Rail and subway park & ride station centroids can have a four-character, user-defined station label attached to them (i.e., which can be something other than the station centroid's node number). Use of these labels considerably improves the "readability" of station-specific model outputs (e.g., boardings by station).

Table 2.2
Station Centroid User Field Definitions

(a) GO-Rail Stations

User Field	Description
ui2	No. of parking spaces at this station
ui3	Line identification number. Up to 10 lines are supported by the program. Base network line numbers are: = 1 -- Lakeshore West = 2 -- Milton = 3 -- Georgetown = 4 -- Bradford = 5 -- Richmond Hill = 6 -- Stouffville = 7 -- Lakeshore East

(b) Subway Park & Ride Stations

User Field	Description
ui1	Daily parking cost at the station (1996 cents)
ui2	No. of parking spaces at this station
ui3	Line identification number. Up to 10 lines are supported by the program. Base network line numbers are: = 1 -- Bloor-Danforth = 2 -- Spadina-University = 3 -- Yonge = 4 -- Scarborough RT

An automated procedure exists for creating station centroids and connectors to the network which can be accessed via the GTAModel front-end user interface (see Section 4.5).

2.2.2 Network Extra Attributes

Seven network link extra attributes are required by GTAModel. These are defined in Table 2.3. All seven extra attributes can be automatically initialized for a new network scenario using a front-end user interface utility (see Section 4.5). This utility also computes values for **@lkcst** and reads in values for **@slc** from a user-defined file. The 1996 base network default screenline code file is MODEL/STATIC/slcodes_96.241. Values for the four emissions attributes (**@co**, **@hc**, **@nox** and **@co2**) are model run specific, and are computed and batched into the databank by GTAModel during a model run. At the time of writing of this manual, the definition of values of **@toll** for toll road links is left to the user to undertake as an EMME/2 network calculation.

Table 2.3
Network Extra Attributes

Extra Attribute	Description
@co	Contains link morning peak-period carbon monoxide (CO) emissions (kg) for the most recent model run using this scenario
@co2	Contains link morning peak-period carbon dioxide (CO ₂) emissions (kg) for the most recent model run using this scenario
@hc	Contains link morning peak-period hydro-carbon (HC) emissions (kg) for the most recent model run using this scenario
@lkcst	Contains the link auto travel cost (1996\$), computed as the link distance multiplied by \$0.0645 per km.
@nox	Contains link morning peak-period nitrous oxides (NO _x) emissions (kg) for the most recent model run using this scenario
@slc	Contains link screenline codes
@toll	Contains toll charges (1996\$) for this link (=0 if not a toll road)

2.3 DATABANK MATRIX DEFINITIONS & USAGE

Appendix A contains a list of all matrices used by GTAModel. As shown in the appendix, these consist of scalars **ms01** through **ms24**, inclusive, and two-dimensional arrays **mf01** through **mf20**, inclusive. These matrices divide into four categories, depending on their use within the

model:

1. "Static" scalars, which should not be altered by the user. There are only two such parameters: **ms03**, the "unit variable" (=1), used as the flow variable in preliminary transit assignments; and **ms13**, the base year (1996) unit auto travel cost (1996\$/km).²
2. User-defined input scalars, which do change from run to run and which must be supplied by the user. **These are all defined interactively within the "front end user interface", discussed in Section 4.2, and do not require explicit definition by the user using EMME/2 commands.**
3. "Working" arrays, which are used within the model run to store intermediate calculations which are of little direct interest to the user.
4. "Results" scalars and arrays, which store model run results generated within EMME/2. These consist of two types:
 - equilibrium travel time and cost matrices (**mf01** through **mf06**, inclusive); and
 - arrays containing the auto-drive and transit origin-destination flow matrices which have been assigned to the network (**mf08** through **mf10**), along with scalars containing various summary totals and average values (**ms07-ms09**, **ms14-ms17**, and **ms21-ms24**).

Note that all data stored in the databank refer to the most recent model run which has been undertaken. If the user wishes to save any data for a given run so that it is not lost when GTAModel is next executed, the user must save this information in user-defined disk files using standard EMME/2 batchout commands.

All EMME/2 matrices can be defined and initialized with default values for a new databank using a utility macro provided in the front-end user interface (see Section 4.4).

2.4 ZONE SYSTEM DEFINITIONS

GTAModel uses the 1996 GTA traffic zone system. There are 1677 traffic zones in this system, defined over the range of zone numbers 1-2670. [DMG, 1998a]

Twenty-six additional "external zones" have been added to base 1996 GTA zone system in order to capture flows into and out of the GTA. These zones have labels in the range 4000-4410,

² **ms13** is included in the user input parameter list (see Appendix C), to permit the specification of a network scenario which does not have 1996 as its base.

inclusive (see Table 2.4). These zones represent a disaggregation of the ten external regions bounding the GTA. GTAModel predicts total (i.e., all trip purposes) flows to/from external zones and GTA zones by mode, and includes these flows in the road and transit assignments performed. User inputs relating to flow to/from external zones are discussed in Section 3.3. For more details concerning modelling flows to/from external zones, see Volumes I and II.

Table 2.4
External Zones

Network Zone	
No.	Name
4000	Trenton
4001	Cobourg
4002	City of Peterborough
4003	Manvers&Emily
4004	Mariposa,Ops,Fenlon,Verulam
4005	Rest of Victoria
4100	Innsfil&Bradford-West Gwillimbury
4101	Essa,Adjala-Tosorontio&New Tecumseth
4102	City of Barrie
4103	Rest of Simcoe
4104	Orillia&Ramara
4201	Orangeville
4202	Rest of Dufferin
4301	Guelph(C&T),Puslinch
4302	Erin(T&V) & Eramosa
4303	Rest of Wellington
4401	Cambridge
4402	Rest of Waterloo
4403	County of Brant
4404	Haldimand-Norfolk
4405	Grimsby&Lincoln
4406	St Catharines,Niagara-O-T-L,Niagara Falls,Thorold, Fort Erie
4407	Welland&Port Colborne
4408	Rest of Niagara
4409	401 Gateway
4410	USA Gateway

All two-dimensional arrays within GTAModel are based on the "extended centroid" system, which consists of actual zone centroids (internal and external to the GTA), augmented by GO-Rail and subway park & ride stations. Figure 2.1 displays the structure of the resulting "extended O-D matrix". Zone labels 7000-7999 are reserved for GO-Rail station centroids, while zone labels 6000-6999 are reserved for subway park & ride stations.

The majority of arrays contained within the databank only contain valid data for the 1677 internal GTA zone centroids (i.e., within "Section A" of the extended O-D matrix shown in Figure 2.2). Given this, matrix calculations that relate strictly to zonal data should always be performed on a "sub-matrix" basis which restricts the calculations to the 1677 zone centroids (i.e., select the "sub-matrix calculation" option with the zone label range 1-2670). This ensures computational efficiency as well as eliminates the possibility of inappropriately including the station centroids (and/or external zones) in the calculations. Table 2.5 lists the matrices which make use of the "extended" portions of their array space, along with the definitions of the data stored in these "extended" portions.

Table 2.5
Matrices Using "Extended" Portions of Their Array Space

Matrix Name	Section	Definition
mf01 tivtt	A	Origin zone to destination zone "local" transit time component
mf02 twalk	B	Origin zone to GO access station "local" transit time component
mf03 twait	C	GO egress station to dest. zone "local" transit time component
	E	Subway park & ride access station to destination zone "local" transit time component
mf04 atavg	A	Origin zone to destination zone auto term
mf05 acost	B	Origin zone to GO access station auto term
mf06 atime	F	Origin zone to subway park & ride access station auto term
mf08 totphv		
	A	Origin zone to destination zone "local" transit trips
	B	Origin zone to GO access station "local" transit access trip links
mf09 tot2x	C	GO egress station to dest. zone "local" transit egress trip links
	D	GO station-to-station trip links
	E	Subway park & ride access to dest. zone transit trip links

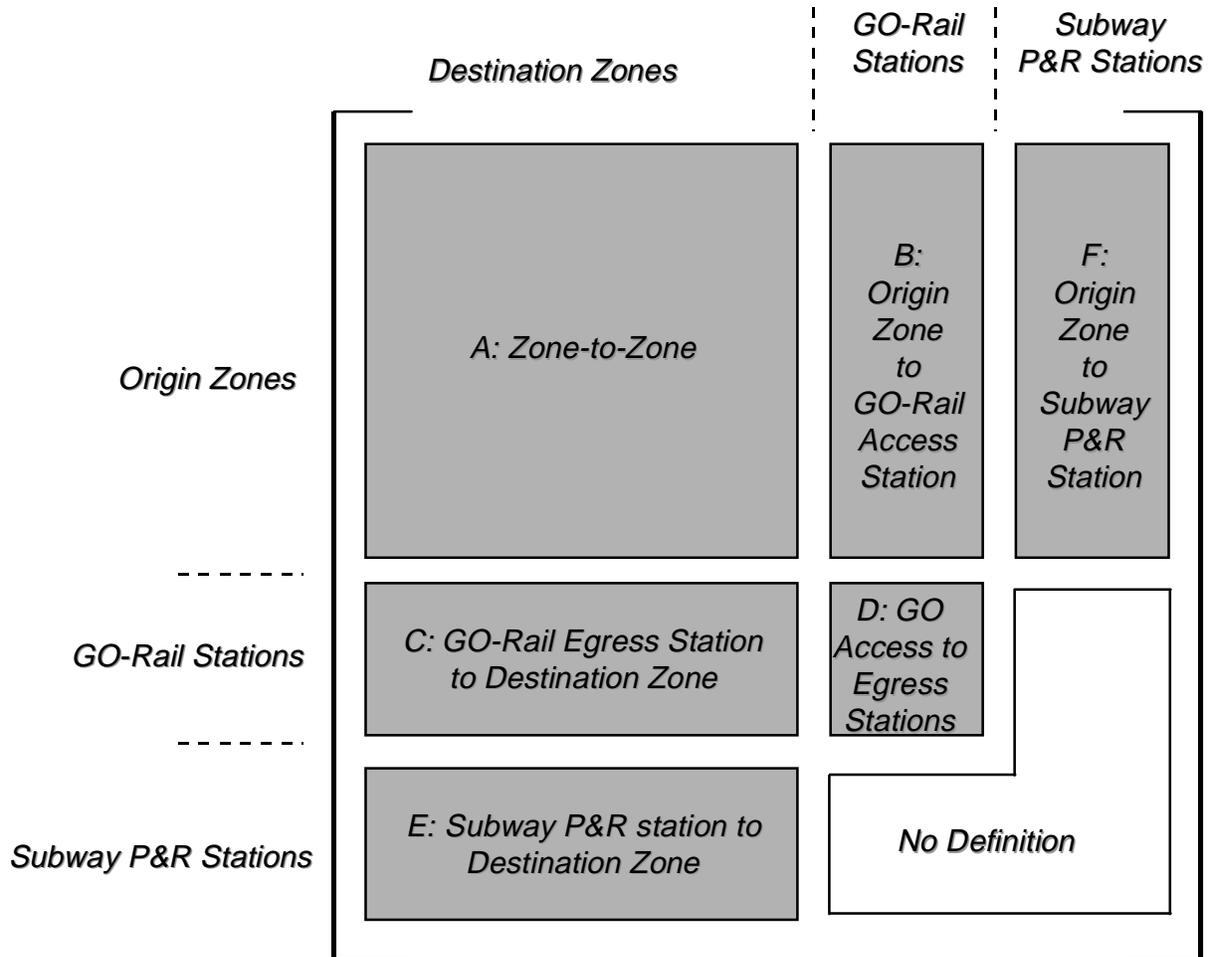


Figure 2.1
Extended O-D Matrix Definition

Table 2.6 summarizes the 1996 GTA zone system plus GTAModel extensions in terms of the number of zones and zone label ranges by type of zone. As shown in this table, two common aggregations of traffic zones are the 6 regional municipalities comprising the GTA and the 46 zone "Planning District" system. These aggregations, along with several others used within the GTA model, are defined within the databank in terms of EMME/2 "zone ensembles". Appendix B provides detailed definitions of all zone ensembles used within GTAModel.

Table 2.6
Summary of GTAModel Zone System

"Zone" Type		Zone Label Range	No. of Zones
Internal Traffic Zone		1-2670	1677
External Zones & Gateways		4000-4410	26
Subway Park & Ride Station Centroids		6000-6999	100 ¹
GO-Rail Station Centroids		7000-7999	100 ¹

Regional Municipality	Number	PD Range	Zone Label Range²	No. of Zones
City of Toronto	1	1 - 16	1 - 463	463
Durham	2	17 - 24	501 - 765	265
York	3	25 - 33	1001 - 1353	353
Peel	4	34 - 36	1501 - 1749	248
Halton	5	37 - 40	2001 - 2179	179
Hamilton-Wentworth	6	41 - 46	2501 - 2670	169

Notes:

1. This indicates the maximum number of station centroids of this type, given current GTAModel software dimensioning. If more than 100 station centroids for either GO-Rail or subway park & ride is ever required, the software can be re-dimensioned and recompiled to accommodate this.
- 2.. Upper value for each municipality range indicates current maximum zone label value within the municipality. The allocated ranges exceed these values.

CHAPTER 3 THE EXTERNAL FILE SYSTEM

3.1 INTRODUCTION

In Version 2.0, most information is stored on disk in fixed-format ASCII data files. Figure 3.1 displays the overall GTAModel directory structure.³ From the general user's point of view, the key points to note about these data files are:

1. Every input data file and model parameter is definable by the user. Every input file has a 1996 default file stored in MODEL/STATIC, while defaults for every parameter are provided in the file .lastrun.par. In the front-end user interface, the user can replace any of these default files or parameters by specifying the new file name or the new parameter value. Section 3.2 defines these input files and parameters by sub-model, and indicates the default files and values in all cases.
2. All GTAModel programs and EMME/2 macros read and write all files from the .temp directory. In the case of all input files, the front-end user interface automatically creates symbolic links from .temp to the actual files, wherever they are located. For intermediate or final output files created by the programs and macros, the actual files created are stored in .temp itself. All symbolic links and actual files located in .temp for a given model run are maintained with the directory until the next model run, at which time they are replaced by the new run's links and files. Section 3.3 discusses the .temp directory in greater detail.
3. "Permanent result files" for a given run are stored in the directory MR.runname, where "runname" is any user-defined name. Section 3.4 discusses this results directory in more detail.
4. The file .lastrun.par conveys to the front-end user-interface program (*gtamodel.out*) all the information required for it to handle all file and parameter manipulations. Its name derives from the fact that when *gtamodel.out* is invoked, the contents read from the file will be the file and parameter definitions for the last run of the model, which can then be updated by the user for the new run. These updated values are then automatically written back to the file by *gtamodel.out* when the model run is initiated.

³ Figure 3.1 indicates that the MODEL directory resides in the same directory as the EMME/2 databank, emme2bank. What MODEL actually consists of is a symbolic link to a system directory within which the GTAModel programs and static (default) files are actually located. This symbolic link is automatically created by the system at the time the user initializes their working directory (see Section 4.3). The result from the user's point of view is the same as if these programs and files were actually located in a directory called MODEL in the user's working directory.

3.2 INPUT FILES AND PARAMETERS

Calculations in GTAModel are executed by 13 Fortran programs, 8 EMME/2 macros and 1 C program. Each program and macro has a number of user-specified input files and parameters. Appendix C documents every input file and parameter in terms of:

- its name⁴ and definition;
- its default file in directory MODEL/STATIC, or, for parameters, its default value; and
- for files, their format structure.

Standard file extensions used are:⁵

- .241 indicates an EMME/2 extra attributes batchin file;
- .311 indicates an EMME/2 batchin file;
- .411 indicates an EMME/2 functions batchin file;
- .par indicates a file containing model run parameters or model coefficients;
- .dat indicates a data input file not in an EMME/2 batchin file format.

All files are fixed-format files with the format for each line of data being defined in Appendix C. EMME/2 batchin files may have any number of comment lines in their header. Model parameter and data files do not have headers of any type, unless explicitly noted in the documentation in Appendix C.

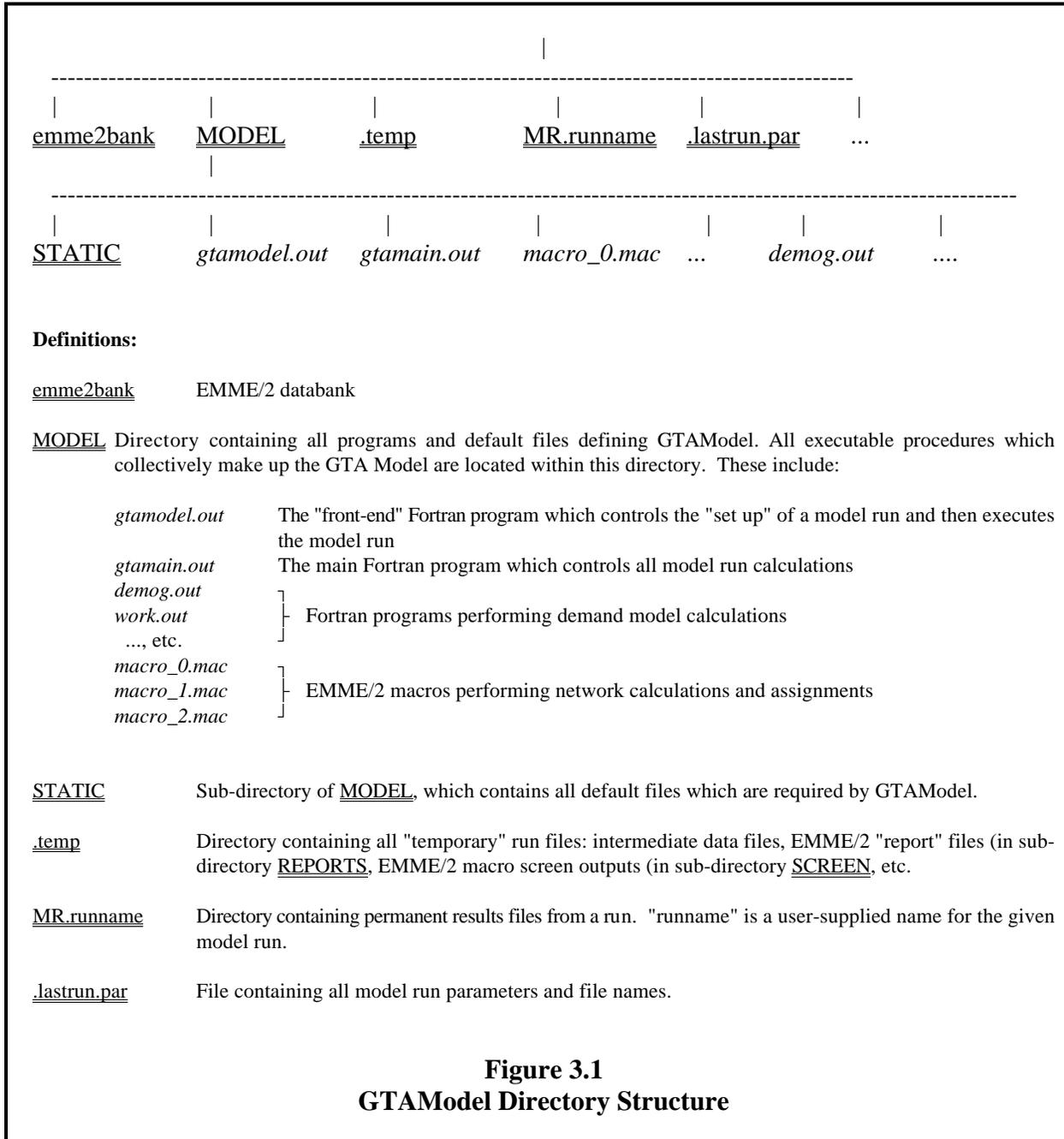
The majority of input files and parameters may never need to be changed from their default values. At a minimum, however, the user will need to specify the total zonal population and employment vectors (pop.311 and emp.311, respectively) for the given forecast year being tested, as well as the number of the network scenario to be tested.

If the user does need/wish to change an input file, then it is up to the user to construct the alternative input file with the desired contents arranged according to the specified file format. The name of this alternative input file is then supplied to GTAModel within the front-end user interface, which ensures that this alternative input file is symbolically linked to the correct .temp file name. Note that you must not edit the default files stored in MODEL/STATIC (indeed, you will not have write permission to these files in any case). Rather, you can copy the default file to an appropriate location within your working space (with an appropriate new name) and edit it as required.

⁴ For files, this is the file name the program or macro looks for in the .temp directory. For parameters, it is the parameter variable name in the program or macro in which it is used.

⁵ Not all data files have .311 or .dat extension. Some possess idiosyncratic names (e.g., mac1out, freq.go, etc.), reflecting the historical evolution of the GTAModel software.

Values of all parameters required by GTAModel can be changed directly within the front-end user interface.



3.3 THE .temp DIRECTORY

As has been discussed above, the .temp directory contains symbolic links to all user-specified input files required by GTAModel programs and macros. In addition, it contains:

1. All "intermediate" files generated as outputs by a program or macro which subsequently become inputs to another program or macro. Most of these files are probably of little interest to the user. An important exception to this general case are EMME/2 batchin files containing home-work O-D flows by mode. Appendix D contains the file names and definitions for these files. Intermediate files may have .311, .par, or .dat extensions, depending on their type. For detailed file formatting, see the file in question and/or the associated program source code.
2. The sub-directory REPORTS, which contains all EMME/2 "reports" files generated by EMME/2 macro operations requested within GTAModel. These files follow the standard naming convention of macroname.rpt, where "macroname" is the name of the EMME/2 macro which generates the given report file.
3. The sub-directory SCREEN, which contains all "screen outputs" generated by the EMME/2 macros. These files have the naming convention of out.macroname.

In the event of an abnormal termination of a model run, the output files saved in the REPORTS and SCREEN sub-directories can prove useful in "debugging" the run termination problem (see Section 4.8). Otherwise, they are little direct use to the user.

The user should never edit or delete any file contained in .temp.

3.4 OUTPUT (PERMANENT RESULTS) FILES

In addition to the various arrays stored in the EMME/2 databank, a number of external results files are stored in a run-specific, user-defined directory MR.runname, where "runname" is a user-defined name supplied by the user within the interactive front end program. Appendix E describes the files stored in MR.runname. These consist of five types of files:

1. The file modelrun.doc. This file provides summary documentation of the model run, including a listing of all input files and model run parameters, summary aggregate results, and a log of the model run execution, step by step. Appendix F provides a sample listing of this file for a base year model run.
2. The file prog2.lst documenting the predicted demand for the three "mixed modes" (modes 3, 4 and 5).

3. EMME/2 batchin files containing predicted origin-destination flows by trip purpose , as well as for trips to/from external zones.
4. Place-of-resident - place-of-work (POR-POW) linkages by occupation group.
5. Miscellaneous summary reports which are generated upon request using the post-run utilities provided within GTAModel (see Chapter 4). These include a comprehensive screen line report, summary reports of predicted trips by various mode-purpose combinations, and summaries of emissions and VKT generated by the predicted auto flows. These latter reports generally use a 10 super-zone aggregation (zone ensemble **gd**). The file name extension for these files is .tab.
5. Summary results files compiled using a user-specified aggregate zone system (the default aggregate zone system is the 46-zone Planning District system, zone ensemble **gb**). The file name extension for these files is .lst.

It is expected that any other run-specific information which the user may wish to export from the databank prior to subsequent model runs would be stored in the MR.runname directory. In particular, note that the "output" arrays in the databank or in .temp are recomputed each model run, and hence any information which the user wishes to save from a given run must be copied elsewhere (e.g., MR.runname) prior to re-executing the model.

CHAPTER 4 RUNNING THE MODEL

4.1 INTRODUCTION

Figure 4.1 presents the flowchart for *gtamain.out*, the Fortran program which controls all GTAModel calculations. The execution of *gtamain.out* is controlled, in turn, by a "front-end" Fortran program, *gtamodel.out*, which provides an interactive user interface for "setting up" a model run and which then invokes *gtamain.out*.

A key feature of the overall model structure is the "outer loop" which causes the major tasks of work trip distribution, work trip mode split and (fixed-demand) road assignment to be performed several times in sequence so as to achieve overall equilibrium among all these stages of the modelling process. The program iterates through this outer loop a user-specified number of times. Experience to date indicates that three outer loop iterations are sufficient to achieve overall convergence of the system.

Section 4.2 discusses the use of the "front end" program in some detail. Section 4.3 then summarizes the steps involved in setting up and running GTAModel. Sections 4.4 - 4.7 deal with various other actions which can be invoked through *gtamodel.out*. Finally, Section 4.8 provides some guidance to the user in the event of an abnormal run termination.

4.2 THE "FRONT END" PROGRAM (*gtamodel.out*)

gtamodel.out is simply invoked by typing its name when working in the directory containing the EMME/2 databank. *gtamodel.out* presents a series of menus to the user which permits the user to control interactively the set of actions which GTAModel is to perform in a given run, and to specify the "input parameters" which control the execution of this run.

The first menu presents the set of actions which can be invoked through *gtamodel.out*. These are:

1. run the full GTA Model;
2. prepare a new network scenario;
3. input data preparation utilities;
4. execute post-run "output" utilities; and
5. quit *gtamodel*.

Options 2 through 4 are discussed further in Sections 4.5 to 4.7, respectively.

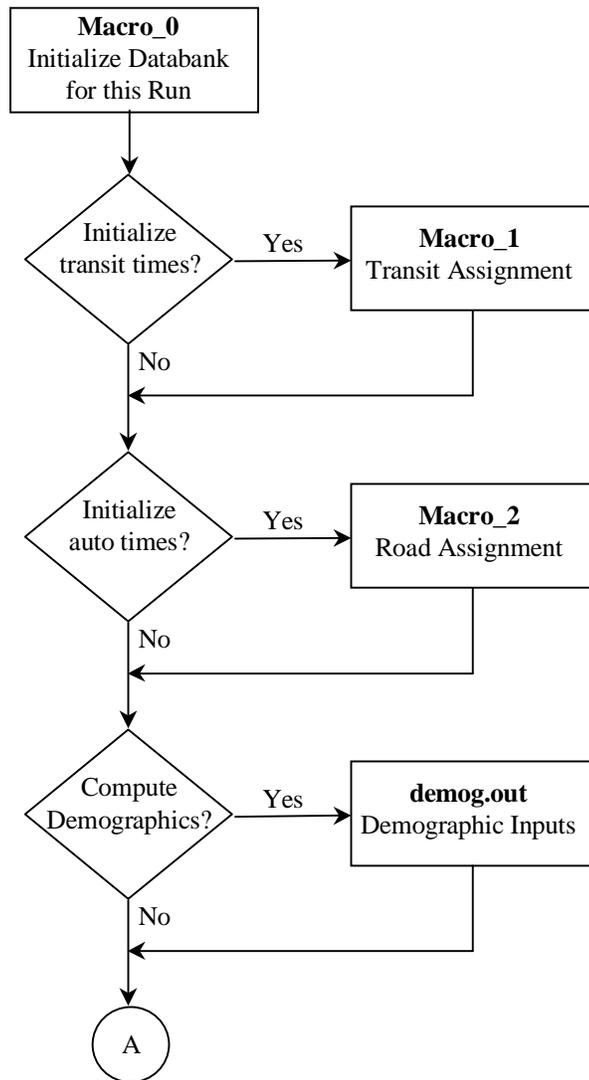


Figure 4.1
gtamain Flowchart

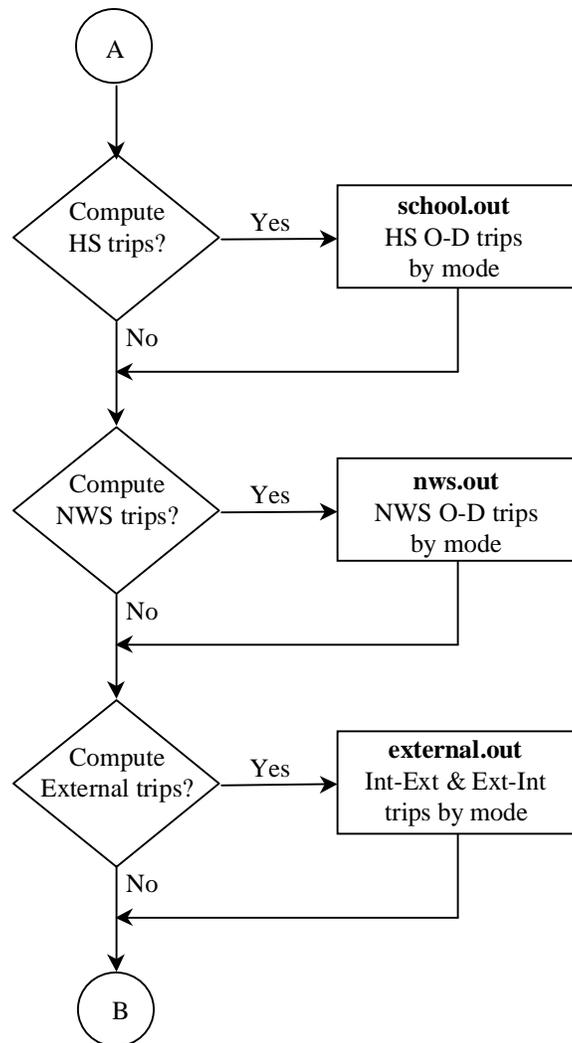


Figure 4.1, cont'd

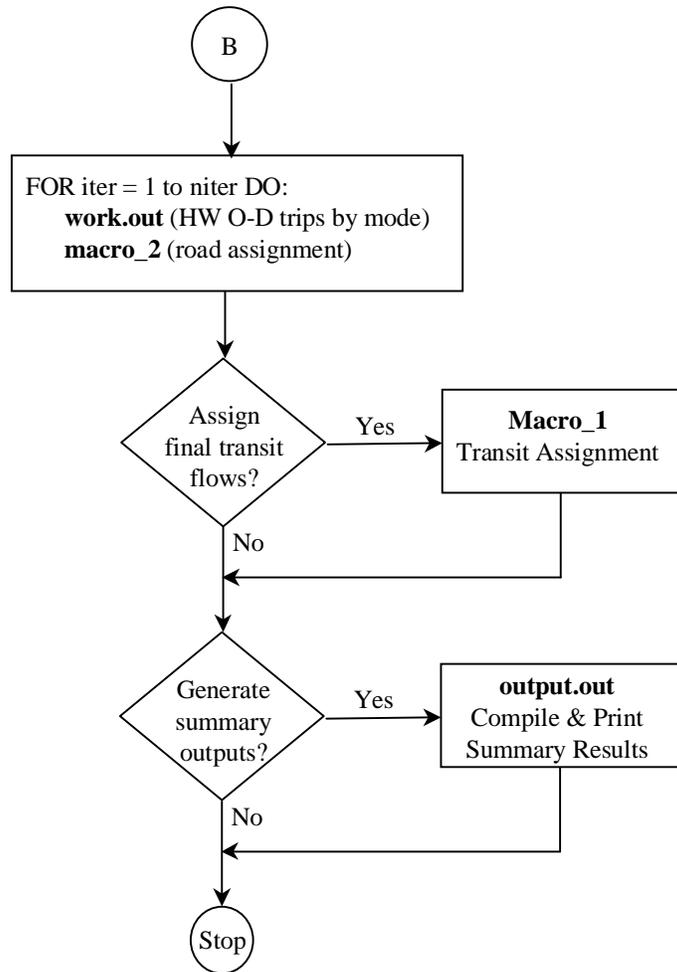


Figure 4.1, cont'd

If Option 1 (run the full model) is selected, a second menu is then displayed which permits the user to select which calculations the full model will perform in this run. This menu displays in the left-most column a task number, then a brief task description, and then a 0-1 flag for this task. In all cases, 0 indicates that the task will not be performed in this run, while a value of 1 indicates that the task will be performed. Selecting any task number automatically “toggles” the task flag from 1 to 0 or *vice versa*. Individual tasks within the modelling system are shown in Table 4.1.

Users will normally want to run the full model system. It is possible, however, to execute selected portions of the full model by setting the flags for the tasks to be executed equal to one and the flags for the tasks that are not to be executed to zero. Selection of less than the full model to run implies that the user has ensured that all data required by the selected individual model components are in place. Essentially this implies that preceding model components have been previously executed and their results are currently active in the EMME/2 databank and the .temp directory.

Table 4.1
GTAModel Tasks Which Can Be Selected
for Individual Execution

Task No.	Description
1	Initial transit assignments (“local transit” and GO-Rail station-to-station) to initialize transit travel times and costs
2	Initial road assignment to initialize road travel times and costs
3	Demographic model (population and employment related calculations; construction of trip rates)
4	Home-to-school model (generation, distribution, mode split)
5	Non-work/school model (generation, distribution, mode split)
6	Trips /to/from external zones model (generation, distribution, mode split)
7	Home-to-work model (POR-POW, generation, mode split)
8	Road network assignment
9	Transit network assignments (“local transit” and GO-Rail)
10	Post-run output utilities

Notes:

1. In Task 2, a user-specified (typically observed) auto-drive matrix is used for the assignment. In Task 8, the model's current estimate of predicted auto-drive trips is used in the assignment.
2. In Task 1, a unit matrix is assignment to the transit network. In Task 9, the final predicted transit O-D flow matrix is assigned.
3. Task 10 causes the post-run output utilities to be executed at model run time. These same utilities can be subsequently invoked through Option 4 of the main menu, see Section 4.7.

Once the user has finished selecting the tasks to be executed, Option 30 within this menu is selected which brings up the next menu to the screen. This menu controls the specification of run parameters, input files, etc. required by the model. User inputs directly defined within this menu are:

1. the number of "outer loop" iterations to be executed within this run;⁶
2. the forecast year for this model run;
3. the file containing the traffic zone to Planning District conversions;
4. the file containing the traffic zone to aggregate zone system to be used for output summary matrices (this can also be the 46-zone Planning District system);
5. the name of the directory for storing model run result outputs (MR.runname, where runname is user-defined); and
6. a brief comment line documenting the run (maximum, 80 characters).

Selecting Option 10 from this menu takes the user to the sub-model parameter and file specification menu. For each sub-model requested for execution which has user-defined input files and/or parameters, the user can select the sub-model parameter menu by typing the sub-model number listed. All input files and parameters for the selected sub-model are then displayed, along with their current settings (as defined for the last run of the model). The user can then change any of these input file names or parameter values by selecting the appropriate file/parameter numbers and then entering the new name/value when prompted by the program to do so.

In all cases, the settings from the previous run are stored and then displayed as the "default" settings for the next run. Only those entries which need to be changed from the last run need to be entered by the user. Further, only those entries required for the set of tasks selected for execution will be displayed in this menu (e.g., if the home-to-school model is not going to be executed, then the user will not be asked to specify school trip related files). The program also checks to ensure that the files (and pathnames) specified are valid before proceeding. **Note that for user-defined files, the full pathnames must be specified, even if the file is resident in the working directory.**

Once the user is satisfied with the parameter settings selected, the user can return to the model parameters menu and request the model run to be executed. The model run control program, *gtamain.out* is then invoked by the front-end program, which then terminates (after storing this run's parameter values in lastrun.par). *gtamain.out* is executed in background mode, with the user being returned to the Unix operating system.

4.3 SETTING UP THE MODELLING SYSTEM/INITIALIZING A NEW DATABANK

To set up GTAModel for the first time in your working directory, simply do the following.

⁶ Note that if Task 8, road assignment is not requested, then the number of outer loop iterations is automatically set equal to 1.

1. Create a new databank in the normal way in the working directory. See Table 2.1 for suggested databank specifications.
2. Run the program */GTAMODEL/gtasetup.out*. This program will automatically perform the following tasks:
 - initialize all matrices required by GTAModel within your EMME/2 databank;
 - import all zone ensembles required by GTAModel (see Appendix B for definitions);
 - create Scenario 31, which is used in GTAModel road assignment macros;
 - create a directory called MODEL in your working directory which is linked with the most recent version of GTAModel;
 - create the .temp directory and load it with all default input files required by GTAModel; and
 - create an initial version of the .lastrun.par file containing all input files and parameters required to run GTAModel using default values.

The modelling system is now ready to run from your working directory by following the steps described in Section 4.4 below.

4.4 STEPS IN RUNNING THE MODEL

Steps in setting up a run of the GTAModel are as follows.

1. Prepare the forecast year integrated network scenario (see Section 4.5).
2. Prepare all user-defined input files required for this run (see Section 4.6).
3. Once all data manipulations require for setting up the run have been performed, use the "front-end" interactive run control program described in detail in Section 4.2. Select the desired run options, specify the run parameters requested, and, when ready, execute *gtamain.out* from within *gtamodel.out*.

4.5 PREPARING A NEW NETWORK SCENARIO

The following check list should be followed in preparing a new network scenario.

1. Code the forecast year integrated network scenario to be analyzed within EMME/2 according to normal procedures as defined in [DMG, 1998b].
2. If the GTAModel extra attributes described in Table 2.3 do not exist in the new scenario, use Option 3, "Compute link extra attributes" of the "Prepare new scenario" menu within

gtamodel.out to create these link extra attributes. If the new scenario has been copied from a previous scenario, ensure that any new links have auto travel costs, screenline codes and (if required) tolls attached in the relevant extra attributes.

3. Code any new GO-Rail or subway park & ride station "centroids" as per the instructions in Section 2.2.1, paying special attention to the centroid user fields required for each new station, as documented in Table 2.2. Option 2, "Create rail station centroids & connectors", in the "Prepare new scenario" menu of *gtamodel.out* may be used to connect new station centroids to the existing network, or the user may perform these tasks manually.
4. **If any GO-Rail or subway park & ride stations have been added to the network then the user-input matrices listed in Table 4.2 must be updated to include information for the new stations (see also Appendix C).**
5. Make any necessary changes to the transit fare matrix (**mf04**) required for this run.⁷

Table 4.2
Input Files Containing Rail Station Information

Description	1996 Default File	Program Name
GO-Rail Frequency Matrix	MODEL/STATIC/freq_96.311	.temp/freq.go
GO-Rail Station-Station Fare Matrix	MODEL/STATIC/gofare_96.311	.temp/gfare.311
GO-Rail Station Data File	MODEL/STATIC/gosta_96.dat	.temp/gosta.dat
GO-Rail Line Data File	MODEL/STATIC/golines_96.dat	.temp/golines.dat
GO-Rail Free Transfer File	MODEL/STATIC/trfree_96.dat	.temp/trfee.dat
Mode 3,5 Auto Occupancies	MODEL/STATIC/aocc35_96.311	.temp/aoc35.311

4.6 INPUT DATA PREPARATION

In addition to any rail station related files discussed in Section 4.5, prepare any other new user input files required for this run as per Section 3.3 and Appendix C. At a minimum, these will consist of forecast year zonal population and employment projections.

The main menu option "input data preparation utilities" currently has only one active option which enables the user to construct the input files required to define a new aggregate zone system

⁷ Note that the "Prepare new scenario" menu, Option 4, "Create a transit fare matrix", which is intended to assist in the development of new transit fare matrices, is not operational at time of preparation of this manual.

for model output purposes. Note that in order to define these files, the aggregate zone system must exist as an EMME/2 zone ensemble, and this zone ensemble must have been “batched out” from the databank.

4.7 POST-PROCESSING RESULTS

Table 4.3 lists the post-run processing procedures currently available within GTAModel. It is expected that several other standard post-run processing procedures will be added over time to this section of system. These model run outputs may be generated in two ways. First, they can be requested as part of a normal model run, as Option 10, “Summary outputs” in the “Run model” menu of *gtamodel.out*. Second, they can be generated at any time after the model has been run by means of Option 4, “Output utilities” of the main menu of *gtamodel.out*.

Procedure No.	Description
1	Generate summary of predicted place-of-residence - place-of-work (POR-POW) linkages
2	Generate summary of predicted O-D home-to-work flows by mode
3	Compute predicted road and transit screenline counts
4	Compute morning peak-period vehicle kilometres travelled (VKT) by auto-drive trips
5	Compute morning peak-period auto emissions (CO, HC, NO _x , CO ₂)
6	Compute 24-hour weekday VKT based on observed TTS flows (i.e., not based on GTAModel forecast results)

The “Output utilities” menu contains two options not available from the run-time “Summary outputs” menu. First, one can use Option 2, “Change screenline defaults & run screenline program”, to change the parameters of the screenline procedure (e.g., the screenline code extra attribute name) to be used in the given screenline calculation.

Second, Option 3, “24-hour VKT calculations”, generates an estimate of total weekday VKT for the GTA based on observed TTS 24-hour auto-drive trips. Currently, VKT calculations are supported for 1986 and 1996. Note that this procedure requires considerable preparation of input files (which has been done for 1986 and 1996, with the resulting input files being located in

MODEL/STATIC). For further documentation on the 24-hour VKT calculation, see Miller [2001].

Table 4.4 provides a typical report page generated by the output utilities summarizing predicted O-D flows by mode at the 10-zone aggregation level (see Appendix B for definition of the 10-zone system). As illustrated in this table, the predicted flows can be compared with the same flows from a user-specified "base case", with both absolute and percentage differences being computed. To request that this comparison be performed, the user must specify the file containing the relevant base case data when selecting the given report option, as well as explicitly "turning on" the "compare to base case" flag within the post-run output utility parameter menu.

If the "forecast year" is actually the model base year (i.e., 1996), then observed TTS data can be used to define the base case. Table 4.5 lists the files available for 1996 which can be used for this purpose. If the forecast year is in the future (and so observed data are not available for comparison), the results from this run can, if the user wishes, be compared with those from some other run, which is treated as the "base case" for this purpose. The data text file generated for the other "base" run is in this case the relevant file to be used. Thus, for example, if the current model run home-to-work mode split results are to be compared with those from a run stored in the directory MR.someOtherRun, then the relevant file containing the "base case" data will be MR.someOtherRun/hw_mode_occ.lst.

Similarly, the emissions calculations involve comparison to a "base case", which can be the default 1996 base stored in MODEL/STATIC, or the results from another run. In the latter case, the user must specify the relevant file in the Output Utilities parameter list during model setup. If other run is stored in MR.someOther Run, then relevant file will be MR.someOtherRun/emissions.tab.

4.8 TROUBLE-SHOOTING ABNORMAL RUN TERMINATIONS

Ideally a model run should never terminate abnormally. Abnormal terminations, do, however, occasionally occur, usually because of some problem with network coding, omitted or incorrect input data, etc. The most common point for the model run to terminate abnormally is during the execution the Fortran program, *work.out*, which performs all calculations for the home-to-work trip model, which is by far the most complicated portion of the GTAModel software system.

To determine the cause of an abnormal termination, first check the modelrun.doc file in the model results directory MR.runname. It will contain a message documenting the execution of each major task successfully undertaken by *gtamain.out*. This file usually should indicate at what point in the program failure occurred. In addition, a file should exist in the working directory called check.error. This file will contain an error message indicating the GTAModel program or macro

Table 4.4 Sample Post-Run Report

SUMMARY O-D FLOWS FOR 10 SUPER ZONES, OCCUPATION GROUP = P HOME-WORK TRIPS, MODE = Auto Passenger (Mode 1)												
	PD1	PD2-6	ETOB	NORTH	SCAR	TORONTO	DURH	YORK	PEEL	HALTON	HAM-W	TOTAL
PD1	609	151	47	62	47	915	23	209	245	35	3	1428
PD2-6	3417	1996	509	803	564	7289	52	699	457	22	1	8519
ETOB	518	314	500	226	94	1652	3	89	616	36	2	2397
NORTH	501	432	168	567	217	1885	24	477	170	4	0	2560
SCAR	675	685	170	470	892	2892	201	429	47	1	0	3570
TORONTO	5719	3578	1395	2128	1814	14633	302	1903	1534	98	5	18475
DURH	199	172	34	148	307	860	1463	409	163	9	1	2906
YORK	593	498	208	650	416	2364	183	1774	511	37	7	4876
PEEL	634	421	653	356	108	2172	45	367	3212	411	100	6307
HALTON	239	82	131	58	19	529	12	78	739	1023	391	2771
HAM-W	27	14	22	9	3	74	3	19	263	402	1885	2647
TOTAL	7412	4765	2441	3348	2666	20631	2009	4550	6422	1980	2390	37983
DIFFERENCES RELATIVE TO FLOWS IN FILE: .temp/hwmsobs.dat												
	PD1	PD2-6	ETOB	NORTH	SCAR	TORONTO	DURH	YORK	PEEL	HALTON	HAM-W	TOTAL
PD1	-192	31	29	-85	7	-210	23	191	157	12	3	173
PD2-6	-274	-102	200	-27	195	-9	-2	284	156	-38	1	389
ETOB	-28	-33	-20	84	94	95	-38	70	432	36	2	595
NORTH	-20	-213	61	-231	81	-324	24	97	65	4	0	-133
SCAR	-250	-268	150	128	-508	-749	120	-185	-66	1	0	-881
TORONTO	-767	-588	419	-133	-130	-1202	126	455	744	14	5	141
DURH	-250	-122	15	28	-272	-603	-490	87	106	9	1	-891
YORK	-404	-16	122	-135	75	-361	183	-217	416	37	7	63
PEEL	-285	105	-206	96	44	-247	28	231	-768	294	57	-407
HALTON	-59	-3	67	-19	19	3	12	59	232	-246	246	305
HAM-W	-68	-4	-20	-11	3	-104	3	0	181	-40	-592	-553
TOTAL	-1838	-632	395	-176	-263	-2517	-138	614	909	65	-276	-1344
PERCENT DIFFERENCES RELATIVE TO FLOWS IN FILE: .temp/hwmsobs.dat												
	PD1	PD2-6	ETOB	NORTH	SCAR	TORONTO	DURH	YORK	PEEL	HALTON	HAM-W	TOTAL
PD1	-23	0	0	0	0	-18	0	0	0	0	0	14
PD2-6	-6	-4	65	-2	53	0	0	68	52	0	0	5
ETOB	-4	-9	-3	0	0	6	0	0	0	0	0	33
NORTH	-3	-32	0	-28	0	-14	0	26	0	0	0	-4
SCAR	-26	-27	0	37	-35	-20	0	-29	0	0	0	-19
TORONTO	-11	-13	43	-5	-6	-7	0	31	94	0	0	1
DURH	-55	-41	0	0	-46	-40	-24	27	0	0	0	-22
YORK	-40	-2	0	-16	22	-12	0	-10	0	0	0	1
PEEL	-30	33	-23	37	0	-9	0	0	-18	0	0	-5
HALTON	-19	0	0	0	0	1	0	0	46	-18	0	12
HAM-W	0	0	0	0	0	0	0	0	0	-8	-23	-16
TOTAL	-19	-11	19	-4	-8	-10	-5	16	16	3	-9	-2

Table 4.5
Base 1996 Files for Use in Post-Run Utilities

Report	1996 Base File
POR-POW linkages by occupation	<u>MODEL/STATIC/prwobs_96.dat</u>
Home-Work trips by mode and occupation	<u>MODEL/STATIC/hwmsobs_96.dat</u>
Emissions by region and link type	<u>MODEL/STATIC/emissions_96.dat</u>

within which the run time error occurred. Note that checks are executed at each stage of the GTAModel process to ensure that each program or macro has terminated successfully. If any such check fails, GTAModel terminates at that point and prints the check.error file.

The files in the directory .temp/SCREEN contain "dialogue" and other "screen" output files for the individual EMME/2 macros which have been executed. If the run terminated during execution of one of the program macros, then examination of this file should indicate the exact point in the macro at which failure occurred. Similarly the EMME/2 "reports" files contained in .temp/REPORTS can also prove useful in tracing problems within execution of the EMME/2 macros. Finally, the files .temp/macXout (EMME/2 batchout file containing modal times and cost used to compute mixed mode utilities in *work.out*; X=1, transit access/egress times; X=2, GO-Rail line-haul times; X=3, GO-Rail and subway park & ride auto access times and costs) often are the source of program run time errors due to mis-coding of GO-Rail and/or subway park & ride station centroids.

Unfortunately, the relationship between an abnormal termination and an input data or network coding error may not be immediately apparent. For example, failure to connect a centroid to the road network may lead to asterisks showing up in an EMME/2 batchout file (e.g., .temp/mac3out) that eventually causes *work.out* to crash while reading this file.

If GTAModel terminates abnormally, several intermediate files may exist which would normally be deleted by the program. In addition, a core-dump file, core will usually exist in the working directory. Once the run time error has been diagnosed, these files can all be erased by executing the shell script MODEL/cleanup.shell.

Finally, note that if the abnormal termination occurred within an EMME/2 macro, the user should enter EMME/2 and ensure that no matrices or other data stored within the databank have been corrupted. In particular, note that abnormal termination during a transit assignment can leave the transit travel matrices in a transposed state. These matrices must be re-transposed back to their normal state prior to re-executing the model. Also the command echo switch (15) should be set to off prior to re-running the model (i.e., enter the command *off=15* within EMME/2).

REFERENCES

Data Management Group [1998a] *1996 GTA Zone Boundaries*, Toronto: University of Toronto Joint Program in Transportation, January.

Data Management Group [1998b] *GTA A.M. Peak Hour Network Coding Standard, Part I - Notation*, Toronto: University of Toronto Joint Program in Transportation, May.

INRO Consultants Inc. [1999] *EMME/2 User's Manual, Software Release: 9.0*, Montreal: August.

Miller, E.J. [2001] *A Procedure for Estimating 24-Hour VKT in the GTA from TTS Data*, Toronto: University of Toronto Joint Program in Transportation, January.

APPENDIX A

EMME/2 Matrices

A: SCALARS

ms01: wtovtt	00-05-15 23:22	ovtt factor	2
ms02: phf	01-01-04 12:08	period to hour conversion factor	.405
ms03: unit	00-03-22 17:00	unit value for transit assignment	1
ms04: acostf	01-01-04 12:08	auto unit travel cost (\$/km)	.0605
ms05: itmax	00-11-22 00:16	max. no. of iterations	20
ms06: iscen	01-01-04 12:08	network scenario no.	1
ms07: pkhrau	01-01-04 12:17	peak-hour auto trips	1154
ms08: avgtme	01-01-04 12:17	avg. pk-hr O-D veh. travel time	9.63911
ms09: avtm2	00-11-22 05:18	avg. travel time, last 2 iterations	20.498
ms10: rflag	00-11-22 00:16	.temp/basedrive.311	0
ms11: rflag	00-11-22 00:16	.temp/vdf.411	0
ms12: minp\$	00-11-22 00:16	time value of money for tolls	5.882353
ms13: bcost	01-01-04 12:08	base auto unit travel cost (\$/km)	.0605
ms14: totm2	00-11-22 05:24	total transit allway trips (mode 2)	38011.6
ms15: totm3	00-11-22 05:24	total subway p&r trips (mode 3)	18776.9472
ms16: goacc	00-11-22 05:24	trans. acc. trips to GO(mode 4)	1379.1
ms17: goegr	00-11-22 05:24	transit egress trips from GO(4+5)	43489.5
ms20: perthr	00-08-02 17:04	Period to hour VKT conversion factor	.405
ms21: vkttot	01-01-04 12:19	Total VKT	13128107
ms22: totadr	01-01-04 12:19	total auto-drive person trips	1154832
ms23: avgvkt	01-01-04 12:19	average VKT/capita	3.171127
ms24: intraz	00-09-26 01:43	total intrazonals	6028

B: 2-D ARRAYS

mf01: tivtt	00-05-15 01:13	transit in-vehicle time (min.)
mf02: twalk	00-05-15 01:13	transit walk (aux. tr.) time (min.)
mf03: twait	00-05-15 01:13	transit wait time (min.)
mf04: aivtt	00-05-15 01:01	auto avg. travel time (min.)
mf05: acost	00-05-15 01:00	auto "in-vehicle" travel cost (1996 \$)
mf06: atime	00-05-15 01:00	auto travel time this iteration (min.)
mf07: work07	00-03-22 16:59	working array
mf08: totphv	00-05-14 23:49	total auto pk-hr vehicle trips
mf09: tot2x	00-05-15 01:15	ext. transit trips (trip link version)
mf10: totdr	00-05-14 23:49	total auto-drive trips
mf11: work11	00-05-14 23:46	working array
mf12: work12	00-05-14 23:48	working array
mf13: work13	00-05-14 23:48	working array
mf14: work14	00-05-14 23:48	working array
mf15: work15	00-05-15 01:05	working array
mf16: work16	00-05-15 01:06	working array
mf17: work17	00-05-15 01:06	working array
mf18: work18	00-05-15 01:06	working array
mf19: work19	00-03-22 17:00	working array
mf20: work20	00-05-15 01:14	working array

APPENDIX B

GTAModel ZONE ENSEMBLE DEFINITIONS

Ensemble	Definition	Page No.
ga	User-specified zone system (not currently required by GTAModel)	
gb	46-zone planning district system	66
gc	6-zone regional municipality system	69
gd	10-zone results aggregation system	69
ge	Local municipalities (including old local municipalities within the amalgamated City of Toronto)	

ENSEMBLE GA: USER-DEFINED ZONE SYSTEM

This zone ensemble is defined by the user. It is not currently required by Version 2.0 of GTAModel.

ENSEMBLE GB: 46 ZONES; PLANNING DISTRICTS

```
t groups init
a gb:      46 zone Planning Districts
a gb01:    153    154    187    188    193    194    195    201    202
a gb01:    203    204    205    206    207    208    209    210    211
a gb01:    212    213    214    215    216    217    218    219    220
a gb01:    221    222    223    224    225    226    227    228    229
a gb01:    230    231    232    233    234    235    236    237    238
a gb01:    239    240    241    242    243    244    245    246    247
a gb01:    248    249    250    251    252    253    359    360
a gb02:    129    130    131    140    141    142    143    144    145
a gb02:    146    147    148    149    150    151    152    155    156
a gb02:    157    158    159    160    161    162    163    164    165
a gb02:    166    168    169    172    173    174    180    181    182
a gb03:     69     80     81     82     83     84     85    101    102
a gb03:    103    113    114    115    116    117    118    119    120
a gb03:    121    122    123    124    125    126    127    128    132
a gb03:    133    134    135    136    137    138    139    167    170
a gb03:    171    175    176    177    178    179    183    295
a gb04:    104    105    184    185    186    189    190    191    192
a gb04:    196    197    198    199    200    267    268    278    279
a gb04:    280    281    282    283    284    285    286    287    288
a gb04:    289    290    291    292    293    294    297    299    303
a gb05:    300    301    302    304    305    306    344    345    346
a gb05:    347    348    349    350    351    352    353    354
a gb06:    254    255    256    257    258    259    260    261    262
a gb06:    263    264    265    266    269    270    271    272    273
a gb06:    274    275    276    277    355    356    357    358    361
a gb06:    362    363    364    365    366    367    368    369    370
a gb07:     1     2     6     7     8     9    10    15    16
a gb07:    17    18
a gb08:     3     4     5    11    12    13    14    19    20
a gb08:    21    22    23    24    25    26    27    28    29
a gb08:    30    31    32    33    34    35    36    37    38
a gb08:    39    40    41    42    43    44    45    46    47
a gb09:    48    49    50    51    52    53    54    55    56
a gb09:    57    58    59    60    61    62    63    64    65
a gb09:    66    67    68
a gb10:    70    71    72    73    74    75    76    77    78
a gb10:    79    86    87    88    89    90    91    92    93
a gb10:    94    95    96    97    98    99    100    108    109
a gb11:   106   107   110   111   112   296   298   307   308
a gb11:   309   310   311   312   313   314   315   316   317
a gb11:   318   319   320   321   322   323   324   325   326
a gb11:   327
a gb12:   328   329   330   331   332   333   334   335   336
a gb12:   337   338   339   340   341   342   343
a gb13:   390   391   392   393   394   395   396   399   400
a gb13:   401   410   411   412   413   414   415   416   417
a gb13:   418   419   420   421   422   423   424   425   426
a gb13:   427   428   450   451   452   453   454
a gb14:   397   398   402   403   404   405   406   407   408
a gb14:   409
a gb15:   447   448   449   455   456   457   458   459   460
a gb15:   461   462   463
a gb16:   371   372   373   374   375   376   377   378   379
a gb16:   380   381   382   383   384   385   386   387   388
a gb16:   389   429   430   431   432   433   434   435   436
a gb16:   437   438   439   440   441   442   443   444   445
a gb16:   446
a gb17:   753   754   755   756   757   758   759   760   761
a gb17:   762   763   764   765
a gb18:   741   742   743   744   745   746   747   748   749
a gb18:   750   751   752
a gb19:   726   727   728   729   730   731   732   733   734
a gb19:   735   736   737   738   739   740
a gb20:   501   502   503   504   505   506   507   508   509
a gb20:   510   511   512   513   514   515   516   517   518
a gb20:   519   520   521   522   523   524   525   526   527
```

a	gb20:	528	529	530	531	532	533	534	535	536
a	gb20:	537	538	539	540	541	542	543	544	545
a	gb21:	546	547	548	549	550	551	552	553	554
a	gb21:	555	556	557	558	559	560	561	562	563
a	gb21:	564	565	566	567	568	569	570	571	572
a	gb21:	573	574	575						
a	gb22:	576	577	578	579	580	581	582	583	584
a	gb22:	585	586	587	588	589	590	591	592	593
a	gb22:	594	595	596	597	598	599	600	601	602
a	gb22:	603	604	605	606	607	608	609	610	611
a	gb22:	612	613	614	615	616	617	618	619	620
a	gb23:	621	622	623	624	625	626	627	628	629
a	gb23:	630	631	632	633	634	635	636	637	638
a	gb23:	639	640	641	642	643	644	645	646	647
a	gb23:	648	649	650	651	652	653	654	655	656
a	gb23:	657	658	659	660	661	662	663	664	665
a	gb23:	666	667	668	669	670				
a	gb24:	671	672	673	674	675	676	677	678	679
a	gb24:	680	681	682	683	684	685	686	687	688
a	gb24:	689	690	691	692	693	694	695	696	697
a	gb24:	698	699	700	701	702	703	704	705	706
a	gb24:	707	708	709	710	711	712	713	714	715
a	gb24:	716	717	718	719	720	721	722	723	724
a	gb24:	725								
a	gb25:	1332	1333	1334	1335	1336	1337	1338	1339	1340
a	gb25:	1341	1342	1343	1344	1345	1346	1347	1348	1349
a	gb25:	1350	1351	1352	1353					
a	gb26:	1308	1309	1310	1311	1312	1313	1314	1315	1316
a	gb26:	1317	1318	1319	1320	1321	1322	1323	1324	1325
a	gb26:	1326	1327	1328	1329	1330	1331			
a	gb27:	1248	1249	1250	1251	1252	1253	1254	1255	1256
a	gb27:	1257	1258	1259	1260	1261	1262	1263	1264	1265
a	gb27:	1266								
a	gb28:	1230	1231	1232	1233	1234	1235	1236	1237	1238
a	gb28:	1239	1240	1241	1242	1243	1244	1245	1246	1247
a	gb29:	1104	1105	1106	1107	1108	1109	1110	1111	1112
a	gb29:	1113	1114	1115	1116	1117	1118	1119	1120	1121
a	gb29:	1122	1123	1124	1125	1126	1127	1128	1129	1130
a	gb29:	1131	1132	1133	1134	1135	1136	1137	1138	1139
a	gb29:	1140	1141	1142	1143	1144	1145	1146		
a	gb30:	1291	1292	1293	1294	1295	1296	1297	1298	1299
a	gb30:	1300	1301	1302	1303	1304	1305	1306	1307	
a	gb31:	1147	1148	1149	1150	1151	1152	1153	1154	1155
a	gb31:	1156	1157	1158	1159	1160	1161	1162	1163	1164
a	gb31:	1165	1166	1167	1168	1169	1170	1171	1172	1173
a	gb31:	1174	1175	1176	1177	1178	1179	1180	1181	1182
a	gb31:	1183	1184	1185	1186	1187	1188	1189	1190	1191
a	gb31:	1192	1193	1194	1195	1196	1197	1198	1199	1200
a	gb31:	1201	1202	1203	1204	1205	1206	1207	1208	1209
a	gb31:	1210	1211	1212	1213	1214	1215	1216	1217	1218
a	gb31:	1219	1220	1221	1222	1223	1224	1225	1226	1227
a	gb31:	1228	1229							
a	gb32:	1267	1268	1269	1270	1271	1272	1273	1274	1275
a	gb32:	1276	1277	1278	1279	1280	1281	1282	1283	1284
a	gb32:	1285	1286	1287	1288	1289	1290			
a	gb33:	1001	1002	1003	1004	1005	1006	1007	1008	1009
a	gb33:	1010	1011	1012	1013	1014	1015	1016	1017	1018
a	gb33:	1019	1020	1021	1022	1023	1024	1025	1026	1027
a	gb33:	1028	1029	1030	1031	1032	1033	1034	1035	1036
a	gb33:	1037	1038	1039	1040	1041	1042	1043	1044	1045
a	gb33:	1046	1047	1048	1049	1050	1051	1052	1053	1054
a	gb33:	1055	1056	1057	1058	1059	1060	1061	1062	1063
a	gb33:	1064	1065	1066	1067	1068	1069	1070	1071	1072
a	gb33:	1073	1074	1075	1076	1077	1078	1079	1080	1081
a	gb33:	1082	1083	1084	1085	1086	1087	1088	1089	1090
a	gb33:	1091	1092	1093	1094	1095	1096	1097	1098	1099
a	gb33:	1100	1101	1102	1103					
a	gb34:	1688	1689	1690	1691	1692	1693	1694	1695	1696
a	gb34:	1697	1698	1699	1700	1701	1702	1703	1704	1705
a	gb34:	1706	1707	1708	1746					

a	gb35:	1623	1624	1625	1626	1627	1628	1629	1630	1631
a	gb35:	1632	1633	1634	1635	1636	1637	1638	1639	1640
a	gb35:	1641	1642	1643	1644	1645	1646	1647	1648	1649
a	gb35:	1650	1651	1652	1653	1654	1655	1656	1657	1658
a	gb35:	1659	1660	1661	1662	1663	1664	1665	1666	1667
a	gb35:	1668	1669	1670	1671	1672	1673	1674	1675	1676
a	gb35:	1677	1678	1679	1680	1681	1682	1683	1684	1685
a	gb35:	1686	1687	1717	1718	1719	1720	1721	1722	1723
a	gb35:	1724	1725	1726	1727	1728	1729	1730	1731	1732
a	gb35:	1733	1734	1735	1736	1737	1738	1739	1740	1741
a	gb35:	1742	1743	1744	1745	1747	1748	1749		
a	gb36:	1501	1502	1503	1504	1505	1506	1507	1508	1509
a	gb36:	1510	1511	1512	1513	1514	1515	1516	1517	1518
a	gb36:	1519	1520	1521	1522	1523	1524	1525	1526	1527
a	gb36:	1528	1529	1530	1531	1532	1533	1534	1535	1536
a	gb36:	1537	1538	1539	1540	1541	1542	1543	1544	1545
a	gb36:	1546	1547	1548	1549	1550	1551	1552	1553	1554
a	gb36:	1555	1556	1557	1558	1559	1560	1561	1562	1563
a	gb36:	1564	1565	1566	1567	1568	1569	1570	1571	1572
a	gb36:	1573	1574	1575	1576	1577	1578	1579	1580	1581
a	gb36:	1582	1583	1584	1585	1586	1587	1588	1589	1590
a	gb36:	1591	1592	1593	1594	1595	1596	1597	1598	1599
a	gb36:	1600	1601	1602	1603	1604	1605	1606	1607	1608
a	gb36:	1609	1610	1611	1612	1613	1614	1615	1616	1617
a	gb36:	1618	1619	1620	1621	1622	1709	1710	1711	1712
a	gb36:	1713	1714	1715						
a	gb37:	2149	2150	2151	2152	2153	2154	2155	2156	2157
a	gb37:	2158	2159	2160	2161	2162	2163	2164	2165	2166
a	gb37:	2167	2168	2169	2170	2171	2172	2173	2174	2175
a	gb37:	2176	2177	2178	2179					
a	gb38:	2100	2101	2102	2103	2104	2105	2106	2107	2108
a	gb38:	2109	2110	2111	2112	2113	2114	2115	2116	2117
a	gb38:	2118	2119	2120	2121	2122	2123	2124	2125	2126
a	gb38:	2127	2128	2129	2130	2131	2132	2133	2134	2135
a	gb38:	2136	2137	2138	2139	2140	2141	2142	2143	2144
a	gb38:	2145	2146	2147	2148					
a	gb39:	2001	2002	2003	2004	2005	2006	2007	2008	2009
a	gb39:	2010	2011	2012	2013	2014	2015	2016	2017	2018
a	gb39:	2019	2020	2021	2022	2023	2024	2025	2026	2027
a	gb39:	2028	2029	2030	2031	2032	2033	2034	2035	2036
a	gb39:	2037	2038	2039	2040	2041	2042	2043	2044	2045
a	gb39:	2046	2047	2048	2049					
a	gb40:	2050	2051	2052	2053	2054	2055	2056	2057	2058
a	gb40:	2059	2060	2061	2062	2063	2064	2065	2066	2067
a	gb40:	2068	2069	2070	2071	2072	2073	2074	2075	2076
a	gb40:	2077	2078	2079	2080	2081	2082	2083	2084	2085
a	gb40:	2086	2087	2088	2089	2090	2091	2092	2093	2094
a	gb40:	2095	2096	2097	2098	2099				
a	gb41:	2627	2628	2629	2630	2631	2632	2633	2634	2635
a	gb41:	2636	2637	2638	2639					
a	gb42:	2617	2618	2619	2620					
a	gb43:	2621	2622	2623	2624	2625	2626	2640	2641	2642
a	gb43:	2643	2644	2645						
a	gb44:	2615	2616	2646	2647	2648	2649	2650	2651	2652
a	gb44:	2653	2654	2655	2656					
a	gb45:	2604	2605	2606	2607	2608	2609	2610	2611	2612
a	gb45:	2613	2614	2658	2659	2660	2661	2662	2663	
a	gb46:	2501	2502	2503	2504	2505	2506	2507	2508	2509
a	gb46:	2510	2511	2512	2513	2514	2515	2516	2517	2518
a	gb46:	2519	2520	2521	2522	2523	2524	2525	2526	2527
a	gb46:	2528	2529	2530	2531	2532	2533	2534	2535	2536
a	gb46:	2537	2538	2539	2540	2541	2542	2543	2544	2545
a	gb46:	2546	2547	2548	2549	2550	2551	2552	2553	2554
a	gb46:	2555	2556	2557	2558	2559	2560	2561	2562	2563
a	gb46:	2564	2565	2566	2567	2568	2569	2570	2571	2572
a	gb46:	2573	2574	2575	2576	2577	2578	2579	2580	2581
a	gb46:	2582	2583	2584	2585	2586	2587	2588	2589	2590
a	gb46:	2591	2592	2593	2594	2595	2596	2597	2598	2599
a	gb46:	2600	2601	2602	2603	2664	2665	2666	2667	2668
a	gb46:	2669	2670							

ENSEMBLE GC: 6-ZONE REGIONAL MUNICIPALITY SYSTEM

```
a gc01: gb01
a gc01: gb02 gb03 gb04 gb05 gb06
a gc01: gb07 gb08 gb09
a gc01: gb10 gb11 gb12
a gc01: gb13 gb14 gb15 gb16
a gc02: gb17 gb18 gb19 gb20 gb21 gb22 gb23 gb24
a gc03: gb25 gb26 gb27 gb28 gb29 gb30 gb31 gb32 gb33
a gc04: gb34 gb35 gb36
a gc05: gb37 gb38 gb39 gb40
a gc06: gb41 gb42 gb43 gb44 gb45 gb46
```

ENSEMBLE GD: 10-ZONE RESULTS AGGREGATION SYSTEM

```
a gz01: gb01
a gz02: gb02 gb03 gb04 gb05 gb06
a gz03: gb07 gb08 gb09
a gz04: gb10 gb11 gb12
a gz05: gb13 gb14 gb15 gb16
a gz06: gb17 gb18 gb19 gb20 gb21 gb22 gb23 gb24
a gz07: gb25 gb26 gb27 gb28 gb29 gb30 gb31 gb32 gb33
a gz08: gb34 gb35 gb36
a gz09: gb37 gb38 gb39 gb40
a gz10: gb41 gb42 gb43 gb44 gb45 gb46
```

APPENDIX C

GTAModel INPUT FILE AND PARAMETER DEFINITIONS

GTA Travel Demand Modelling System, Version 2.0
-- USER'S MANUAL

MODEL-LEVEL PARAMETERS

File Description	Default File/Value	Name	Format/Contents Per Line
No. of Iterations	3	niter	(i2)
Forecast year	1996	year	(i4)
Planning District file	MODEL/STATIC/gb.dat	.temp/gb.dat	Record 1: (i3) -- No. of
Planning Districts			Remaining records: (2i6) -- 96TTS zone #; PD#
Output aggregate zone file	MODEL/STATIC/gb.dat	.temp/zagg.dat	Record 1: (i3) --
No. of aggregation zones			Remaining records: (2i6)
			96TTS zone #; aggregation zone #

DEMOGRAPHIC MODEL

File Description	Default File/Value	Name	Format/Contents Per Line
Total Zonal Population File	MODEL/STATIC/pop_96.311	.temp/pop.311	EMME/2 batchin file; (1x,i6,8x,f5.0)
Total Zonal Employment File	MODEL/STATIC/emp_96.311	.temp/emp.311	EMME/2 batchin file; (7x,1x,i6,1x,f5.0)
Work at Home Rate File	MODEL/STATIC/hwwah_96.dat	.temp/hwwah.dat	96TTS Zone #; Forecast year total employment (2i2,f7.4)
HW 24-Hour Trip Rate File	MODEL/STATIC/hwrat_96.dat	.temp/hwr24.dat	PD#; Occ; Avg. fraction of workers in age groups 2-5 working at home by occ.; 1 line per occ.
making an interzonal work			(2i2,4f7.4)
per occ. group			PD#; Occ; 24-hour trip rate for workers
HW Peak-Period Trip Factor File	MODEL/STATIC/hwppf_96.dat	.temp/hwppf.dat	trip in age groups 2-5 by occ. group; 1 line
conversion factors for			(2i2,4f7.4)
line per occ. group			PD#; Occ; 24-hour to am peak-period trip
School Participation Rate File	MODEL/STATIC/schpr_96.dat	.temp/schpr.dat	workers in age groups 2-5 by occ. group; 1
groups			(i2,6f7.4)
HS 24-Hour Trip Rate File	MODEL/STATIC/hsrat_96.dat	.temp/hsr24.dat	PD#; School participation rate by 6 age
HS Peak-Period Trip Factor File	MODEL/STATIC/hspff_96.dat	.temp/hspff.dat	PD#; 24-hr school trip rates by 6 age groups
			(i2,6f7.4)
			PD#; 24-hour to am peak-period trip

GTA Travel Demand Modelling System, Version 2.0
-- USER'S MANUAL

conversion

Population x Age Dist'n File MODEL/STATIC/popage_96.dat

[5] 31-65; [6] 66+

Employment x Occ. Dist'n File MODEL/STATIC/empocc_96.dat

groups:

Sales; [4] Mfg. & Other

factors for students by 6 age groups
.temp/popage.dat (i2,6f7.4)
PD#; Average age distribution by 6 groups:
[1] 11-15; [2] 16-18; [3] 19-25; [4] 26-30;

.temp/empocc.dat (i2,4f7.4)
PD#; Avg. occupation distribution by 4
[1] Prof/Mngmt; [2] General Office; [3]

DEMOGRAPHIC MODEL, cont'd

File Description	Default File/Value	Name	Format/Contents Per Line
Labour Force Part. Rate File	MODEL/STATIC/lfpr_96.dat	.temp/lfpr.dat	(2i2,4f7.4) PD#; Occ; Avg. fract. of pop. in age groups employed in an occ. group; 1 line for each
2-5 occ. Origin-Based Intrazonal File	MODEL/STATIC/elfint_96.dat	.temp/oint.dat	(i2,4f7.4) PD#; Avg. fract. of workers working outside the home working intrazonally, for 4 occ. groups
Destination-Based Intrazonal File	MODEL/STATIC/empint_96.dat	.temp/dint.dat	(i2,4f7.4) PD#; Avg. fract. of jobs with intrazonal workers working outside the home, 4 occ. groups
GTA RLF Living Outside GTA File	MODEL/STATIC/ext_por_96.dat	.temp/ext_por.dat	(i2,4f7.4) PD#; Avg. fraction of PD jobs filled by workers living outside the GTA by 4 occupation groups
GTA ELF Working Outside GTA File	MODEL/STATIC/ext_pow_96.dat	.temp/ext_pow.dat	(i2,4f7.4) PD#; Avg. fract. of PD workers employed outside outside the GTA by 4 occupation groups

HOME-TO-SCHOOL (HS) TRIP MODEL

File Description	Default File/Value	Name	Format/Contents Per Line
HS Mode Choice Probability File	MODEL/STATIC/hsmode_96.dat	.temp/hsmode.dat	(i2,i3,i2,7f7.4) Origin PD#; Destination PD#; Age Group; AM peak period school mode splits by 7 modes for an age group; 1 line per age group; Modes are: auto pass; transit; subway park & ride; GO-Rail w/ transit access; GO-Rail w/ auto access; auto drive; other (walk, school bus, etc.)

NON-WORK/SCHOOL (NWS) TRIP MODEL

File Description	Default File/Value	Name	Format/Contents Per Line
NWS Mode Choice Probability File	MODEL/STATIC/nwsmode_96.dat	.temp/nwsmode.dat	(i2,i3,7f7.4) Origin PD#; Destination PD#; NWS mode splits

GTA Travel Demand Modelling System, Version 2.0
-- USER'S MANUAL

by

```
NWS Seeded Base Year Trip Matrix      MODEL/STATIC/nws96s.311      .temp/nwsobsv      7 modes (same modes as for HS trips)
                                          (i4,i5,f11.0)
                                          96TTS origin zone; 96TTS dest. zone; O-D
trips
Balancing convergence factor      0.0050      xlimit      (f10.4)
Max. no. of balancing iterations      10      maxit      (i8)
```

EXTERNAL-INTERNAL TRIP MODEL

File Description	Default File/Value	Name	Format/Contents Per Line
External Zone Definition File	MODEL/STATIC/ext_zones96.dat	.temp/ext_zones.dat	(4x,i4) External zone number
Ext-Int Observed Mode Splits mode splits for 5 modes;	MODEL/STATIC/eimode_96.dat	.temp/eimode.dat	(i4,i3,5f7.4) External zone origin #; PD destination #; modes are: auto pass; subway park & ride; GO-Rail w/ auto access; auto drive; other (includes transit)
Int-Ext Observed Mode Splits	MODEL/STATIC/iemode_96.dat	.temp/iemode.dat	(i3,i4,5f7.4) PD origin #; External zone destination #; mode splits for 5 modes (same modes as for eimode.dat)
Ext-Int Trip Rates period trip rate, ext.	MODEL/STATIC/eirate_96.dat	.temp/eirate.dat	(i4,f7.4) Ext. zone #; Per capita external zone am peak org. to GTA dest. zones
Int_Ext Trip Rates period trip rate, GTA	MODEL/STATIC/ierate_96.dat	.temp/ierate.dat	(i4,f7.4) Ext. zone #; Per capita external zone am peak org. to ext. dest. zone
External Population Files	MODEL/STATIC/extpop_96.dat	.temp/extpop.dat	(i4,f8.0) External zone #; Forecast year population
Observed Ext-Int Trip File #; fraction of trips #; fraction of trips	MODEL/STATIC/exinobs_96.311	.temp/exinobs	EMME/2 batchin file; (i4,i5,1x,f7.4) Contains 2 matrices: Matrix 1: Ext. origin zone #; GTA dest. zone from ext. org. to GTA dest. Matrix 2: GTA origin zone #; Ext. dest. zone from GTA org. to ext. dest.

HOME-TO-WORK (HW) TRIP MODELS

File Description	Default File/Value	Name	Format/Contents Per Line
Rail Access Station Parameters model parameters, 6	MODEL/STATIC/access_86.par	.temp/access.par	Record 1: (i4) -- No. of parameters, rail station access mode model Remaining records: (6e13.6) -- Access mode per line, modes 3,4,5

```
HW Mode Choice Parameters MODEL/STATIC/s3-21_96.par .temp/hwms.par          Record 1: (i4) -- No. of parameters,
                                         mode split model
                                         Remaining records: (6e13.6) -- Main mode
split model parameters,
                                         6 per line, occ. groups 1-4
HW Worker Category Parameters  MODEL/STATIC/wc3-05_96.par .temp/wcat.par          Record 1: (i4) -- No. of
                                         parameters, worker cat.
                                         model
                                         Remaining records: (6e13.6) -- Worker
category model parameters,
                                         6 per line, occ. groups 1-4
HW Mode Adjustment Parameters  MODEL/STATIC/mode_adj_4.par .temp/mode_adj.par      Record 1: (i2) -- No. of
                                         mode split adjustment
                                         records
                                         Remaining records: (i1,4i3,7f8.4) -- Occ #;
First, last org. PD#s;
                                         First, last dest.PD#s; multiplicative adjust.
factors, 7 modes
```

HOME-TO-WORK (HW) TRIP MODELS, cont'd

File Description	Default File/Value	Name	Format/Contents Per Line
HW POR-POW Model Parameters	MODEL/STATIC/96-17.par	.temp/hwtd.par	Record 1: (i2) -- No. of POR-POW dist'n parameters Remaining records: (8x,4f8.5) Parameter
values for occ. groups			1-4, grouped by spatial segment
Transit Fare Matrix	MODEL/STATIC/tfare_96.311	.temp/tfare.311	EMME/2 batchin file; (1x,i6,5(1x,i6,1x,f5.0)) Origin zone #; 5 pairs per line: Dest. zone
#, avg. adult fare (\$)			
Parking Cost Matrix	MODEL/STATIC/pkcost_96.311	.temp/parkcst	EMME/2 batchin file; (7x,i7,1x,f8.0) Dest. zone #; Average daily parking cost (\$)
GO-Rail Frequency Matrix	MODEL/STATIC/freq_96.311	.temp/freq.go	EMME/2 batchin file; (1x,i6,5(1x,i6,1x,f5.0)) GO-Rail access station #; 5 pairs per line:
GO-Rail egress station #, to egress station			AM peak period trains travelling from access
GO-Rail Fare Matrix	MODEL/STATIC/gofare_96.311	.temp/gfare.311	EMME/2 batchin file; (1x,i6,5(1x,i6,1x,f5.0)) Org. zone #; 5 pairs per line: Dest. zone #,
GO-Rail sta-sta fare (\$)			
GO-Rail Station Data File	MODEL/STATIC/gosta_96.dat	.temp/gosta.dat	(i7,6x,i4) GO-Rail sta. #; station 96TTS zone #; 1
header line before records			
GO-Rail Line Data File	MODEL/STATIC/golines_96.dat	.temp/golines.dat	Record 1: (i2) -- No. of GO-Rail lines Remaining records: (a12) -- GO-Rail line name
GO-Rail Free Transfer File	MODEL/STATIC/trfree_96.dat	.temp/trfee.dat	(i2,1x,f3.0) PD#; free transfer dummy [0=free; 1=pay]
Mode 3,5 Auto Occupancies	MODEL/STATIC/aocc35_96.311	.temp/aoc35.311	EMME/2 batchin file; (4x,i5,1x,f5.2) Subway/GO-Rail acc. sta #; avg. persons/veh
for rail auto-access			
POR-POW K-factor File	MODEL/STATIC/kfac.96-17.dat	.temp/kfac.dat	Record 1: (i2) -- No. of K-factors to be read Remaining records: (i2,i3,4f8.5) Org. PD#;
Dest. PD#; K-factor			

```

POR-POW Spatial Segment File      MODEL/STATIC/kseg.96-17.dat      .temp/kseg.dat      Record 1: (i2) -- No. of
                                spatial segments
                                Remaining records: (2x,4i3)
                                First & last PD#s defining segment org.

range;
                                First & last PD#s defining segment dest.

range;
Observed POR-POW File            MODEL/STATIC/hwtdo_96.311 .temp/hwtdo.311      EMME/2 batchin file;
                                (i7,5(i7,1x,f5.0)) Contains 4
                                obs. POR-POW
                                matrices, one for each occ. group, 1-4; Each
record: Home zone
                                #; 5 pairs per line: Work zone #; No. of

workers
Average TTC Fare                  1.7100                          fttc                  (f10.4)
Balancing convergence factor      0.0050                          xlimit                (f10.4)
Max. no. of balancing iterations  50                                maxit                 (f10.4)
POW-POR Model Switch [0,1]       1                                swhwtd               (i8)
HW Mode Choice Model Switch [0,1] 1                                swhwms               (i8)
HW Save All Modes Switch [0,1]    1                                sw3                  (i8)
Output Mixed Mode Time Switch [0,1] 1                                sw4                  (i8)
Output Total HW trips Switch [0,1] 1                                sw5                  (i8)

```

POST-RUN OUTPUT UTILITIES

File Description	Default File/Value	Name	Format/Contents Per Line
Base POR-POW Matrix	MODEL/STATIC/prwobs_96.dat	.temp/prwobs.dat	Record 1: (i2) -- No. of matrices to read (=1) Remaining records: (i2,i3,2x,4f10.1) -- Org. PD#; Dest. PD#; POR-POW links, occ. groups 1-
4 Base Work Mode Split Matrix	MODEL/STATIC/hwmsobs_96.dat	.temp/hwmsobs.dat	Record 1: (i2) -- No. of modes (=7) Remaining records: (i2,i3,i2,7f10.1) -- Org. PD#; Dest. PD#; Occ. Group #; O-D trips by
mode Conversion file to 10-zone system	MODEL/STATIC/gb_gd.dat	.temp/gdfile.dat	Record 1: (i3) -- No. of Planning Districts Remaining records: (2i6) -- PD#; Super zone #
Intrazonal Trip Distances	MODEL/STATIC/intra_dist96.311	.temp/intradist.311	Any valid EMME/2 batchin format
Emission rates file	MODEL/STATIC/erate_86.dat	.temp/erate.dat	Record 1: header line

Base Emissions File	MODEL/STATIC/emissions_96.tab	.temp/ebfile.dat	Remaining records: free format, each line: Speed (mph); HC, CO, Nox factors (gm/km)	Table containing emissions estimated for 1996 conditions using GTAModel modelled flows (i.e., not based on observed TTS flows)
Print POR-POW summary tables [0,1]	1	prprw	(i8)	
Compare pred. POR-POW to base [0,1]	1	bsprw	(i8)	
Print HWMS summary tables [0,1]	1	prhwms	(i8)	
Compare pred. HWMS to base [0,1]	1	bshwms	(i8)	
Accumulate screenline counts [0,1]	1	screen	(i8)	
Compute VKT [0,1]	0	vkt	(i8)	
Compute link emissions [0,]	0	emfac	(i8)	

ROAD & TRANSIT NETWORK MACROS

File Description	Default File/Value	Name	Array Label
Base Auto-Drive Matrix	MODEL/STATIC/drvtot96.311	.temp/basedrive.311	ms10
VDF File	MODEL/STATIC/tangent_96.411	.temp/vdf.411	ms11
Transit Wait Time Factor	2.0000	wtovtt	ms01
Peak-Hour Factor	0.4050	phf	ms02
Auto Drive Cost/km	0.0645	acostf	ms04
Base Auto Drive Cost (\$/km)	0.0645	bcost	ms13
Toll Road Value of Time (\$/hr)	10.2000	minp\$	ms12
Max. No. of Iterations/step	20	itmax	ms05
Network Scenario No.	1	iscen	ms06

FIXED PARAMETERS

There are a limited number of fixed or "hard-wired" parameters in the model which are fundamental to the model's construction, and which are not changeable by the user. These are contained in two files. The files and their contents are described below.

MODEL/STATIC/fixed 96.par (Input to *gtamodel.out*):

Parameter	Definition	Value
nzones	No. of 96TTS traffic zones	1677
nmetro	Maximum zone no. within City of Toronto	500
byear	Model base year	1996
nocc	No. of worker occupation groups	4
nwcat	No. of worker DLIC-NVEH categories	5
nages	No. of age categories for HS trips	6
nagew	No. of age categories for HW trips	4
nagen	No. of age categories for NWS trips	1
nagee	No. of age categories for trips to/from external zones	1
nmodes	No. of HS modes	7
nmodew	No. of HW modes	7
nmoden	No. of NWS modes	7
nmodee	No. of modes for trips to/from external zones	5

MODEL/STATIC/workfix.par (Input to *work.out*):

Parameter	Definition	Value
union	Union Station GO-Rail station label	7001
oaksta	Oakville Station GO-Rail station label	7035
zwoak	96TTS zone containing Oakville Station	2001
byxc,byyc	X,Y coordinates for Bloor-Yonge intersection	630145,836344

APPENDIX D

.temp Intermediate Files

NAME	DESCRIPTION
carcost	Auto O-D travel cost (1996\$)
carivtt	Auto O-D travel time (min.)
demog.par	Input parameter file, <i>demog.out</i>
distz.311	O-D auto trip distances (km)
dst.311	Zonal jobs filled by workers living out of the zone by occupation
elf_age.dat	Worker age distributions by occupation and residence zone
emissions.241	Link emissions (CO, HC, NO _x , CO ₂) (g)
emissions.par	Input parameter file, <i>emissions.out</i>
ext_apass.311	External <-> Internal auto passenger O-D flows
ext_drive.311	External <-> Internal auto drive O-D flows
ext_rail.dat	External <-> Internal modes 3,4,5 O-D flows
external.par	Input parameter file, <i>external.out</i>
gtamain.par	Input parameter file, <i>gtamain.out</i>
hs_apass.311	Home-school auto passenger O-D flows
hs_drive.311	Home-school auto drive O-D flows
hs_rail.dat	Home-school auto modes 3,4,5 O-D flows
hs_trans.311	Home-school transit O-D flows
hspop.dat	Zonal population by age, used in <i>school.out</i>
hsrate.dat	Home-school am peak-period trip rates
hw_apass.311	Home-work auto passenger O-D flows
hw_drive.311	Home-work auto drive O-D flows
hw_grail.311	Home-work GO-Rail O-D flows
hw_mode3.311	Home-work subway park & ride O-D flows
hw_trans.311	Home-work transit O-D flows
hwfac.dat	POR-POW k-factors
hwrates.dat	Home-work am peak-period trip rates
intra.dat	Intrazonal workers (excludes work-at-homes) by zone and occupation
iter.dat	Outer loop iteration counter
linkfile	EMME/2 network link file
mac1out	Transit access/egress in-vehicle, walk and wait times, modes 3,4,5 (min.)
mac2out	GO-Rail line-haul station-to-station in-vehicle travel times (min.)
mac3out	Auto access times & costs, modes 3 & 5 (min.; 1996\$)
modsum2.par	Input parameter file, <i>modsum2.out</i>
networks.par	Input parameter file, EMME/2 network scenario
nodefile	EMME/2 network node file
nodes.0	GO-Rail and subway nodes for walk access calculations in <i>subwalk.out</i>
nw_rail.dat	Total non-work modes 3,4,5 O-D flows
nws.par	Input parameter file, <i>nws.out</i>
nws_apass.311	Non-work/school auto passenger O-D flows
nws_drive.311	Non-work/school auto drive O-D flows
nws_rail.dat	Non-work/school modes 3,4,5 O-D flows
nws_trans.311	Non-work/school transit O-D flows
org.311	Resident workers working out of home zone by occupation
output.par	Input parameter file, <i>output.out</i>
school.par	Input parameter file, <i>school.out</i>
sl.par	Input parameter file, <i>sl.out</i>
slfile.241	File linked to screenline codes file. 1996 default file is <u>MODEL/STATIC/slcodes_96.241</u>
subwalk.par	Input parameter file, <i>subwalk.out</i>
tot_golh.311	Total GO-Rail line-haul station-to-station flows
trnivtt	Transit in-vehicle O-D travel time (min.)
trnwait	Transit wait O-D travel time (min.)
trnwalk	Transit walk O-D travel time (min.)
tt_mode3.311	Total O-D trips, mode 3
tt_mode4.311	Total O-D trips, mode 4
tt_mode5.311	Total O-D trips, mode 5
version.dat	Current GTAModel version number
vkt2.par	Input parameter file, <i>vkt2.out</i>
vkt2par.311	EMME/2 input parameters required when running <i>vkt2.out</i>
wah.dat	Work-at-home workers by zone and occupation
work.par	Input parameters, <i>work.out</i>

APPENDIX E

MR.runname Directory

NAME	DESCRIPTION
emissions.tab	Emissions output table
exttot.311	External <-> GTA O-D trips (EMME/2 batchin file)
hs_mode_age.lst	HS O-D trips by mode and age category (PD O-Ds)
hstot.311	HS O-D trips (EMME/2 batchin file)
hw_age_wcat.lst	HW O-D trips by age and worker category (PD O-Ds)
hw_mode_age.lst	HW O-D trips by mode and age (PD O-Ds)
hw_mode_occ.lst	HW O-D tips by mode and occupation (PD O-Ds)
hw_mode_occ.tab	HW O-D trip output table by mode and occupation (10 super zones)
hw_mode_wcat.lst	HW O-D trips by mode and worker category (PD O-Ds)
hw_occ_age.lst	HW O-D trips by occupation and age (PD O-Ds)
hw_occ_wcat.lst	HW O-D trips by occupation and worker category (PD O-Ds)
hwtot.311	HW O-D trips (EMME/2 batchin file)
modelrun.doc	Run documentation file (includes summary outputs from each module)
nws_mode.lst	NWS O-D trips by mode (PD O-Ds)
nwstot.311	NWS O-D trips (EMME/2 batchin file)
por_pow.lst	POR-POW linkages by occupation (PD O-Ds)
por_pow.tab	POR-POW linkages output table by occupation (10 super zones)
prog2.lst	Mode 3,4,5 boardings by station and line
prw_occG.311	POR-POW linkages, occupation group G (EMME/2 batchin file)
prw_occM.311	POR-POW linkages, occupation group M (EMME/2 batchin file)
prw_occP.311	POR-POW linkages, occupation group P (EMME/2 batchin file)
prw_occS.311	POR-POW linkages, occupation group S (EMME/2 batchin file)
slsum.csv	Screenline summary file (for input into Excel spreadsheet)
vkt.lst	AM peak-period VKT by O-D (PDs)
vkt.tab	AM peak-period VKT by O-D output table (10 super zones)

APPENDIX F

SAMPLE modelrun.doc FILE

GTA Travel Demand Modelling System, Version 2.0
-- USER'S MANUAL

=====
Thu Jan 11 23:39:12 EST 2001
Base rerun; Misc. small changes; 3 iterations

OVERALL MODEL PARAMETERS AND INPUT FILES

=====
Fixed Parameter File MODEL/STATIC/fixe_96.par
Planning District File MODEL/STATIC/gb.dat
Output Aggregation File MODEL/STATIC/gb.dat
No. of Iterations 3
Forecast Year 1996

DEMOGRAPHIC MODEL Version 2.00

=====
Total Zonal Population File MODEL/STATIC/pop_96.311
Total Zonal Employment File MODEL/STATIC/emp_96.311
Work at Home Rate File MODEL/STATIC/hwwah_96.dat
HW 24-Hour Trip Rate File MODEL/STATIC/hwrat_96.dat
HW Peak-Period Trip Factor File MODEL/STATIC/hwppf_96.dat
School Participation Rate File MODEL/STATIC/schpr_96.dat
HS 24-Hour Trip Rate File MODEL/STATIC/hsrat_96.dat
HS Peak-Period Trip Factor File MODEL/STATIC/hsppf_96.dat
Population x Age Dist'n File MODEL/STATIC/popage_96.dat
Employment x Occ. Dist'n File MODEL/STATIC/empocc_96.dat
Labour Force Part. Rate File MODEL/STATIC/lfpr_96.dat
Origin-Based Intrazonal File MODEL/STATIC/elfint_96.dat
Destination-Based Intrazonal File MODEL/STATIC/empint_96.dat
GTA Workers Living Outside GTA File MODEL/STATIC/ext_por_96.dat
GTA ELF Working Outside GTA File MODEL/STATIC/ext_pow_96.dat

HOME-TO-SCHOOL (HS) TRIP MODEL Version 2.00

=====
HS Mode Choice Probability File MODEL/STATIC/hsmode_96.dat

NON-WORK/SCHOOL (NWS) TRIP MODEL Version 2.00

=====
NWS Mode Choice Probability File MODEL/STATIC/nwsmode_96.dat
NWS Seeded Base Year Trip Matrix MODEL/STATIC/nws96s.311
Balancing convergence factor 0.0050
Max. no. of balancing iterations 10

EXTERNAL-INTERNAL TRIP MODEL Version 2.00

=====
External Zone Definition File MODEL/STATIC/ext_zones96.dat
Ext-Int Observed Mode Splits MODEL/STATIC/eimode_96.dat
Int-Ext Observed Mode Splits MODEL/STATIC/iemode_96.dat
Ext-Int Trip Rates MODEL/STATIC/eirate_96.dat
Int_Ext Trip Rates MODEL/STATIC/ierate_96.dat
External Population Files MODEL/STATIC/extpop_96.dat
Observed Ext-Int Trip File MODEL/STATIC/exinobs_96.311

HOME-TO-WORK (HW) TRIP MODELS Version 2.00

=====
Rail Access Station Parameters MODEL/STATIC/access_86.par
HW Mode Choice Parameters MODEL/STATIC/s3-21_96.par
HW Worker Category Parameters MODEL/STATIC/wc3-05_96.par
HW Mode Adjustment Parameters MODEL/STATIC/mode_adj_4.par
HW POR-POW Model Parameters MODEL/STATIC/96-17.par
Transit Fare Matrix MODEL/STATIC/tfare_96.311
Parking Cost Matrix MODEL/STATIC/pkcost_96.311
GO-Rail Frequency Matrix MODEL/STATIC/freq_96.311
GO-Rail Fare Matrix MODEL/STATIC/gofare_96.311
GO-Rail Station Data File MODEL/STATIC/gosta_96.dat
GO-Rail Line Data File MODEL/STATIC/golines_96.dat
GO-Rail Free Transfer File MODEL/STATIC/trfree_96.dat
Mode 3,5 Auto Occupancies MODEL/STATIC/aocc35_96.311
POR-POW K-factor File MODEL/STATIC/kfac_96new.dat
POR-POW Spatial Segment File MODEL/STATIC/kseg.96-17.dat
Observed POR-POW File MODEL/STATIC/hwtdo_96.311
Average TTC Fare 1.7100

GTA Travel Demand Modelling System, Version 2.0
-- USER'S MANUAL

Balancing convergence factor	0.0050
Max. no. of balancing iterations	50
POW-POR Model Switch [0,1]	1
HW Mode Choice Model Switch [0,1]	1
HW Save All Modes Switch [0,1]	1
Output Mixed Mode Time Switch [0,1]	1
Output Total HW trips Switch [0,1]	1

POST-RUN OUTPUT UTILITIES Version 2.00

=====

Base POR-POW Matrix	MODEL/STATIC/prwobs_96.dat
Base Work Mode Split Matrix	MODEL/STATIC/hwmsobs_96.dat
Conversion file to 10-zone system	MODEL/STATIC/gb_gd.dat
Intrazonal Trip Distances	MODEL/STATIC/intra_dist96.311
Emission rates file	MODEL/STATIC/erate_86.dat
Print POR-POW summary tables [0,1]	1
Compare pred. POR-POW to base [0,1]	1
Print HWMS summary tables [0,1]	1
Compare pred. HWMS to base [0,1]	1
Accumulate screenline counts [0,1]	1
Compute VKT [0,1]	1
Compute link emissions [0,1]	1

ROAD & TRANSIT NETWORK MACROS Version 2.00

=====

Base Auto-Drive Matrix	MODEL/STATIC/drvtot96.311
VDF File	MODEL/STATIC/tangent_96.411
Transit Wait Time Factor	2.0000
Peak-Hour Factor	0.4050
Auto Drive Cost (\$/km)	0.0645
Base Auto Drive Cost (\$/km)	0.0645
Toll Road Value of Time (\$/hr)	10.2000
Max. No. of Iterations/step	20
Network Scenario No.	1

GTAMODEL Version 2.00 Beginning Execution.

=====

Procedure MACRO.0 beginning execution. Version No.: 2.00
Read road volume-delay function file .temp/vdf.411
Model run initialization (Macro.0) completed

Procedure MACRO.1 beginning execution. Version No.: 2.00
Transit assignment (Macro.1) completed

Procedure MACRO.2 beginning execution. Version No.: 2.00
 Peak-Hour Veh. Trips Assigned = 670373.875
 Avg. Veh. O-D Travel Time, This Iteration = 17.741964
Fixed demand road assignment (Macro.2) completed

Program SUBWALK.F beginning execution. Version No.: 2.00
Program SUBWALK.F completed.

Program DEMOG.F beginning execution. Version No.: 2.00
Read file ./temp/pop.311
Read file .temp/popage.dat

POPULATION BY AGE GROUP

GROUP	TOTAL
11-15	319055.2
16-18	189136.3
19-25	434694.2
26-30	418870.8
31-65	2352316.8
66+	462186.8
Total	4176260.0
Total Population (all ages) 4926355.0	

Read file ./temp/emp.311
Read file .temp/empocc.dat
Read file .temp/ext_por.dat

GTA Travel Demand Modelling System, Version 2.0
-- USER'S MANUAL

Read file .temp/dint.dat
 Read file .temp/lfpr.dat
 Read file .temp/hwwah.dat
 Read file .temp/oint.dat
 Read file .temp/ext_pow.dat

ELF & EMP BY OCCUPATION GROUP

OCC	TOTAL		INTRA-GTA		BALANCED
	RAW ELF	RAW EMP	RAW ELF	RAW EMP	ELF & EMP (INTERNAL)
P	984715.8	982889.0	948346.2	948309.9	948328.1
G	332132.2	334581.3	326033.9	326027.9	326030.9
S	566447.1	555400.2	540394.1	540409.4	540401.8
M	536514.4	521348.6	495714.2	495694.5	495704.3
Total	2419809.5	2394219.0	2310488.5	2310441.5	2310465.0

OCC	WORK AT	INTRA	EXTERNAL	EXTERNAL	INTERNAL	INTERNAL
	HOME	ZONAL	POW	POR	ELF	EMP
P	47960.6	41313.8	36368.4	34530.4	859053.2	859102.3
G	6654.8	11182.4	6097.9	8549.4	308193.6	308197.5
S	25009.5	32316.6	26054.0	14958.8	483075.2	483106.8
M	22614.9	20956.2	40798.2	25629.3	452134.9	452157.9
Total	102239.8	105768.9	109318.5	83667.9	2102457.0	2102564.8

Read file .temp/hwr24.dat
 Read file .temp/hwppf.dat

AVERAGE HW TRIP RATES BY OCC & AGE

OCC	16-18	19-25	26-30	31-65
P	0.0874	0.6646	0.7445	0.7432
G	0.0439	0.5956	0.7411	0.7406
S	0.0290	0.3380	0.5803	0.6320
M	0.2122	0.6110	0.7316	0.7197

Read file .temp/schpr.dat
 Read file .temp/hsr24.dat
 Read file .temp/hspff.dat

AVERAGE HS TRIP RATES BY AGE

11-15	0.9170
16-18	0.8037
19-25	0.1698
26-30	0.0284
31-65	0.0087
66+	0.0018

Program DEMOG.F completed.

Program SCHOOL.F beginning execution. Version No.: 2.00

Read file .temp/hsrate.dat
 Read file .temp/hspop.dat
 Read file MODEL/STATIC/hsobs96_1.311
 Read file MODEL/STATIC/hsobs96_2.311
 Read file MODEL/STATIC/hsobs96_3.311
 Read file MODEL/STATIC/hsobs96_4.311
 Read file MODEL/STATIC/hsobs96_5.311
 Read file MODEL/STATIC/hsobs96_6.311

HS Trips by Mode and Age:

Mode	Age Group						Total
	1	2	3	4	5	6	
Auto Passenger	56984.5	37004.9	10773.7	885.4	1685.5	130.2	107464.6
Transit Allway	39040.5	39942.2	29067.3	5276.5	7453.6	165.6	120945.6
Subway P&R	468.0	499.0	1819.8	145.1	197.8	0.0	3129.7
GO-4	60.6	86.7	532.8	100.7	49.7	0.0	830.5
GO-5	107.4	151.6	815.9	183.6	39.3	24.1	1321.8
Auto Drive	0.0	10238.6	20666.5	3661.3	7631.7	179.1	42377.3
Other	114726.3	46536.9	7584.9	1316.8	2415.8	315.6	172896.1
Interzonals	211387.4	134460.4	71261.2	11569.4	19473.3	814.6	448958.1
Intrazonals	81169.3	17510.6	2539.9	296.9	889.3	19.9	102426.0
Total Trips	292568.9	151998.7	73828.3	11879.6	20373.2	838.0	551487.2

GTA Travel Demand Modelling System, Version 2.0
-- USER'S MANUAL

Total HS rail records written= 2158
Program SCHOOL.F completed.

Program NWS.F beginning execution. Version No.: 2.00
Read file ../temp/pop.311
Read file ../temp/emp.311
Read file ../temp/nwsobsv

Raw NWS Origins 412403.6
Raw NWS Destinations 412177.4
Balanced NWS Total 412290.5
Bi-proportional balancing NWS matrix
Maximum iterations= 10
Error Tolerance= 0.0050
Iteration No. 1 Maximum Error=85.51944 j,b,d= 741 86.5 84.5
Iteration No. 2 Maximum Error=72.94038 j,b,d= 1022 73.9 101.6
Iteration No. 3 Maximum Error=70.71909 j,b,d= 1022 71.7 101.6
Iteration No. 4 Maximum Error=70.67759 j,b,d= 1022 71.7 101.6
Iteration No. 5 Maximum Error=70.67694 j,b,d= 1022 71.7 101.6
Iteration No. 6 Maximum Error=70.67693 j,b,d= 1022 71.7 101.6
Iteration No. 7 Maximum Error=70.67693 j,b,d= 1022 71.7 101.6
Iteration No. 8 Maximum Error=70.67693 j,b,d= 1022 71.7 101.6
Iteration No. 9 Maximum Error=70.67693 j,b,d= 1022 71.7 101.6
Iteration No. 10 Maximum Error=70.67693 j,b,d= 1022 71.7 101.6
Matrix balanced.
Auto Passenger 33176.2
Transit Allway 18922.9
Subway P&R 548.0
GO-4 359.7
GO-5 534.4
Auto Drive 300309.8
Other 6834.2
Interzonals 360677.7
Intrazonals 51229.1
Total Trips 412290.2

Total NWS rail records written= 1923
Program NWS.F completed.

Program EXTERNAL.F beginning execution. Version No.: 2.00
Finished reading file ../temp/eirate.dat
Finished reading file ../temp/ierate.dat
Read file ../temp/exinobs
Finished reading file ../temp/extpop.dat

External Zone Inputs:
No. POP EIRATE IERATE
1 0. 0.0000 0.0000
2 13913. 0.0588 0.0659
3 114066. 0.0223 0.0091
4 13642. 0.0841 0.0082
5 45717. 0.0495 0.0175
6 8886. 0.0611 0.0235
7 45405. 0.1899 0.0278
8 47139. 0.1186 0.0166
9 75326. 0.0555 0.0185
10 27515. 0.0294 0.0241
11 0. 0.0000 0.0000
12 23452. 0.1461 0.0491
13 0. 0.0000 0.0000
14 100610. 0.0461 0.0274
15 16080. 0.1853 0.0279
16 23160. 0.0233 0.0034
17 97512. 0.0364 0.0208
18 304632. 0.0117 0.0084
19 0. 0.0000 0.0000
20 0. 0.0000 0.0000
21 37997. 0.1370 0.0325
22 264061. 0.0176 0.0118
23 66409. 0.0109 0.0057

GTA Travel Demand Modelling System, Version 2.0
-- USER'S MANUAL

24 33245. 0.0439 0.0114
25 0. 0.0000 0.0000
26 0. 0.0000 0.0000

External Trips by Mode

Mode	Ext-Int	Int-Ext
Auto Passenger	5945.4	2192.5
Subway P&R	212.0	0.0
GO-5	640.4	0.0
Auto Drive	48480.6	18123.9
Other	1943.4	980.8
Interzonals	57222.0	21297.1
Total Trips	57251.3	21297.0

Total External rail records written= 195
Program EXTERNAL.F completed.

Program SUMRAIL.F beginning execution. Version No.: 2.00
End of file for file: .temp/nws_rail.dat
No. of records read= 1923
End of file for file: .temp/hs_rail.dat
No. of records read= 2158
No. of records written= 4063
No. of combined records= 18
Program SUMRAIL completed.

=====
Fri Jan 12 01:01:59 EST 2001
Beginning outer loop iteration no. 1

Program WORK.F beginning execution. Version No.: 2.00
Read file ../temp/work.par
Read file MODEL/STATIC/workfix.par
Read file nodefile.
Read file ext_zones.dat
Total centroids= 1765
Total GO-Rail stations= 49
Total subway park&ride stations= 13
Total external zones= 26
Number of GO-Rail lines= 6
Number of subway lines with p&r= 4
Read file ../temp/mac1out
Read file ../temp/mac2out
Read file ../temp/mac3out
Read file ../temp/freq.go
Read file .temp/tfare.311
Read file .temp/gfare.311
Read file ../temp/parkcst
Read file .temp/aoc35.311
Read file ../temp/carivtt
Read file ../temp/carcost
Read file ../temp/trnivtt
Read file ../temp/trnwalk
Read file ../temp/trnwait
Read file walksta.dat.
Read file gosta.dat.
Read file elf_age.dat.
Read file gb.dat.
Read file zagg.dat.
Read file lines.go.
Read file hwrate.dat.
Read file trfree.dat.
Read file .temp/access.par
Read file .temp/hwms.par
Read file .temp/wcat.par
Read file .temp/mode_adj.par
Read file ../temp/org.311
Read file ../temp/dst.311

WORKERS BY AGE AND OCCUPATION

GTA Travel Demand Modelling System, Version 2.0
-- USER'S MANUAL

OCC	Age<19	19-25	26-30	Age>30	Total
1	2157.4	61368.1	127928.7	671934.4	863388.7
2	5188.2	42692.3	48861.1	212485.1	309226.7
3	34056.8	100269.1	65564.2	286710.8	486600.8
4	6390.0	49875.1	62395.2	335556.1	454216.6
Total	47792.4	254204.6	304749.3	1506686.4	2113432.8

Read file .temp/kfac.dat
 Read file .temp/kseg.dat
 Read file .temp/hwtd.par
 Read file .temp/nw_rail.dat

Beginning HWTD calculations

Starting processing for origin= 1

...

Starting processing for origin= 1600

Balancing POR-POW matrix for occ=1

Maximum iterations= 50

Error Tolerance= 0.0050

Iteration No. 1 Maximum Error= 6.19687

...

Iteration No. 32 Maximum Error= 0.00499

Matrix balanced.

Finished writing file MR.test7/prw_occP.311

Total residual trips not written to file= 960.68597

Total trips computed within WORK.F= 855638.8

Total trips written to file= 855581.4

Balancing POR-POW matrix for occ=2

Maximum iterations= 50

Error Tolerance= 0.0050

Iteration No. 1 Maximum Error=14.10464

...

Iteration No. 24 Maximum Error= 0.00467

Matrix balanced.

Finished writing file MR.test7/prw_occG.311

Total residual trips not written to file= 1072.98914

Total trips computed within WORK.F= 306886.2

Total trips written to file= 306734.3

Balancing POR-POW matrix for occ=3

Maximum iterations= 50

Error Tolerance= 0.0050

Iteration No. 1 Maximum Error=11.82243

...

Iteration No. 50 Maximum Error= 0.00726

Balancing terminating at maximum number of iterations.

Finished writing file MR.test7/prw_occS.311

Total residual trips not written to file= 1015.90564

Total trips computed within WORK.F= 481259.1

Total trips written to file= 481172.5

Balancing POR-POW matrix for occ=4

Maximum iterations= 50

Error Tolerance= 0.0050

Iteration No. 1 Maximum Error=20.88669

...

Iteration No. 33 Maximum Error= 0.00491

Matrix balanced.

Finished writing file MR.test7/prw_occM.311

Total residual trips not written to file= 1106.57410

Total trips computed within WORK.F= 450372.5

Total trips written to file= 450253.9

TOTAL POR-POW FLOWS BY ORIGIN, DESTINATION & OCCUPATION

OCC	OSUM	DSUM
1	863393.9	859104.1
2	309229.3	308197.4
3	486592.8	483106.5
4	454217.3	452157.2
Total	2113433.5	2102565.2

Beginning HWMS calculations

Starting processing for origin= 1

```

...
Starting processing for origin= 1600

Read file .temp/ex_rail.dat
Finished writing file .temp/hw_drive.311
  Total residual trips not written to file= 928.61084
  Total trips computed within WORK.F= 968864.9
  Total trips written to file= 968818.2
Finished writing file .temp/hw_trans.311
  Total residual trips not written to file= 578.56079
  Total trips computed within WORK.F= 264016.9
  Total trips written to file= 263913.6
Finished writing file .temp/tot_golh.311
  Total residual trips not written to file= 0.54912
  Total trips computed within WORK.F= 42068.4
  Total trips written to file= 42067.9
Finished writing file .temp/hw_apass.311
  Total residual trips not written to file= 1225.47034
  Total trips computed within WORK.F= 124251.8
  Total trips written to file= 123585.0
Finished writing file .temp/hw_mode3.311
  Total residual trips not written to file= 91.05312
  Total trips computed within WORK.F= 17007.8
  Total trips written to file= 16922.7
Finished writing file .temp/hw_grail.311
  Total residual trips not written to file= 272.83871
  Total trips computed within WORK.F= 38554.7
  Total trips written to file= 38338.3
Finished writing file .temp/tt_mode3.311
  Total residual trips not written to file= 22.00226
  Total trips computed within WORK.F= 453684.9
  Total trips written to file= 453680.4
Finished writing file .temp/tt_mode4.311
  Total residual trips not written to file= 171.98793
  Total trips computed within WORK.F= 13967924.0
  Total trips written to file= 13967924.0
Finished writing file .temp/tt_mode5.311
  Total residual trips not written to file= 186.12376
  Total trips computed within WORK.F= 14264836.0
  Total trips written to file= 14264836.0
Finished writing file MR.test7/hwtot.311
  Total residual trips not written to file= 884.61060
  Total trips computed within WORK.F= 1329563.8
  Total trips written to file= 1329534.0
Finished writing file MR.test7/hw_mode_occ.lst
Finished writing file MR.test7/hw_mode_age.lst
Finished writing file MR.test7/hw_mode_wcat.lst
Finished writing file MR.test7/hw_occ_age.lst
Finished writing file MR.test7/hw_occ_wcat.lst
Finished writing file MR.test7/hw_age_wcat.lst

```

HW TRIPS BY MODE BY OCCUPATION GROUP

	OCC_P	OCC_G	OCC_S	OCC_M	TOTAL
1. Auto-Passenger	41662.1	24120.6	23637.7	35324.6	124745.0
2. Transit Allway	77466.8	45060.7	37060.6	32114.6	191702.8
3. Subway P&R	8645.4	5205.1	1913.1	1249.6	17013.2
4. GO-Rail,Trans.	5221.3	2813.0	1110.6	590.9	9735.7
5. GO-Rail,Auto	17540.5	7773.2	2114.3	1445.9	28873.9
6. Walk	12803.7	4501.0	4868.6	2966.3	25139.6
7. Auto-Drive	438743.6	122439.4	150208.9	226863.0	938254.9
TOTAL	602083.4	211912.9	220913.8	300554.9	1335465.0

HW TRIPS BY MODE BY AGE GROUP

	A<19	19-25	26-30	A>30
1. Auto-Passenger	1092.2	19380.3	20123.5	84151.9
2. Transit Allway	702.3	24274.7	35061.8	131666.3
3. Subway P&R	9.3	1194.5	2529.5	13280.1
4. GO-Rail,Trans.	7.9	772.4	1349.8	7605.9
5. GO-Rail,Auto	29.1	2322.5	3974.3	22548.1
6. Walk	122.2	2934.4	4562.1	17521.3

GTA Travel Demand Modelling System, Version 2.0
-- USER'S MANUAL

7. Auto-Drive	1290.8	72349.8	136521.2	728103.6
TOTAL	3253.7	123228.6	204122.2	1004877.2

HW TRIPS BY MODE BY WORKER CATEGORY

	D0,N0	D0,N1	D0,N2	D1,N1	D1,N2
1. Auto-Passenger	9763.1	17826.6	7812.8	46519.9	42824.3
2. Transit Allway	62881.1	22548.1	5616.7	66944.4	33713.3
3. Subway P&R	0.0	1001.6	294.6	5162.3	10554.6
4. GO-Rail,Trans.	1007.0	617.1	220.4	3929.2	3962.1
5. GO-Rail,Auto	0.0	569.0	214.5	7232.4	20858.0
6. Walk	7740.7	2088.2	634.9	10237.4	4438.7
7. Auto-Drive	0.0	0.0	0.0	259994.6	678239.4
TOTAL	81391.9	44650.8	14793.9	400020.3	794590.4

HW TRIPS BY OCC AND AGE GROUPS

	A<19	19-25	26-30	A>30
OCC_P	244.3	38688.6	90360.4	472785.3
OCC_G	302.3	24877.5	35768.1	150964.8
OCC_S	1072.0	30248.3	34226.4	155365.3
OCC_M	1635.1	29412.1	43763.5	225741.6
TOTAL	3253.7	123226.6	204118.4	1004856.9

HW TRIPS BY OCC AND WORKER CATEGORY

	D0,N0	D0,N1	D0,N2	D1,N1	D1,N2
OCC_P	28646.6	10783.8	3425.3	178131.3	381085.7
OCC_G	16360.2	11133.1	3565.6	65835.6	115015.9
OCC_S	19456.9	10848.3	3267.9	61678.8	125658.8
OCC_M	16928.5	11885.7	4535.2	94373.9	172827.2
TOTAL	81392.2	44650.8	14794.0	400019.6	794587.6

HW TRIPS BY AGE AND WORKER CATEGORY

	D0,N0	D0,N1	D0,N2	D1,N1	D1,N2
A<19	262.9	193.8	76.0	963.9	1757.6
19-25	9742.3	5488.8	1834.9	37466.2	68695.3
26-30	15093.4	7440.4	2339.5	63771.0	115475.3
A>30	56295.1	31528.5	10544.0	297823.6	608670.2
TOTAL	81393.8	44651.5	14795.5	400024.9	794598.6

SUMMARY OF RAIL TRIPS BY MODE AND PURPOSE

Mode	Non-Work	Externals	Work	Total
3	3677.7	212.0	16980.7	20870.4
4	1190.2	0.0	9696.6	10886.8
5	1856.2	640.4	28792.0	31288.7

Infeasible external mode 5 trips not assigned= 7.3

Finished writing file MR.test7/por_pow.lst

n3a,n3b,n3c= 0 0 0

Program WORK.F completed.

Procedure MACRO.2 beginning execution. Version No.: 2.00
 Peak-Hour Veh. Trips Assigned = 559322.687
 Avg. Veh. O-D Travel Time, This Iteration = 22.493762
 Avg. Veh. O-D Travel Time, Last 2 Iterations= 21.817092
 Fixed demand road assignment (Macro.2) completed

=====

Fri Jan 12 05:47:58 EST 2001

Beginning outer loop iteration no. 2

Program WORK.F beginning execution. Version No.: 2.00

...

Program WORK.F completed.

Procedure MACRO.2 beginning execution. Version No.: 2.00
 Peak-Hour Veh. Trips Assigned = 556938.937
 Avg. Veh. O-D Travel Time, This Iteration = 21.593791
 Avg. Veh. O-D Travel Time, Last 2 Iterations= 21.545539
 Fixed demand road assignment (Macro.2) completed

GTA Travel Demand Modelling System, Version 2.0
-- USER'S MANUAL

=====
 Fri Jan 12 09:22:55 EST 2001
 Beginning outer loop iteration no. 3

Program WORK.F beginning execution. Version No.: 2.00
 ...

HW TRIPS BY MODE BY OCCUPATION GROUP

	OCC_P	OCC_G	OCC_S	OCC_M	TOTAL
1. Auto-Passenger	41033.4	23728.3	23318.4	35094.6	123174.8
2. Transit Allway	79686.4	45930.3	37906.9	32916.1	196439.6
3. Subway P&R	8776.7	5215.3	1934.1	1273.1	17199.2
4. GO-Rail,Trans.	5573.7	2953.2	1178.2	624.0	10329.2
5. GO-Rail,Auto	18301.3	7954.1	2196.2	1448.6	29900.2
6. Walk	13021.1	4590.5	4972.0	3053.5	25637.1
7. Auto-Drive	435296.5	121334.0	148757.1	225862.0	931249.6
TOTAL	601689.1	211705.8	220262.8	300272.1	1333929.9

HW TRIPS BY MODE BY AGE GROUP

	A<19	19-25	26-30	A>30
1. Auto-Passenger	1084.1	19103.8	19846.8	83142.6
2. Transit Allway	717.3	24823.3	35904.9	134996.4
3. Subway P&R	9.3	1198.6	2557.0	13434.5
4. GO-Rail,Trans.	8.5	820.6	1429.7	8070.6
5. GO-Rail,Auto	29.1	2395.8	4103.5	23372.0
6. Walk	125.0	2990.2	4647.4	17874.8
7. Auto-Drive	1283.7	71607.1	135352.7	723016.4
TOTAL	3257.0	122939.4	203842.0	1003907.3

HW TRIPS BY MODE BY WORKER CATEGORY

	D0,N0	D0,N1	D0,N2	D1,N1	D1,N2
1. Auto-Passenger	9540.5	17586.4	7759.4	45927.1	42363.2
2. Transit Allway	63876.3	23018.8	5744.9	68863.9	34937.0
3. Subway P&R	0.0	997.6	292.7	5211.2	10697.7
4. GO-Rail,Trans.	1033.3	644.7	231.8	4156.8	4262.6
5. GO-Rail,Auto	0.0	576.2	217.4	7434.1	21672.5
6. Walk	7875.6	2136.6	649.8	10440.3	4535.3
7. Auto-Drive	0.0	0.0	0.0	257591.5	673636.9
TOTAL	82325.7	44960.2	14896.0	399624.9	792105.2

HW TRIPS BY OCC AND AGE GROUPS

	A<19	19-25	26-30	A>30
OCC_P	244.4	38624.4	90263.5	472551.7
OCC_G	303.3	24838.1	35736.5	150827.7
OCC_S	1073.0	30098.7	34137.7	154951.8
OCC_M	1636.2	29376.0	43700.2	225556.6
TOTAL	3256.9	122937.2	203837.9	1003887.8

HW TRIPS BY OCC AND WORKER CATEGORY

	D0,N0	D0,N1	D0,N2	D1,N1	D1,N2
OCC_P	29036.5	10890.3	3453.4	178180.3	380118.5
OCC_G	16517.9	11193.0	3580.9	65745.9	114665.5
OCC_S	19662.8	10913.6	3292.6	61463.8	124926.9
OCC_M	17108.7	11963.4	4569.3	94234.0	172391.6
TOTAL	82325.9	44960.2	14896.1	399624.0	792102.5

HW TRIPS BY AGE AND WORKER CATEGORY

	D0,N0	D0,N1	D0,N2	D1,N1	D1,N2
A<19	265.3	194.8	76.5	965.0	1755.7
19-25	9828.9	5512.1	1843.6	37382.6	68371.1
26-30	15260.3	7491.6	2355.6	63684.3	115047.7
A>30	56972.9	31762.3	10620.9	297597.6	606938.8
TOTAL	82327.4	44960.9	14897.6	399629.6	792113.5

SUMMARY OF RAIL TRIPS BY MODE AND PURPOSE

Mode	Non-Work	Externals	Work	Total
3	3677.7	212.0	17166.6	21056.3
4	1190.2	0.0	10289.2	11479.4
5	1856.2	640.4	29817.9	32314.6

GTA Travel Demand Modelling System, Version 2.0
-- USER'S MANUAL

66

Infeasible external mode 5 trips not assigned= 7.3

Finished writing file MR.test7/por_pow.lst
n3a,n3b,n3c= 0 0 0
Program WORK.F completed.

Procedure MACRO.2 beginning execution. Version No.: 2.00
Peak-Hour Veh. Trips Assigned = 556839.437
Avg. Veh. O-D Travel Time, This Iteration = 21.532779
Avg. Veh. O-D Travel Time, Last 2 Iterations= 21.539941
Fixed demand road assignment (Macro.2) completed

Procedure MACRO.1 beginning execution. Version No.: 2.00
Transit Allway (mode 2) Trips Assigned = 335928.156
Subway P&R (mode 3) Trips Assigned = 20169.1972
Transit Access to GO-Rail (mode 4) Trips Assigned= 11362.08
GO-Rail (modes 4&5) Transit Egress Trips Assigned= 43693.0078
Transit assignment (Macro.1) completed

Program OUTPUT.F beginning execution. Version No.: 2.00
Read file .temp/output.par

occ= 1 Observed= 858544.4 308138.9 482678.9 451874.2
occ= 1 Predicted= 859102.2 308193.5 483103.4 452154.3

Finished printing POR-POW summary table

occ= 1 Observed=	39558.1	76970.3	8743.9	5978.6	17906.3	16866.1	428062.3
occ= 1 Predicted=	41032.8	79682.2	8776.7	5568.8	18295.1	13020.4	435294.8
occ= 2 Observed=	22998.7	45615.6	4916.2	2567.3	6820.0	6072.6	117338.7
occ= 2 Predicted=	23721.6	45926.9	5214.7	2948.4	7949.2	4590.1	121332.1
occ= 3 Observed=	21668.2	36974.5	1806.9	1402.6	2264.5	7000.1	141490.6
occ= 3 Predicted=	23315.6	37903.6	1933.7	1172.9	2191.0	4971.8	148752.8
occ= 4 Observed=	34049.9	32250.1	1141.3	488.0	1149.4	5495.1	212641.2
occ= 4 Predicted=	35092.6	32913.0	1272.6	619.6	1444.1	3052.7	225856.5

Finished printing HW mode split summary table
Screenline calculations completed.

Procedure VKT.MAC beginning execution. Version No.: 2.00

Total auto-drive trips = 1374917.5
Total VKT = 26321744
Average VKT/capita = 5.343047

Macro VKT calculations completed

Program VKT1.F beginning execution. Version No.: 2.00

Read file .temp/vktpd.311

Program VKT1.F completed.

occ= 1 Observed= 0.0

occ= 1 Predicted= 21712.2

Finished printing VKT summary table

Procedure EMISSIONS_1.MAC beginning execution. Version No.: 2.00

EMISSIONS_1.MAC completed

Program EMISSIONS.F beginning execution. Version No.: 2.00

TOTAL GTA EMISSIONS BY TYPE (TONNES)

CO 0.842404E+06

HC 0.739001E+05

NOx 0.831989E+05

CO2 0.498836E+07

Program EMISSIONS.F completed.

Procedure EMISSIONS_2.MAC beginning execution. Version No.: 2.00

EMISSIONS_2.MAC completed

Program OUTPUT.F completed.