Travel Forecasting Model
User's Guide

prepared for

Maryland Transit Administration
Baltimore, Maryland

prepared by

William G. Allen, Jr., P.E.
Transportation Consultant
Mitchells, Virginia

21 August 2006
Revised November 2006

Table of Contents

List of Tables

List of Figures

1.0 Introduction

1.1 History

This report documents the development of a new regional travel forecasting model for the Baltimore metropolitan area. The principal motivation for the development of this new model was the need for an improved forecasting model to meet the requirements of the Federal Transit Administration's (FTA) New Starts capital grants program for fixed guideway transit systems. The Maryland Transit Administration (MTA) needed a model that would be suitable for preparing acceptable forecasts for the proposed Red Line corridor study.

Regional travel forecasting is generally the responsibility of the metropolitan planning organization, which in this case is the Baltimore Metropolitan Council (BMC). BMC's current travel model has evolved over time as a combined effort of BMC staff and consultant assistance. The most recent major improvement was a new mode choice model developed by URS Consultants and KPMG (now DMJM/AECOM) in 2000. The current model is documented in *Task 7: Mode Choice Model Estimation and Calibration*.

Although that model has been used successfully for various planning studies throughout the region, it has been found unsuitable for the specific requirements of New Starts planning studies. Parsons, Brinckerhoff, Quade & Douglas, Inc. wrote a report evaluating the current model (*Review of the Baltimore Metropolitan Council Mode Choice Model*, October 2004) and identified a number of areas in which improvements would be required to meet New Starts requirements. In addition, BMC convened a peer review group in September 2004 to review the existing model and recommend improvements. That group suggested a number of changes, as documented in *Report on the Findings of the First Peer Review Panel of the Baltimore Metropolitan Council* and *Report of Findings of the Second Peer Review Panel of the Baltimore Metropolitan Council*. Another change involved the calculation of transit "user benefits", which the current model does not do and which is essential for FTA's evaluation of a New Starts project.

With this in mind, MTA retained a consultant in early 2005 to develop a brand new travel forecasting model to address the issues raised by these reviewers. The consultant worked in concert with BMC staff on this project. Although the initial use of the new model will be for the Red Line study, it is expected that this model will be adopted by BMC as the accepted travel forecasting model for all transportation planning studies in the Baltimore region.

1.2 Model Overview

The most common approach to travel forecasting for the past four decades has been the aggregate, zone-based, four-step process. This is a proven, accepted, and generally well-understood methodology. In the past few years, a new approach has been developed. This new approach is usually referred to as *microsimulation* and uses a very disaggregate approach to representing travel. Instead of zonal averages and zone-to-zone trip movements, travel is represented in terms of individual trips. Travel choices (e.g., destination, mode, departure time, etc.) are calculated as probabilities and Monte Carlo simulation techniques are applied to determine whether a trip was made, to what zone, by what mode, and at what time of day. There is a growing (but by no means unanimous) consensus that this new approach represents the future of travel forecasting. As of this writing, a handful of cities presently have models that operate in this manner. When the development and application tools for this approach become more refined, it is expected that more models will adopt this approach.

The consultant carefully considered this new approach in light of the resources available for this project. Although it might have been technically feasible to pursue the new methodology, the MTA placed a high priority on adhering to the overall schedule for the Red Line project and on achieving a model which would be acceptable to FTA. In the consultant's view, these constraints could be met only by using the conventional approach. However, the consultant has recommended to BMC that its next major model update, which will probably occur sometime around 2008-2011, should strive to provide enough resources to use the new methodology. By that time, there should be a more substantial base of experience that is sufficient to support the efficient development of this new type of travel model.

The schedule constraints also meant that the existing base of data – networks, zone system, land use data – would have to be used more or less as is. There was not enough time available to develop this information completely anew. The consultant's initial review of this information indicated that, with minor changes, it would be sufficient to support the development of a model that would meet all of this study's needs.

The current BMC travel model and database covers ten jurisdictions. Six of these: Baltimore City and the Counties of Baltimore, Anne Arundel, Carroll, Harford, and Howard, make up the BMC and are considered to be the "traditional" Baltimore region. Because of the increasing travel interaction with the Washington metropolitan area, BMC expanded its modelled area and zone system to cover the District of Columbia and the counties of Frederick, Montgomery, and Prince George's. The traffic analysis zones in those areas are

larger, generally corresponding to the traffic analysis districts that have been defined by the Metropolitan Washington Council of Governments (MWCOG, the Washington region's MPO), although MWCOG TAZ-level zones are used along the border with the Baltimore region. There are 1,151 zones in the Baltimore region, 270 in the Washington region, and 42 external stations, for a total of 1,463 zones.

The Cube/TP+ software package developed by Citilabs, version 3.2.1, is used to apply the current BMC model and this same software was selected for the new model. This is one of the most powerful and flexible software systems for applying travel models and the consultant and BMC staff are familiar with this software. At the time this project began, that was the most stable and most commonly used version of TP+ in the U.S. During 2005, a number of planning agencies started using the Cube/Voyager package, which includes many of the programs of Cube/TP+ and is considered the successor to that package. However, the consultant and BMC felt that the base of experience with that version is not yet sufficient to justify its use at this time.

This model uses the conventional "four-step" process, which in most urban areas now actually consists of five steps: generation, distribution, mode choice, time of day, and assignment. The consultant incorporated a variety of recent enhancements to this process from experience in other areas, so that this model would reflect the best practices from around the country and be easier to use.

Personal travel is categorized by seven trip purposes:

HBW home-based work
SCH home-based school (K-12)
HBS home-based shop
HBO home-based other
JTW non-home-based (NHB) journey to/from work
JAW non-home-based journey at work
OBO non-home-based other

The three NHB categories are defined by examining the home interview survey trip chain for each tour that is not a direct home-to-nonhome trip (or back). If one end of the tour is home and the other is work, the intermediate NHB legs are defined as JTW. If both ends of the tour are at work (with no stops at home), all legs are defined as JAW. If both ends of the tour are at home (with no stops at work), then the intermediate NHB legs are defined as OBO (and the home-based legs are defined as SCH, HBS, or HBO). This is the same convention followed in a number of recent models. Segmenting the NHB trips this way greatly improves the accuracy of the time of day and mode choice steps.

There are three types of non-personal travel, all of which are defined as vehicle trips:

COM commercial
MTK medium truck
HTK heavy truck

These models were developed recently for BMC by this same consultant (see *Development of Truck Models* and *Development of Commercial Trip Models*). Medium trucks are defined as vehicles with two axles and six tires. Heavy trucks are vehicles with more than two axles. Commercial vehicles are light-duty vehicles which are used for non-personal travel. Almost all such vehicles bear the name or logo of the vehicle's owner.

External travel is defined in terms of vehicle trips and is split by vehicle type and directionality, as follows:

IEW internal/external work auto
IEN internal/external non-work auto
EIW external/internal work auto
EIN external/internal non-work auto
IEC internal/external COM
EIC external/internal COM
IEM internal/external MTK
EIM external/internal MTK
IEH internal/external HTK
EIH external/internal HTK

I/X trips are those made by residents of the region; X/I trips are those made by non-residents.

Through trips (trips with both ends outside the modelled region) are defined as vehicle trips and split into these types:

EEA external/external auto
EEC external/external COM
EEM external/external MTK
EEH external/external HTK

The trip production model uses trip rates, applied to households (HH's) which have been automatically stratified by size and income and (separately) by workers and income. The trip attraction model uses standard linear regression

models. Trip ends are normalized to the production total. For the home-based purposes, trip ends are output by four levels of HH income. These are defined so as to represent the lowest 10% of the region's HHs, the next 15%, the next 20%, and the highest 55%.

The trip distribution model is a standard gravity model, but instead of using highway time as the measure of separation between zones, it uses a composite definition of impedance which incorporates transit time and highway tolls, with weights that vary by purpose and income level. Trip distribution is performed separately by income for the home-based purposes. Twenty-nine separate gravity models are run.

Mode choice uses a nested logit model whose basic structure was borrowed from the New Orleans regional model. This splits person trips into auto and transit. The auto trips are split into drive alone and carpool, and the carpool trips are then split into 2/car and 3+/car modes. The transit trips are split into walk-to-transit and drive-to-transit and then each of those is further split by sub-mode: bus, rail (Metro or LRT), and commuter rail (MARC). The basic variables and system coefficients were adopted from the New Orleans model and have been used in several other models around the country. The bias coefficients were adjusted so as to match the trip targets by mode and income.

The time of day is a straightforward factor model which applied temporal distributions by purpose and directionality (based on the home interview survey) to split daily trips into four time periods: AM peak (6:30 – 9:30), midday (9:30 – 3:30), PM peak (3:30 – 6:30), and night (6:30 pm – 6:30 am). Transit trips are also split by purpose, so that work and non-work are each allocated to their appropriate time periods (peak and off-peak).

The current BMC highway assignment process was modified slightly. Trips are now assigned by four periods, respecting HOV and truck restrictions. Paths are based on an impedance which includes time and toll. Volume/delay functions are input for three facility type groups. Multiple iterations of capacity-restrained assignment are used with the final link volumes computed as a weighted average of the iterations. Speed feedback is applied and the steps after trip generation are re-calculated for the peak-based purposes (HBW and JTW). Two iterations of feedback have been shown to produce acceptable convergence of constrained speeds. The vehicle trip portion of drive-to-transit trips is included in the assignments.

Transit assignment is performed by period (AM peak, off-peak), access (walk, drive), and submode (bus, rail, MARC), with the trips assigned in production/attraction (P/A) format. This produces 12 loaded network files

which are summarized and reported using a custom-written program, TGFLOAD.

The model was calibrated using data that approximately represents year 2000 conditions. This mainly includes a 2001 home interview survey, 2000 Census data, and a 1996 on-board transit survey.

The current document describes the usage of the model, including the preparation of the inputs, running the model, and understanding the outputs. A companion document, *Calibration Report*, explains the development of the model, including the derivation of all coefficients and parameters.

This user's guide does not describe or list the hundreds of parameters and coefficients that go into this model. Those are discussed in the Calibration Report and are also described in the main model setup, MODEL.JOB, which is fairly well annotated. All of these coefficient values were set during model calibration and as a general rule, unless the model is being re-validated, should not be changed by the user.

1.3 Acknowledgements

This project represents a collaborative effort between the consultant and BMC staff. Charles Baber and Matt de Rouville of BMC performed a significant share of the work, mainly involving the networks, Census data processing, model validation, household sub-model development, and user benefit analysis. The consultant is indebted to them for their assistance.

Several other agency staff members were an important part of the project team, including:

Ernie Baisden, MTA
Lorenzo Bryant, MTA, Project Manager
Gene Bandy, BMC, Assistant Director of Transportation Planning
Dunbar Brooks, BMC, Manager of Data Development

2.0 Overview

2.1 Introduction

The Baltimore regional travel model is a conventional "four step" model, using data aggregated to the traffic analysis zone level. The model is applied using the TP+/Cube software package, specifically version 3.2.1 of TP+. The entire model is contained in one setup file (a.k.a. "driver" or "script" file). A specific file naming convention and directory structure have been established to facilitate applying the model to different scenarios, and creating new scenarios. A relatively simple user interface has been created in Cube to help the user get a model run started.

This model was developed specifically for use in a New Starts study of the Red Line. However, it also has a broader application to other transportation studies in the Baltimore region. Setups have been created that meet the specific needs of FTA's New Starts program, as well as the more generalized manner of applying travel models.

This document presumes that the reader is familiar with the Cube software package. Citilabs is in the process of phasing out the "TP+" name, but in this document, "TP+" and "Cube" are used interchangeably.

This model is currently set up to run under the Windows XP operating system on a single computer. It can be applied in a network environment, but is not presently designed to run in a multiple processor environment or on a 64-bit operating system.

2.2 File Naming

A convention of file naming has been established that links the file's extension to its format, as shown in Table 2.1.

Most of the .DAT files are zonal data in fixed column format, but this extension is also used for other files that are in plain text (ASCII) format and can be viewed/edited in any text editor. The .PEN files are also ASCII, but adhere to the specific layout for TP+ turn penalties or prohibitors. The .SKM, .TRP, and .MTX files can all be viewed in Cube and manipulated using the MATRIX program. Note that most of the matrices in this model are maintained in 4-byte single-precision floating point format, with six or seven digits of precision. The .DBF format used by the transit networks is a fairly standard implementation of xBase format, that is readable by Cube, Excel, FoxPro, and Access, among other

Table 2.1
File Names and Formats

Extension	Description
.CTL	non-TP+ setup file
.DAT	ASCII file
.DBF	transit network DBF file
.JOB	TP+ setup file
.MIN	MINUTP binary matrix
.MTX	TP+ binary matrix: other
.NET	TP+ binary network
.PEN	ASCII, TP+ turn penalty format
.PRN	ASCII program listing file
.SKM	TP+ binary matrix: travel impedances
.TRP	TP+ binary matrix: trip table

programs. The .JOB extension is reserved for TP+ setups, while the .CTL extension is used for setup files for the non-TP+ programs. The .PRN extension is used for listing files for both TP+ and non-TP+ programs.

With only a few exceptions, the principal file names adhere to the standard DOS 8.3 naming convention. However, no such limitation is imposed on the directory names.

The following purpose abbreviations are used throughout this document and in the model setup:

HBW home-based work
SCH home-based school (K-12)
HBS home-based shop
HBO home-based other
JTW non-home-based (NHB) journey to/from work
JAW non-home-based journey at work
OBO non-home-based other

COM commercial
MTK medium truck
HTK heavy truck

IEW internal/external work auto
IEN internal/external non-work auto
EIW external/internal work auto
EIN external/internal non-work auto
IEC internal/external COM
EIC external/internal COM

IEM internal/external MTK
EIM external/internal MTK
IEH internal/external HTK
EIH external/internal HTK

2.3 Directory Structure

This model has been developed and tested using a specific directory structure. This structure is strongly recommended to all users of this model. It has been found to be suitable for facilitating file management and creating new scenarios. This structure is shown below:

```
C:\MTA
      \MODEL
      \ALT1
            \INPUTS
      \ALT2
            \INPUTS
      \ALT3
            \INPUTS
      \etc.
```

The names shown in italics are required. On the working hard drive, a principal directory is established (\MTA in the example above). This directory may have any name, since it is never specifically referenced in the setups. This directory **must** contain a subdirectory called \MODEL. Stored here are the basic model files that do not change for each scenario. Then under the main directory, a subdirectory is established for each scenario. These subdirectories can have any name allowed by the operating system. The names used for the 2000 calibration run and the 2030 long range plan base run are called \2000 and \2030BASE, respectively. Under each scenario's subdirectory there must be a subsubdirectory called \INPUTS. This subsubdirectory contains all of the input files for that scenario. The output files for each scenario are stored in the scenario's subdirectory.

This is probably the least number of directories that is necessary to support the application of a regional travel model. The consultant has found that having fewer directories is preferable, in the long run.

2.4 Basic Files

The \MODEL subdirectory contains the basic files that are necessary to run the model and which do not change for each scenario. This includes the main

setups, coefficient and parameter files, zone/district equivalency files, and the executable files for the non-TP+ programs. Generally, these files should not be changed unless the model is being re-validated or if the zone system changes (see below). These files are listed in Table 2.2 and described below.

Table 2.2
Basic Files

New File Name	Description
model.job	full model TP+ setup
newstart.job	New Starts TP+ setup
summit.job	Summit TP+ setup
parameter.dat	parameter values for all steps
basexx.trp	base year (2000) through trip table by vehicle type
distkfac.mtx	district-district K factors by purpose (10x10)
kfaczone.dat	zone/K factor district equivalency (non-School K's)
jurzone.dat	zone/jurisdiction equivalency (for School K factors)
zd10.dat	zone/district equivalency for SQZ (jurisdictions)
zd11.dat	zone/district equivalency for SQZ (jurisdictions + externals)
zd12.dat	zone/district equivalency for Summit
ffactors.dat	F factors by purpose
delta.mtx	COM/TRK calibration adjustment factors
coefhbw.dat	HBW mode choice coefficients
coefsch.dat	SCH mode choice coefficients
coefhbs.dat	HBS mode choice coefficients
coefhbo.dat	HBO mode choice coefficients
coefjtw.dat	JTW mode choice coefficients
coefjaw.dat	JAW mode choice coefficients
coefobo.dat	OBO mode choice coefficients
tazbwidata.dat	zone data for air passenger model
sqz.exe	trip table reporting program
summit.exe	user benefit calculation/reporting program
tpp2ub.exe	user benefit file conversion program
tgfload.exe	transit assignment reporting program

MODEL.JOB is the principal setup to perform a full model run, including all steps. For many projects, this will be the setup that is mainly used. However, for New Starts projects, FTA requires that transit scenarios be evaluated using a fixed person trip table. For such studies, MODEL.JOB would be used to apply the model to the baseline condition and NEWSTART.JOB would be used to apply the model for each alternative scenario. NEWSTART.JOB uses the tested scenario's networks, but starts by assigning the second feedback AM peak vehicle trips from the baseline run (as specified by the user). Then, a set of peak period highway and transit skims are built. Next, the mode choice model is applied using the newly built skims and the person trips from the baseline run. From that point, the model proceeds as usual (with no further feedback).

Although Summit is not a TP+ program, a Cube user interface has been written to facilitate the application of Summit. SUMMIT.JOB invokes this interface.

PARAMETER.DAT contains various model parameters that will generally not change between scenario runs. This annotated file is shown in Table 2.3. The following situations are the most likely that would require this file to be changed.

- If the zone system changes.
- If the transit coding changes the highest or lowest rail or MARC node number.
- To test changes to the average auto operating cost.
- To change the HOV lane occupancy criterion (the options are 2 or 3).
- To change the zone(s) to be traced throughout the model run.

Table 2.3
Model Parameters

```
; Baltimore Regional Travel Model 2006
; parameter.dat
; various zone ranges and other parameters needed to run all steps of the model

; General parameters
zonecity='1-217'                                    ;Baltimore City Zone Range
zoneaa='218-425'                                    ;Anne Arundel County Zone Range
zoneba='426-767'                                    ;Baltimore County Zone Range
zoneca='768-862'                                    ;Carroll County Zone Range
zoneha='863-1002'                                   ;Harford County Zone Range
zoneho='1003-1151'                                  ;Howard County Zone Range
zonebr='1-1151'                                     ;Baltimore Region Zone Range
zonedc='1900-1934'                                  ;Washington, DC Zone Range
zonemo='2219-2306'                                  ;Montgomery County Zone Range
zonepg='2527-2652'                                  ;Prince George's County Zone Range
zonefr='2908-2928'                                  ;Frederick County Zone Range
zonewr='1900-2928'                                  ;Washington Region Zone Range
zones =2973                                         ;Highest zone number
zoneblank='1152-1899,1935-2218,2307-2526,2653-2907,2929-2931'        ;Blank Zones
zoneblank2='1152-1899,1935-2218,2307-2526,2653-2907,2929-2931,2974-2999'   ;
      Blanks, incl drive-acc "zones"
zoneex='2932-2973'                                   ;External Zone Range
zonein='1-2928'                                      ;Internal Zone Range
lastinterzone = 2928                                 ;Last Internal Zone
firstWashzone = 1900                                 ;First Washington Zone
firsttrzone = 3000                                   ;First drive-acc "zone"
lasttrzone = 3564                                    ;Last drive-acc "zone"
lastBaltzone = 1151

; Highway skim parameters
odtrace = '(i=1 && j=1-141)'            ; Trace zones for hwy skim

; Trip generation parameters
doGQ     = 1                    ; 1 to include GQ trips, 0 to exclude
doNonRes = 1                    ; 1 to include non-resident NHB trips, 0 to
exclude
; (Need to exclude both types of trips for survey validation.)
ixwavoB  = 1.193                ; I/X work person/vehicle ratio, Baltimore zones
ixnavoB  = 1.899                ; I/X non-work person/vehicle ratio, Baltimore zones
ixwavoW  = 1.428                ; I/X work person/vehicle ratio, Washington zones
```

```
ixnavoW  = 1.636                ; I/X non-work person/vehicle ratio, Wash. zones
xiwavoB  = 1.223                ; X/I work person/vehicle ratio, Baltimore zones
xinavoB  = 1.942                ; X/I non-work person/vehicle ratio, Baltimore zones
xiwavoW  = 1.465                ; X/I work person/vehicle ratio, Washington zones
xinavoW  = 1.673                ; X/I non-work person/vehicle ratio, Washington zones
cbd      = '115-141,1900-1905'  ; CBD zones (Balt., Wash.) (used in attraction model)
tgtrace  = '100'                ; Trace zone for generation (pick one zone only)

; Trip distribution parameters
tdtrace  = '100,318'                    ; Trace zones for distribution

; Mode choice parameters
row      = 896                  ; production zone to trace (0= no trace)
col      = 226                  ; attraction zone to trace (0= no trace)
hovdef   = 2                    ; minimum occupancy for HOV lanes
opcostmi =  9.9                 ; Auto Operating Cost, Cents/mi (in 2000 $)
skimwarn = 1                    ; 1 = Warn If Transit Access but No Paths
avgDurWk = 6                    ; average parking duration; work trips; hours
avgDurNw = 2                    ; average parking duration; non-work trips; hours
rail1    = 4105                 ; lowest rail node number
rail2    = 4499                 ; highest rail node number
marc1    = 4000                 ; lowest MARC node number
marc2    = 4100                 ; highest MARC node number
bus1     = 5000                 ; lowest bus node number
crivtfac = 0.75                 ; commuter rail IVT adjustment factor

; Assignment parameters
optollmile  =  5.00             ; Off-peak toll, cents/mile, managed lanes
ptollmile   = 15.00             ; Peak toll, cents/mile, managed lanes
valueoftime = 23.33             ; Value of time, in cents/min. (equiv. to $14/hour)
```

BASEXX.TRP represents the year 2000 through trip table by vehicle type. Table 2.4 shows the tables, their definitions, and the year 2000 totals. This table is Fratared to estimate the forecast year through trips.

Table 2.4
Base Year Through Trips

Table	Name	Vehicle Type	Total
1	PC	Passenger car	81,068
2	CV	Commercial vehicle	4,250
3	MT	Medium truck	1,833
4	HT	Heavy truck	7,749

DISTKFAC.MTX is a binary matrix containing the district-district K factors, by purpose. The tables are: 1=HBWK, 2=SCHK, 3=HBSK, 4=HBOK, 5=JTWK, 6=JAWK, 7=OBOK. There are two different K factor district systems, but both have 10 districts. JURZONE.DAT provides the zone/district equivalency for the School K's and KFACZONE.DAT provides it for the other K's. The format of both of those file is: zone, district and the only format requirement is that the zone and district must be separated by at least one space on each record.

This model uses a proprietary program, SQZ.EXE, to display some of the output trip tables in district-district format. The "ZD" files provide the zone/district

equivalency to that program and are keyed to the district definitions shown near the end of MODEL.JOB. Table 2.5 shows ZD10.DAT as an example.

Table 2.5
Example SQZ Zone/District Equivalency

```
DIST 1=1-217
DIST 2=218-425
DIST 3=426-767
DIST 4=768-862
DIST 5=863-1002
DIST 6=1003-1151
DIST 7=1152-1934
DIST 8=1935-2306
DIST 9=2307-2652
DIST 10=2653-2928
```

The F factor file contains all of the F factors used in this model. The file consists of a header record and 100 impedance records. Each record contains 20 F factors, in the following sequence: hbw1 (i.e., home-based work, income 1), hbw2, hbw3, hbw4, sch, hbs1, hbs2, hbs3, hbs4, hbo1, hbo2, hbo3, hbo4, jtw, jaw, obo, mtk/com, htk, extw (external work), extn (external non-work). For the two external purposes, the F's go up to 100 minutes; for the other purposes, 80 minutes.

The COM, MTK, and HTK models incorporate an O/D-based calibration adjustment. This takes the form of a matrix with six tables: 1 = COM, 2 = MTK, 3 = HTK, 4 = XXCV (i.e., commercial through trips), 5 = XXMT, 6 = XXHT.

The mode choice model's coefficients are specified in a separate file for each purpose. The files are named COEFppp.DAT, where ppp is the purpose code, as defined above. These are relatively free-format ASCII files, specifying one coefficient value per line: coefficient name, equal sign (=), and the value of the coefficient. Table 2.6 defines the coefficients used in these files. These coefficients should not be changed unless the model is being re-calibrated.

The remaining files in \MODEL are the non-Cube executable programs needed to apply the model. These are as follows:

- SQZ.EXE: Compresses zonal matrices to districts and nicely formats them for presentation.
- SUMMIT.EXE: FTA program to calculate and report user benefits.
- TPP2UB.EXE: Converts TP+ matrices containing Summit data into binary format.

- TGFLOAD.EXE: Sums the transit loaded networks and produces nicely formatted transit assignment reports.

The Appendices contain advice on using these programs. The documentation for TGFLOAD is in a separate file: TGFLOAD_328.PDF, which is generally stored in the \MODEL directory. Information on using SUMMIT is available from FTA.

Table 2.6
Mode Choice Coefficient Names

Name	Description
Crun	In-vehicle time
Cterm	Highway terminal time
Cwalk	Transit walk time
Cwait1s	Transit initial wait time < 7.5 min
Cwait1l	Transit initial wait time above 7.5 min
Cwait2	Transit transfer time
Cxfers	Transit number of transfers
Cdrvtm	Transit drive-access drive time
Cfare	Transit fare
Cpcost	Auto parking cost
Copcost	Auto operating cost
Csrnest	Shared ride nesting coefficient
Caunest	Auto mode nesting coefficient
Cwtnest	Walk-to-transit nesting coefficient
Cdtnest	Drive-to-transit nesting coefficient
Ctrnest	Transit mode nesting coefficient
Ccbdsr	CBD bias for Shared Ride mode
Cshort	Short distance coefficient (Transit)
Clong	Long distance coefficient (Transit)
Cvlong	Very long distance coefficient (Commuter Rail)
Catype[a]	Bias coefficient on attraction zone by area type (a = 1-9)
mbtrX	Transit bias coefficient for income group X (1-4)
mbsrX	Shared ride coefficient for income group X (1-4)
mbs3X	3-per-auto coefficient for income group X (1-4)
mbdtX	Drive-to-transit coefficient for income group X (1-4)
mbwrX	Walk-to-rail coefficient for income group X (1-4)
mbwcX	Walk-to-commuter rail coefficient for income group X (1-4)
mbdrX	Drive-to-rail coefficient for income group X (1-4)
mbdcX	Drive-to-commuter rail coefficient for income group X (1-4)
mbfwr	Feeder bus bias coefficient, walk-to-rail
mbfwc	Feeder bus bias coefficient, walk-to-commuter rail
mbfdr	Feeder bus bias coefficient, drive-to-rail
mbfdc	Feeder bus bias coefficient, drive-to-commuter rail

If the zone system should change, some of the basic input files must be changed. These are listed in Table 2.7.

Table 2.7
Basic Input Files Relating to the Zone System

File	Notes
parameter.dat	Mentions several zone number ranges, used throughout the model
basexx.trp	Changes if the external station numbering changes
kfaczone.dat	Must assign a K factor district to each active zone
jurzone dat	Must assign a K factor district to each active zone
zd10.dat	Must assign a summary district to each active zone
zd11.dat	Must assign a summary district to each active zone
zd12.dat	Must assign a summary district to each active zone
delta.mtx	Must split the COM/TRK calibration adjustments to match the new zones

2.5 Scenario Input Files

For each alternative scenario, 22 files are required to specify all of the necessary model inputs, as shown in Table 2.8 and described below.

Table 2.8
Scenario Input Files

New File Name	Description
bwi.trp	BWI vehicle trip table
cogtrn.mtx	MWCOG "freeze-dried" transit shares by purpose
drvaccop.dat	off-peak drive access links (mode 11,15)
drvaccpk.dat	peak drive access links (mode 11,15)
external.dat	external vehicle volumes by external station and vehicle type
fare.dat	transit fare links
highway.net	binary highway network (w/o speed/cap set)
landuse.dat	basic socioeconomic data by zone
line.dat	transit line records
marcfare.dat	MARC fare adjustment parameters
raillink.dat	rail links (mode 4-6)
sidewalk.dat	sidewalk records (mode 13)
tload.ctl	setup file for TGFLOAD (transit assignment reporting)
tolllink.dat	toll link definition file
turn.pen	turn penalties
walktime.dat	percent walk to transit/walk time by submode and period
washop.dat	off-peak DC walk access links (mode 16)
washpk.dat	peak DC walk access links (mode 16)
wkxferop.dat	off-peak rail station walk access and transfer links (mode 12, 14)
wkxferpk.dat	peak rail station walk access and transfer links (mode 12, 14)
wlkaccop.dat	off-peak walk access links (mode 16)
wlkaccpk.dat	peak walk access links (mode 16)
cw3240.dll	dll files for tpp2ub
tppdlibx.dll	dll files for tpp2ub
tputlib.dll	dll files for tpp2ub

BWI.TRP is a TP+ matrix file of trips to/from BWI Airport. At present, versions of these trips for 2000 and 2030 have been calculated by BMC staff. BMC is working on an airport ground access model that will eventually produce this trip table for any forecast year. The matrix total is 21,497 in 2000 and 71,156 in 2030.

COGTRN.MTX is a matrix of the percent transit by purpose and O/D, extracted from the MWCOG model, for the Washington region zones. About half of the MWCOG region is included in the Baltimore model, but the transit routes that serve only the Washington area are not coded in the transit network. In order to obtain a reasonable estimate of highway link volumes and speeds, it is necessary to remove approximately the right number of transit trips. Thus, the MWCOG modal trip table was used to provide the estimated transit share by purpose for the intra-Washington region O/D pairs. This file provides that information, converted to the BMC zone system. The file contains four tables: 1 = HBWTRN, 2 = HBSTRN, 3 = HBOTRN, 4 = NHBTRN. These files have been prepared for 2000, 2005, and 2030. They should change by year, but should probably not change with each Baltimore transit scenario. They may change in the case of a substantial change in the Washington region's transit system, in which case updates should be obtained from MWCOG. Appendix D contains a TP+ setup that can be used to extract and reformat the necessary files from the MWCOG model.

The main transit access link files – DRVACCPK.DAT, DRVACCOP.DAT, WLKACCPK.DAT, and WLKACCOP.DAT – are created automatically by BMC's access development procedure. This is an off-line process, documented in Appendix F. These files must be updated to reflect any change in the topology of the transit system.

Two other files are used to represent transit access in the Washington area: WASHPK.DAT and WASHOP.DAT. These files represent transit travel times, peak and off-peak, respectively, between each TAZ in the District of Columbia and Washington Union Station. Their purpose is to provide for the collection and distribution of transit trips on the MARC commuter rail system connecting Washington with the Baltimore region. These files should be changed only if it is necessary to model substantial changes in Washington area transit service.

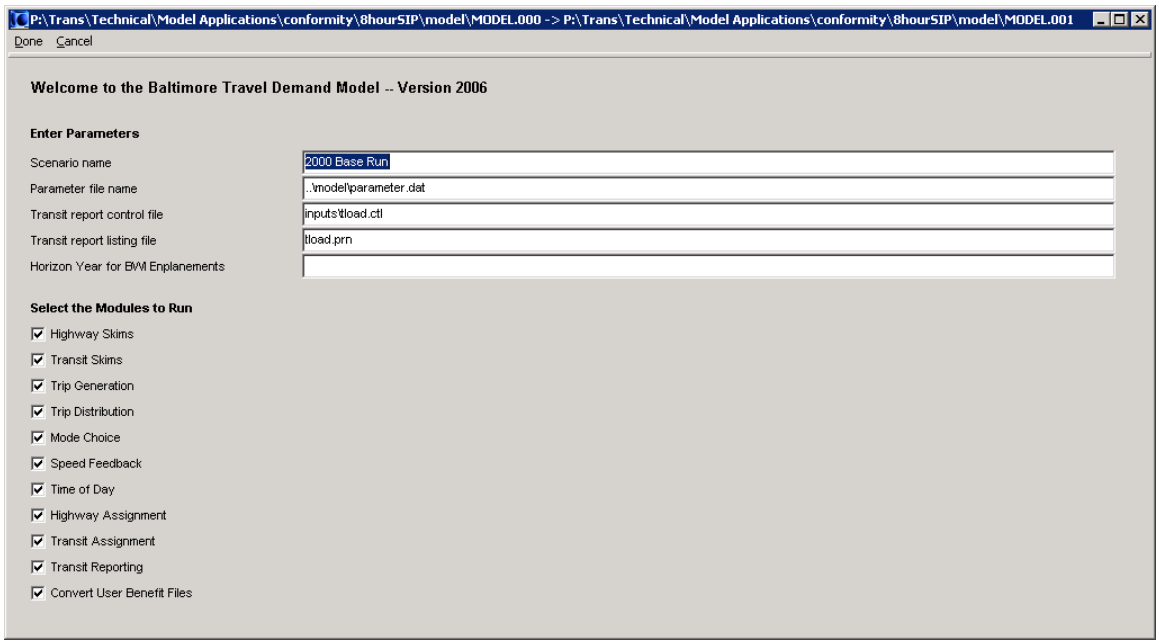
The other transit files – FARE.DAT, LINE.DAT, RAILLINK.DAT, MARCFARE.DAT, SIDEWALK.DAT, WKXFERPK.DAT, WKXFEROP.DAT, and WALKTIME.DAT – are created manually and must also be updated to reflect changes in the transit network. The format of these files is described further in Chapter 5.

TLOAD.CTL is the setup file for the TGFLOAD transit reporting program (see Appendix B). This file must be updated any time a transit line or rail PnR lot is added or removed, or its name modified.

HIGHWAY.NET, TURN.PEN, and TOLLINK.DAT describe the highway system. The format of these files is described further in Chapter 4.

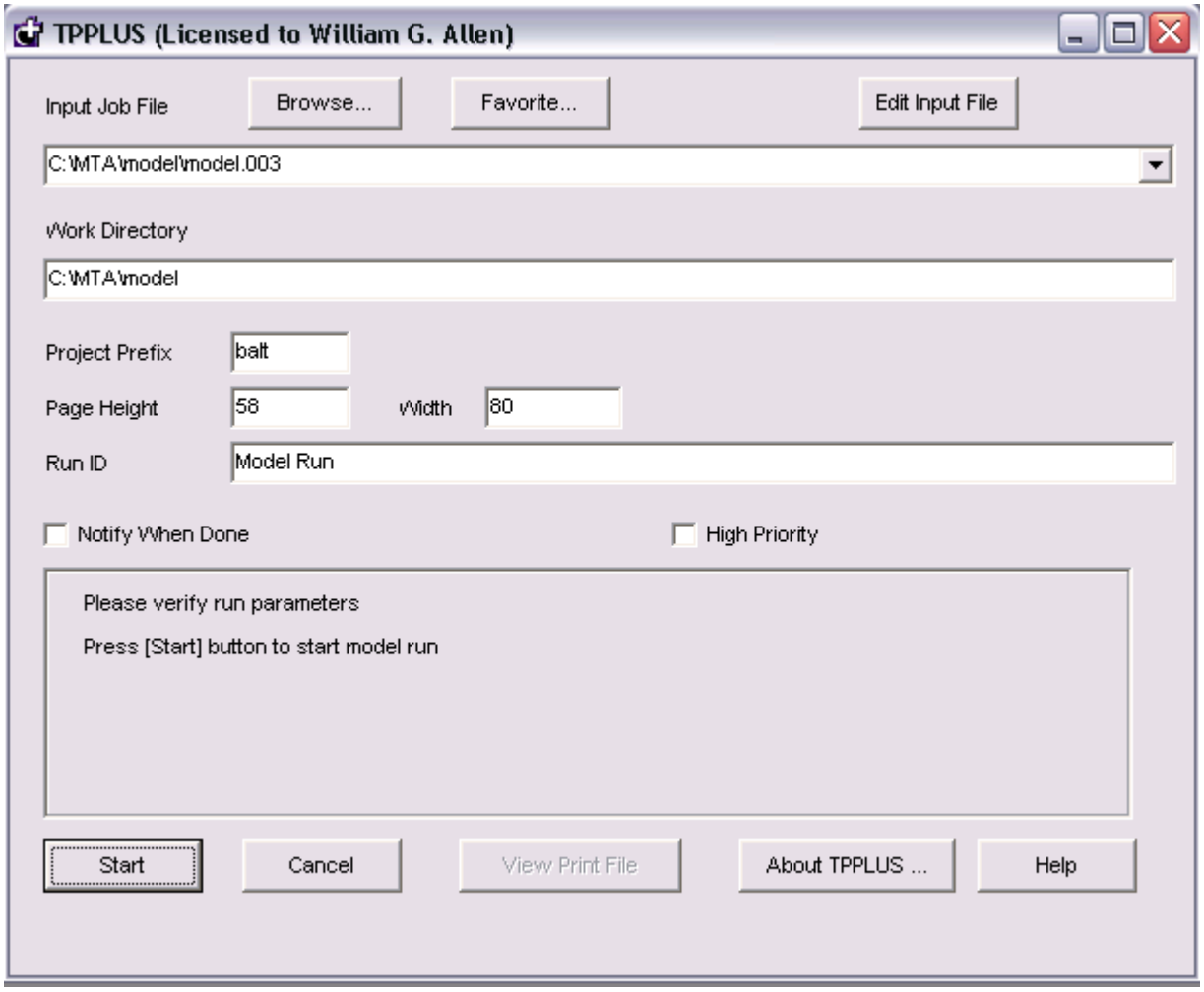
2.6 User Interface

Cube provides a relatively simple way to create a user interface for this model. The desired procedure for a full run is to start Cube, then open MODEL.JOB and press the **F9** key. This brings up the following window:



Generally the user will need to edit only the Scenario name and enter the horizon year for BWI enplanements. This is used to label various parts of the output file. It should be 56 characters or less (otherwise it may cause problems with Summit, farther down the job stream). The default scenario name is "2000 Base Run", so if the user is running any other scenario, he must type in that scenario's name every time. By default, all steps are checked and typically, the user will run all steps. However, this feature makes it possible to run only selected steps, *assuming the user has taken great care to ensure that the necessary inputs exist for each step*.

Clicking **Done** then brings up this screen:



This is the standard Cube/TP+ run screen. For each run, this screen must be edited to place the scenario's directory name in the Work Directory window, like so:

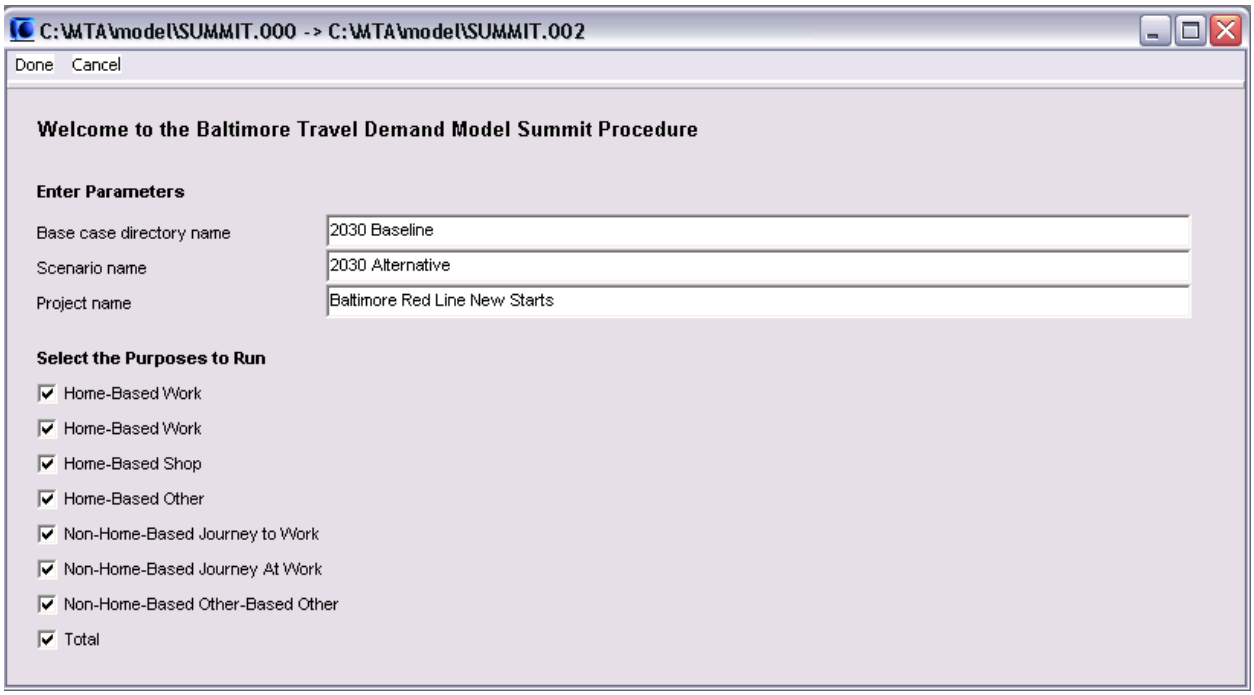
The Project Prefix field may be changed at the user's option, but it will only provide the initial characters (generally four) for the listing files (xxxxnnnn.PRN) documenting the model run, where xxxx is the prefix chosen and nnnn is a four digit sequential serial number assigned by the software. There is no need to change the Run ID; each model step contains an ID.

Once these changes are made, pressing the **Start** button starts the run.

For a New Starts run, open NEWSTART.JOB in Cube and press **F9**, which brings up the following screen:

In this case, the user must also specify the directory containing the scenario to be used as the Baseline run (56 characters or less). This is the scenario whose person trips will be input to mode choice. Clicking **Done** brings up the same TPPLUS screen shown above, and the Work Directory must be modified to reflect the scenario for which the model is being run.

Once a Baseline run and a Scenario run have been made, it is possible to run Summit. Open SUMMIT.JOB in Cube and press **F9**, which brings up the following screen:



The user must specify the Baseline directory in the first edit box and then the title of the scenario in the second edit box. The Project name box is used to title the Summit reports. Generally, all trip purposes and the total will remain selected. Clicking on "Done" brings up the same TPPLUS screen shown above, and the Work Directory must be modified to reflect the scenario for which the model is being run. That is, the alternative scenario being analyzed is in the working directory and the interface screen tells the setup where to find the Summit files for the Baseline case.

Appendix E contains a list of the 222 individual TP+ steps required to run this model.

The main model setups, MODEL.JOB, NEWSTART.JOB, and SUMMIT.JOB, are far too large to incorporate directly in this document. These are provided on the model's CD in the \MODEL directory.

3.0 Land Use

3.1 Zone Numbering

This model retained the zone numbering system established by BMC in 2000. This system uses 1,421 internal traffic analysis zones and 42 external stations, numbered as shown in Table 3.1. The BMC system of Regional Planning Districts (RPDs) was also used.

Table 3.1
Zone System

	Zones			RPDs		
	Start	End	Zones	Start	End	Districts
Baltimore City	1	217	217	101	126	26
Anne Arundel	218	425	208	201	217	17
Baltimore County	426	767	342	301	331	31
Carroll	768	862	95	401	406	6
Harford	863	1002	140	501	507	7
Howard	1003	1151	149	601	607	7
DC	1900	1934	35	700	700	1
Montgomery	2219	2306	88	800	800	1
Prince George's	2527	2652	126	900	900	1
Frederick	2908	2928	21	1000	1000	1
Total Internal Zones			1421			98
BMC Externals	2932	2933	2			
	2954	2973	20			
Washington Externals	2934	2953	20			
Total External Stations			42			

3.2 Definitions and File Layout

An objective of the new model development work was to simplify the model inputs as much as possible. To that end, the land use input data for a particular scenario is specified in one ASCII file, cleverly called LANDUSE.DAT. This file consists of one record per active zone, preferably sorted in ascending zone order and preferably using fixed column format, although those are not absolute requirements. However, there must be at least one space separating each field on each record. As developed by the consultant, this file also carries a header record. This is also not required, but is a really good idea. Table 3.2 describes the required fields.

Table 3.2
Land Use File Layout

Field	Name	Definition
1	TAZ	Zone (TAZ) number
2	RPD	Regional planning district number
3	Tpop	Total population (sum of population living in GQs and in HHs)
4	IGQ	Population living in institutionalized group quarters
5	NIGQ	Population living in non-institutionalized group quarters
6	HH	Households
7	MedInc	Median household income
8	Workers	Total number of resident workers (labor force)
9	RE	Retail employment
10	OFF	Office employment
11	IND	Industrial employment
12	OTH	Other employment
13	ACRES	Land acreage in the zone
14	TKZONES	Truck zone code (0-12)
15	ENROLL	School enrollment (K-12)

The two types of group quarters population uses the Census Bureau's definition. Institutionalized population includes people under formally supervised care in institutions at the time of enumeration, such as correctional institutions, nursing homes, and juvenile institutions. Non-institutionalized population includes all people who live in group quarters other than institutions, such as college dormitories, military quarters, and group homes. Also included are staff residing at institutional group quarters.

"Households" is equivalent to occupied dwelling units, with the caveat that one person living in a dwelling unit is a household, even though the Census Bureau does not treat it as such. The TKZONES field is zero, except where the user judges that the land use in the zone is such that it would probably generate a relatively high number of truck trips, in which case the codes shown in Table 3.3 should be used. The distinction between "larger" and "smaller" is subjective and is open to the user's interpretation.

Table 3.3
Truck Zone Codes

Land Use Type	Larger	Smaller
Business District	1	7
Warehouse/Manufacturing	2	8
Intermodal Transfer	3	9
Airport	4	N/A
Institutional/Other	5	11
Delivery/Medium Truck	6	12

The same variables are used for all zones, whether in the Baltimore region or the Washington region. However, the data for the Washington zones (1900 – 2928) is typically obtained from MWCOG. It appears that MWCOG and BMC use slightly different definitions for these variables, particularly the split of employment by type. Since the model was developed using these two differing definitions, the user should attempt to apply it that same way.

Although MWCOG maintains data on group quarters population, it does not subdivide this by institutional vs. non-institutional as does BMC. However, this distinction is not terribly important to the travel model. BMC staff estimated this split for the MWCOG data.

In addition, it should be noted that MWCOG does not currently maintain zonal data on workers at their residence (labor force). Thus, these values should be left as zero for the Washington region zones. The travel model includes a component that estimates workers for those zones.

Table 3.4 shows the totals for the land use variables by region and year.

Table 3.4
Land Use Totals

Region	Item	2000 Total	2030 Total
Baltimore	Total population	2,515,360	2,882,558
	Institutional GQ pop	34,067	39,363
	Non-institutional GQ pop	34,499	49,127
	Households	959,656	1,164,282
	Workers	1,189,894	1,365,732
	Retail employment	244,104	300,530
	Office employment	676,126	844,772
	Industrial employment	164,819	197,823
	Other employment	449,427	571,822
	Acres	1,432,953	1,432,953
	School enrollment	483,034	846,777
Washington	Total population	2,448,360	3,093,066
	Institutional GQ pop	20,260	25,819
	Non-institutional GQ pop	46,745	51,153
	Households	931,525	1,213,637
	Workers	N/A	N/A
	Retail employment	262,064	375,184
	Office employment	722,286	1,036,501
	Industrial employment	155,443	226,922
	Other employment	445,255	633,693
	Acres	1,113,442	1,113,442
	School enrollment	434,031	560,865
Total	Total population	4,963,720	5,975,624
	Institutional GQ pop	54,327	65,182
	Non-institutional GQ pop	81,244	100,280
	Households	1,891,181	2,377,919
	Workers	N/A	N/A
	Retail employment	506,168	675,714
	Office employment	1,398,412	1,881,273
	Industrial employment	320,262	424,745
	Other employment	894,682	1,205,515
	Acres	2,546,395	2,546,395
	School enrollment	917,065	1,407,642

4.0 Highway Network

4.1 Definitions

BMC uses a GIS-based process to create the highway network, which is then converted to TP+ format. It is not necessary to use the GIS-based process – the base networks can be edited in Cube. Table 4.1 lists the fields that make up the highway network. The coordinates are expressed in feet, using the Maryland state plane coordinate system.

The most important fields for network coding are FT, ROADTYPE, AMLANE, PMLANE, OFFLANE, AMLIMIT, PMLIMIT, OFFLIMIT, TAZ00, and SPDP. These must be specified by the user during coding. Another field important to the model is AREATYPE, but this is computed automatically by the model, based on the area type of the link's zone (TAZ00). The remaining fields are used for summary or evaluation purposes.

The highway network is maintained in a file called HIGHWAY.NET. However, the values of speed and capacity in this file are not necessarily those that the model uses. As part of each model run, the model inserts a new area type, free-flow speed, initial congested speed, and capacity for each link, as a function of the facility type and area type. *That* network is called SPDCAP.NET and is an intermediate output file for each model run.

Table 4.1
Highway Network Fields

Field	Description
Node Records	
N	Node number
NODETYP (C)	
X	X coordinate
Y	Y coordinate
EFFYEAR	Horizon year node becomes active
EXPYEAR	Horizon year node becomes inactive
ENABLED	(not used)
Link Records	
A	A node
B	B node
EFFYEAR	Horizon year link becomes active
AMLIMIT	AM peak link usage restriction code (see Table 4.2)
PMLIMIT	PM peak link usage restriction code (see Table 4.2)
OFFLIMIT	Off-peak link usage restriction code (see Table 4.2)
EXPYEAR	Horizon year link becomes inactive
FUA	Federal Urban Aid Functional Classification system (for air quality): 1=interstate,2=freeway,3=prin. art., 4=min. art., 5=collector
FT	Facility type (see Table 4.3)
ROADTYPE	Roadway type
DISTANCE	Distance in miles
JUR	Jurisdiction (see Table 4.4)
TAZ00	Nearest traffic analysis zone
RPD	Regional planning district
SPDP	Posted speed limit, mph
LANES	(not used)
TSVA	(not used)
SCRN	Screenline number
SCRN2	Second screenline number
SCRNID	Screenline link ID
SCRNID2	Second screenline link ID
URBAN	Urban flag (for air quality)
SPDCLASS	(not used)
CAPCLASS	Maximum daily lane capacity divided by 50 (Service level 'E')
CNTID (C)	Regional count database identification
CNT00	Year 2000 daily count
CNTWKD00	Year 2000 weekday count
HTCNT00	Year 2000 heavy truck count
MTCNT00	Year 2000 medium truck count
COMCNT00	Year 2000 commercial vehicle count (not presently coded)
MANAGEDLAN	Managed line code: 1=Managed Lane, 0-Non-Managed Lane
OLD_DISTAN	(not used)
AMLANE	AM peak number of lanes
PMLANE	PM peak number of lanes
OFFLANE	Off-peak number of lanes
TSIN (C)	(not used)
AREATYPE	Area type code (see section 4.2)
FFSPEED	Free-flow speed, mph
CONGSPD	Initial congested speed, mph
CAPE	Maximum daily lane capacity (Service level 'E')
TOLLCOSTOFF	Off-peak toll, cents (year 2000 $)
TOLLCOSTPK	Peak toll, cents (year 2000 $)

Table 4.2
Link Usage Restrictions

Code	Restriction
0	None
1	None
2	HOV2+ only
3	HOV3+ only
4	No heavy or medium trucks
9	No vehicles at all (used for HOV links that are closed in one direction for a given time period)

Table 4.3
Facility Type Codes

Code	Definition
1	Interstate
2	Non-interstate freeway
3	Principal arterial
4	Minor arterial
5	Collector
6	Interstate high-speed ramp
7	Interstate medium-speed ramp
8	Interstate low-speed ramp
9	Non-interstate freeway medium-speed ramp
10	Non-interstate freeway low-speed ramp
11	Centroid connector
12	Special older freeway
13	Transit drive-access connector
14	Business routes (important local links in certain developed areas)

Table 4.4
Jurisdiction Codes

Code	Definition
1	Baltimore City
2	Anne Arundel County
3	Baltimore County
4	Carroll County
5	Harford County
6	Howard County
7	Washington, DC
8	Montgomery County
9	Prince George's County
10	Frederick County
11	External station connectors

4.2 Area Type Model

A submodel is used to compute the area type of each zone from the input socioeconomic data file. Since the zone that each link is in is known, the area type for the zone can be automatically attached to the link. The area type model is applied every time the model is run.

The area type model uses what has become a more or less standard methodology: a look-up table based on household and employment density, with density based on the subject zone and zones whose centroids are within one mile of the subject zone. Table 4.5 presents the area type model. Figures 4.1 and 4.2 show the area types by zone for 2000 and 2030 respectively.

Table 4.5
Area Type Model

	Households/Acre									
Empl/ Acre	< 0.5	0.5-1.0	1.0-1.5	1.5-2.25	2.25-3.0	3.0-4.0	4.0-5.0	5.0-7.5	7.5-11	> 11
< 1.5	1	1	2	2	3	3	4	5	5	6
1.5-3.5	1	1	2	2	3	3	4	6	6	6
3.5-6.5	1	1	2	2	3	3	4	6	6	6
6.5-12	1	2	2	3	3	4	4	6	6	7
12-20	1	2	3	3	4	4	5	7	7	7
20-30	2	3	4	4	5	5	5	7	7	7
30-45	3	4	4	5	5	6	6	7	7	8
45-70	3	4	4	5	5	6	7	8	8	8
70-110	4	4	5	6	6	7	8	9	9	9
> 110	4	5	6	7	7	8	9	9	9	9

In order to avoid unnecessary controversy, no names have been assigned to the nine area type codes. However, it should be apparent that area type "1" is associated mainly with rural areas and "9" describes the Baltimore and Washington CBDs.

4.3 Supplemental Files

Coding the highway network requires the development of two additional files: turn penalties and toll links.

The turn penalty file is an ASCII file in the standard TP+ format: from node, turn node, to node, set number, penalty. The file name is TURN.PEN. As of this writing, all turn penalty records are actually turn prohibitors (penalty = -1), designated as set #1, and the turn penalty file contains a description of each location.

In this model, tolls are implemented in a somewhat unconventional manner. At present, there are only a handful of toll links and so the consultant decided to have the user identify each toll link individually, in a separate ASCII file. This file, named TOLLINK.DAT, specifies the toll in cents for specific links, using HWYNET syntax, as shown in Table 4.6 for 2000. An advantage to entering the toll data in this manner is that it provides an easy way for the user to document the toll assumptions associated with each scenario.

Toll is specified in cents, in year 2000 dollars. In 2000, all of the region's toll facilities carried a toll of $1.00. In 2003, these tolls were all raised to $2.00. Given the rate of inflation between 2000 and 2003, this is equivalent to $1.85 in year 2000 dollars. The 2030 base case assumes that tolls will continue to rise from 2003 to 2030 at the same rate as inflation, so that the $1.85 value is used for 2030 as well.

Table 4.6
Year 2000 Toll Link File

```
; Toll links for base 2000 run

   ;Off-peak toll, cents
   if (a=6703 && b=6717)  tollcostoff=100  ;Fort Mc. Henry Tunnel toll
   if (a=6828 && b=6492)  tollcostoff=100  ;Fort Mc. Henry Tunnel toll
   if (a=6720 && b=6842)  tollcostoff=100  ;Baltimore Harbor Tunnel toll
   if (a=6739 && b=6511)  tollcostoff=100  ;Baltimore Harbor Tunnel toll
   if (a=15325 && b=6829) tollcostoff=100  ;Francis Scott Key Bridge
   if (a=6701 && b=15324) tollcostoff=100  ;Francis Scott Key Bridge

   ;Peak toll, cents
   if (a=6703 && b=6717)  tollcostpk=100  ;Fort Mc. Henry Tunnel toll
   if (a=6828 && b=6492)  tollcostpk=100  ;Fort Mc. Henry Tunnel toll
   if (a=6720 && b=6842)  tollcostpk=100  ;Baltimore Harbor Tunnel toll
   if (a=6739 && b=6511)  tollcostpk=100  ;Baltimore Harbor Tunnel toll
   if (a=15325 && b=6829) tollcostpk=100  ;Francis Scott Key Bridge
   if (a=6701 && b=15324) tollcostpk=100  ;Francis Scott Key Bridge
```

Maryland Department of Transportation (MDOT) and Maryland Transportation Authority (MTA) have proposed the future implementation of *managed lanes* within the Baltimore region. Under managed lanes, additional capacity is proposed for construction within the median of existing interstate right of way. Users will have the option of traveling on the existing interstate system at no charge or paying a dynamic toll charge to travel on the managed lanes (i.e., the toll would be determined in real time based on the level of congestion on the parallel free interstate). Managed lanes would be physically separated from the non-managed facilities. The dynamic toll would be designed with the goal of achieving level of service "C" on the managed lane.

The current model uses an off-peak toll price of 5 cents per mile and a peak toll price of 15 cents per mile in order to represent the effects of managed lanes. This is implemented on I-95, between I-895 and MD 543, and on the Intercounty Connector in Prince George's and Montgomery Counties in the 2030 base network.

Figure 4.1
2000 Area Types

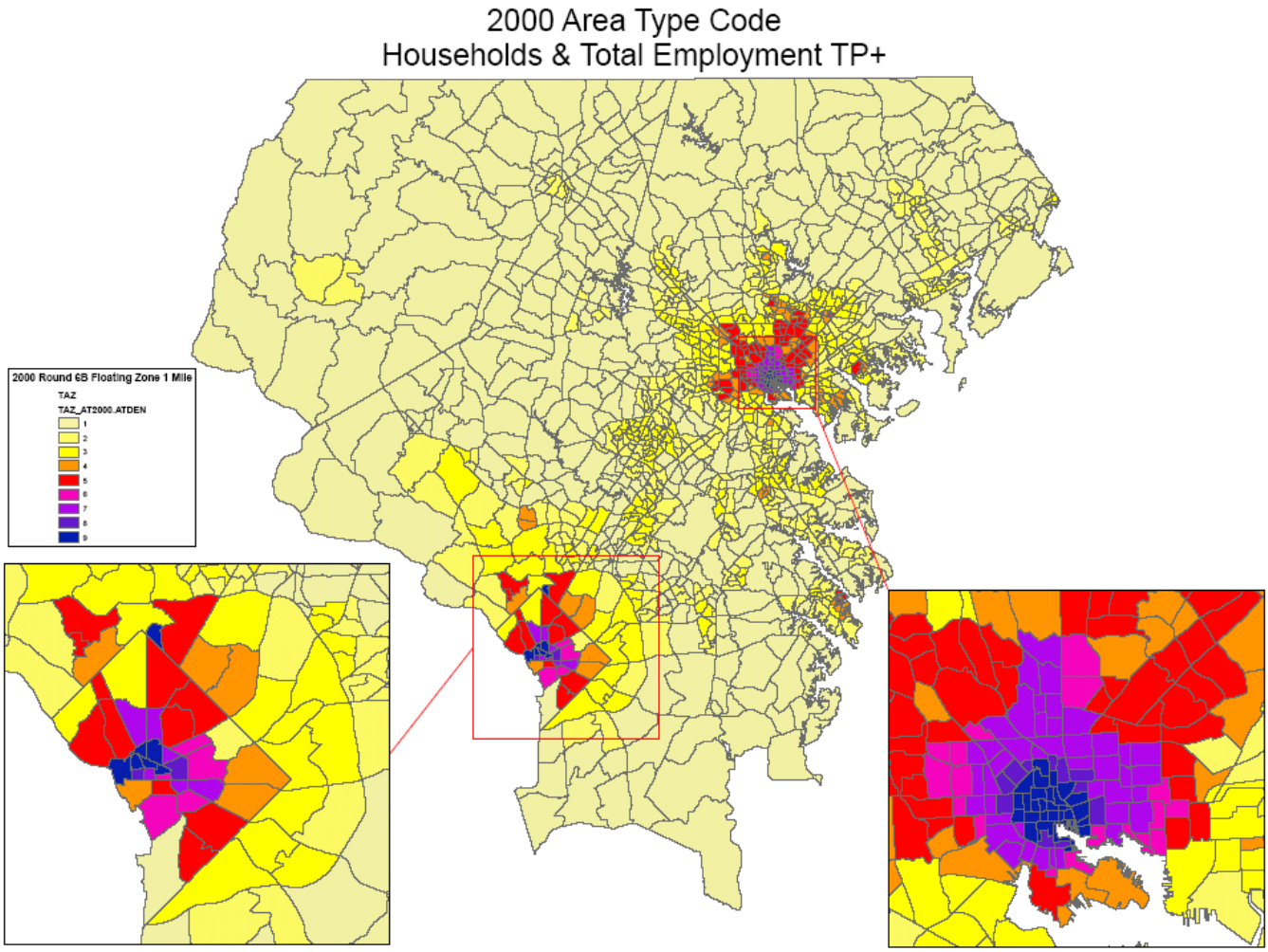
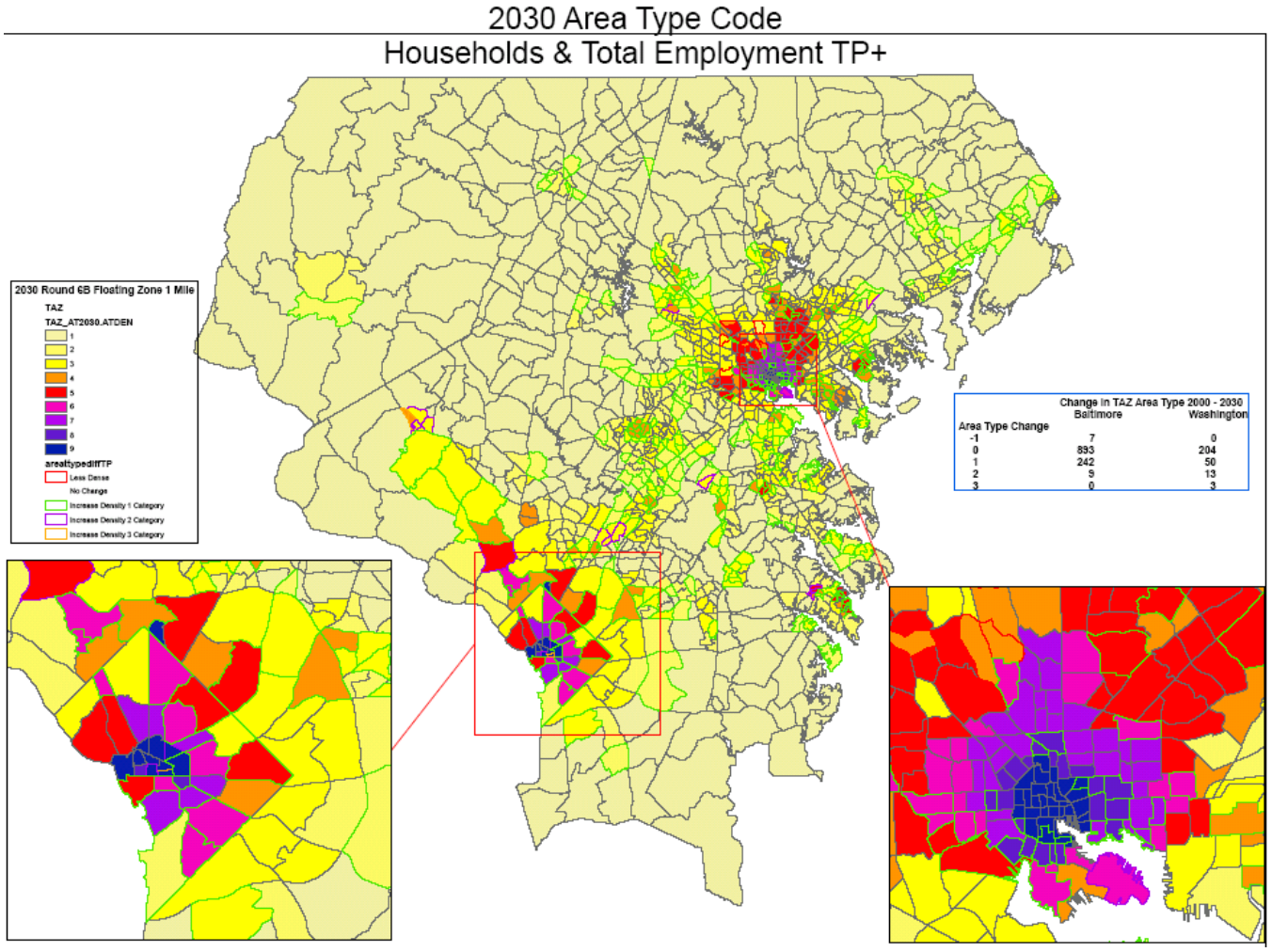


Figure 4.2
2030 Area Types



5.0 Transit Network

5.1 Line Coding

Table 5.1 defines the transit and non-transit mode codes used in this model.

Table 5.1
Transit Line Codes

Mode	Definition	Owner	Color
1	MTA local bus	11	1
2	MTA express bus	11	2
3	MTA premium bus	12	2
4	Light rail	13	3
5	Metro rail	14	4
6	Commuter rail (MARC)	15	5
7	Harford County bus	22	6
8	HATS/Howard Transit/Connect-a-Ride (Howard County bus)	21	6
8	Carroll County bus	24	6
9	Annapolis Transit bus	23	6
11	Zonal drive access		
12	Transit transfer link		
13	Sidewalk link		
14	Intra-station walk link		
15	PnR link		
16	Zonal walk access		

The transit line descriptions follow the standard TP+ TRNBUILD coding convention. All line records are stored in one file: LINE.DAT. The following parameters are coded: NAME, ONEWAY, MODE, COLOR, FREQ[1], FREQ[2], and OWNER. The node strings include specific stop and non-stop nodes and the DELAY_C parameter is set to 0.5 at the beginning of each line, to signify that each stop carries a delay of 30 seconds. The OWNER and COLOR codes are not used by TP+, but are available for user-specified summary purposes. The ALLSTOPS parameter is coded as Y for those few lines for which all nodes are stop nodes.

FREQ[1] represents the AM headway and FREQ[2] represents midday headway. If either of those parameters is set to zero or is missing for a line, it means that line does not operate during that period. Coded headways reflect the headway that is generally implied by the published timetable and are coded to the nearest whole minute. If the timetable suggests "clock" headways, that is what is coded (rather than the more intricate calculation used in some models, dividing the number of trips into the minutes in each time period).

Transit lines are coded using the coded highway network. The objective of transit coding is to provide service to the zones that have service in the real world, not to serve as an exact representation of the route system. Streets that are too insignificant to be in the highway network are not added in order to provide a more detailed representation of each bus route. Bus routes are coded using node numbers 5000 and higher.

Table 5.2 shows the year 2000 actual transit lines and their coded representations.

Table 5.2
2000 Transit Lines

RouteName/End Points	Coded Name	OneWay	AllStop	Mode	AM Hdwy.	MD Hdwy.
;MARC Penn A--Perryville to Washington	MARCPA	TRUE	FALSE	6	60	
;MARC Penn B--Penn Station to Washington	MARCPB	FALSE	FALSE	6	45	60
;MARC Camden--Camden Station to Washington	MARCC	FALSE	FALSE	6	45	
;METRO--Owings Mills to Johns Hopkins Hospital	METRO	FALSE	TRUE	5	8	10
;CLRL Central Light Rail Line	CLRL	FALSE	FALSE	4	17	17
;CLRL Central Light Rail Line Penn Station-BWI	CLRLPB	FALSE	FALSE	4	17	17
;1A--Sinai Hospital-Ft. McHenry	MTA01A	FALSE	TRUE	1	40	40
;1B--Druid Hill & Fulton-Ft. McHenry	MTA01B	FALSE	TRUE	1	40	
;2A--Catonsville-City Hall	MTA02A	FALSE	TRUE	1	20	30
;2B--City Hall-Irvington	MTA02B	FALSE	TRUE	1	20	30
;2X--Catonsville-City Hall (Express)	MTA02X	TRUE	FALSE	2	20	
;3A--Inner Harbor-Cromwell Bridge	MTA03A	FALSE	TRUE	1	10	45
;3B--Inner Harbor-Sheppard Pratt	MTA03B	FALSE	TRUE	1	30	45
;3C--Inner Harbor-Taylor Avenue	MTA03C	FALSE	TRUE	1	20	
;3D--Inner Harbor-Northwood	MTA03D	FALSE	TRUE	1	20	45
;3X--Cromwell Bridge-Inner Harbor (Express)	MTA03X	TRUE	FALSE	2	5	
;4A--Dundalk-Eastpoint	MTA04A	TRUE	FALSE	1	70	70
;4B--Eastpoint-Dundalk	MTA04B	TRUE	FALSE	1	70	70
;5A--Cedonia-Mondawmin (Via Preston)	MTA05A	FALSE	FALSE	1	20	30
;5B--Cedonia-Mondawmin (Via Federal)	MTA05B	FALSE	FALSE	1	30	30
;5C--Patterson Park & Lanvale-Mondawmin	MTA05C	FALSE	FALSE	1	30	
;5X--Cedonia-Eutaw & Saratoga	MTA05X	TRUE	FALSE	2	10	
;7--Mondawmin-Canton	MTA07	FALSE	FALSE	1	24	35
;8A--Lutherville-University Hospital	MTA08A	FALSE	TRUE	1	10	15
;8B--Lutherville-Inner Harbor	MTA08B	FALSE	TRUE	1	15	20
;8C--Highlands Corperate Park-University Hospital	MTA08C	FALSE	TRUE	1	15	
;8X--Towson-University Hospital	MTA08X	TRUE	FALSE	2	30	
;10A--Sparrows Point-State Center	MTA10A	FALSE	FALSE	1	20	60
;10B--Dundalk-State Center	MTA10B	FALSE	FALSE	1	15	20
;11A--Riverview-GBMC via Charles	MTA11A	FALSE	TRUE	1	60	72
;11B--Riverview-GBMC via Rodgers Forge	MTA11B	FALSE	TRUE	1	40	50
;11C--Riverview-Goucher via Rodgers Forge & Charles and Kenilworth	MTA11C	FALSE	TRUE	1	60	72
;11D--Gable Avenue-GBMC via Charles	MTA11D	FALSE	TRUE	1	90	120
;11E--Riverview-Goucher via Charles and Kenilworth	MTA11E	FALSE	TRUE	1	120	200

RouteName/End Points	Coded Name	OneWay	AllStop	Mode	AM Hdwy.	MD Hdwy.
;11F--Gable Avenue-Goucher via Rodgers Forge & Charles and Kenilworth	MTA11F	FALSE	TRUE	1	90	120
;13A--Walbrook-Canton	MTA13A	FALSE	FALSE	1	15	20
;13B--Walbrook-Fells Point	MTA13B	FALSE	FALSE	1	15	20
;13C--Walbrook-North & Milton	MTA13C	FALSE	TRUE	1	30	
;13D--Social Security-Canton	MTA13D	FALSE	FALSE	1	25	
;14--Annapolis-Patapsco	MTA14A	FALSE	FALSE	1	60	60
;14--Jumper's Hole-Patapsco	MTA14B	FALSE	FALSE	1	60	60
;15A--Overlea-Lorraine	MTA15A	FALSE	TRUE	1	14	120
;15B--Overlea-Walbrook	MTA15B	FALSE	TRUE	1	14	60
;15C--Overlea-Social Security	MTA15C	FALSE	TRUE	1	25	30
;15D--Overlea-Windsor Hills	MTA15D	FALSE	TRUE	1		36
;15X--Perry Hall-Downtown	MTA15X	TRUE	FALSE	2	10	
;17--Parkway Center-Patapsco	MTA17	FALSE	FALSE	1	30	105
;19A--Loch Raven & Taylor-State Center	MTA19A	FALSE	FALSE	1	14	20
;19B--Carney-State Center	MTA19B	FALSE	FALSE	1	14	20
;19X--Carney-State Center (Express)	MTA19X	TRUE	FALSE	2	10	
;20A-Dundalk-Rolling and Security	MTA20A	FALSE	TRUE	1	15	20
;20B-Dundalk Marine Terminal-Hilton and Franklin	MTA20B	FALSE	TRUE	1	30	60
;20C-Holabird-Social Security	MTA20C	TRUE	TRUE	1	25	
;21--Fells Point-Penn North	MTA21	FALSE	TRUE	1	15	27
;22A--FSK Medical Center-Mondawmin	MTA22A	FALSE	FALSE	1	15	30
;22B--FSK Medical Center-Brooklyn	MTA22B	FALSE	FALSE	1	30	60
;23A--US 40 & Rolling Road-Middle River	MTA23A	FALSE	TRUE	1	30	30
;23B--Wildwood-Fox Ridge	MTA23B	FALSE	TRUE	1	30	30
;23C--Northbend-Middle River	MTA23C	FALSE	TRUE	1	30	
;23D--Social Security-Middle River	MTA23D	FALSE	TRUE	1	40	
;24--Tidewater Village-Golden Ring	MTA24	FALSE	FALSE	1	75	75
;27A--Reisterstown Plaza-Camden Yards	MTA27A	FALSE	TRUE	1	60	60
;27B--Reisterstown Plaza-Cherry Hill LR Stop via Roland	MTA27B	FALSE	TRUE	1	60	60
;29A--Cherry Hill Stop-Patapsco	MTA29A	FALSE	TRUE	1	45	45
;29B--Cherry Hill Stop-Cherry Hill	MTA29B	FALSE	TRUE	1	15	15
;30--Cherry Hill Stop-Patapsco	MTA30	FALSE	FALSE	1	30	60
;31A--UMBC-Penn Station	MTA31A	FALSE	TRUE	1	20	40
;31B--Washington Boulevard-Penn Station	MTA31B	FALSE	TRUE	1	20	40
;33--Rogers Avenue Station-Moravia	MTA33	FALSE	TRUE	1	15	50
;35A--White Marsh-University Hospital	MTA35A	FALSE	FALSE	2	15	30
;35B--Marshfield Busines Park-University Hospital	MTA35B	FALSE	FALSE	2	5	
;35C--Rosedale Industrial Park-University Hospital via Armistead Gardens	MTA35C	FALSE	FALSE	2	15	30
;36--York Road & Northern Parkway-University Hospital	MTA36	FALSE	FALSE	1	15	25
;44A--Hollander Ridge-Social Security	MTA44A	FALSE	TRUE	1	30	
;44B--Hollander Ridge-Brighton	MTA44B	FALSE	TRUE	1	40	74
;44C-Hollander Ridge-Gwynn Oak Park	MTA44C	FALSE	TRUE	1	40	74
;50--Belair-Parkside Loop	MTA50	TRUE	FALSE	1	20	20
;51A--Rogers Avenue-Monroe Street	MTA51A	FALSE	TRUE	1	15	64
;51B--Rogers Avenue-Cherry Hill	MTA51B	FALSE	TRUE	1	30	64
;55A--GBMC-Franklin Square Hosp.	MTA55A	FALSE	FALSE	1	60	40

RouteName/End Points	Coded Name	OneWay	AllStop	Mode	AM Hdwy.	MD Hdwy.
;55B--GBMC-Fox Ridge	MTA55B	FALSE	FALSE	1	35	90
;61--Lake Avenue-Inner Harbor	MTA61	FALSE	TRUE	1	10	45
;64A--Wagner's Point-North Avenue	MTA64A	FALSE	TRUE	1	15	30
;64B--Riviera Beach-North Avenue	MTA64B	FALSE	TRUE	1	60	0
;77--Patapsco-Old Court Station	MTA77P	FALSE	FALSE	1	45	0
;77O--UMBC-Old Court Station	MTA77O	FALSE	FALSE	1	0	45
;86--Goucher Blvd.-Social Security	MTA86	TRUE	FALSE	2	60	
;91A--Sinai Hospital-City Hall	MTA91A	FALSE	TRUE	1	30	40
;91B--Sinai Hospital-City Hall via Rogers Avenue Station	MTA91B	FALSE	FALSE	1	30	40
;120-White Marsh-Johns Hopkins Hospital	MT120	FALSE	FALSE	3	10	
;150A--Western Express via US 40 (Outbound AM)	MT150A	TRUE	FALSE	3	15	
;150B--Western Express via Edmondson (Inbound AM)	MT150B	TRUE	FALSE	3	15	
;160A--Fox Ridge-Baltimore	MT160A	TRUE	FALSE	3	30	
;160B--Oliver Beach-Baltimore	MT160B	TRUE	FALSE	3	30	
;210--Annapolis-Baltimore Express	MTA210	FALSE	FALSE	3	25	
;310--Columbia-Baltimore Express	MTA310	FALSE	FALSE	3	60	
;311--Columbia-Baltimore Express	MTA311	FALSE	FALSE	3	30	
;320--Laurel-Baltimore	MTA320	FALSE	FALSE	3	40	
;410--Bel Air-Baltimore	MT410	TRUE	FALSE	3	30	
;411--Bel Air-Baltimore	MT411	TRUE	FALSE	3	40	
;420--Havre de Grace-Baltimore	MT420	TRUE	FALSE	3	20	
;M-1A--Milford Mill-Mondawmin Station	M1A	FALSE	TRUE	1	10	20
;M-1B--Milford Mill Station-Mondawmin Station	M1B	FALSE	TRUE	1	20	60
;M-1C--Bellmore Farms-Milford Mill Station	M1C	FALSE	TRUE	1	20	0
;M-2--Old Court Station-Mondawmin Station	M2	FALSE	TRUE	1	12	20
;M-3--Milford Mill Station-Penn North Station	M3	FALSE	TRUE	1	10	17
;M-6A--Rogers Avenue Station-Social Security	M6A	FALSE	TRUE	1	15	60
;M-6B--Rogers Avenue Station-Security Square Mall	M6B	FALSE	TRUE	1	60	60
;M-8--Randallstown-Rogers Avenue Station	M8	FALSE	TRUE	1	18	32
;M-9--Owings Mills-Reisterstown Plaza Station	M9	FALSE	TRUE	1	26	37
;M-10A--Brooklandville-Rogers Avenue Station	M10A	FALSE	TRUE	1	70	70
;M-10B--Mt. Washington Station-Rogers Avenue Station	M10B	FALSE	TRUE	1	70	70
;M-12A--Stevenson Road-Reisterstown Plaza Station	M12A	FALSE	TRUE	1	60	90
;M-12B--Stevenson Road-Reisterstown Plaza Station	M12B	FALSE	TRUE	1	60	120
;M-16A--Reisterstown-Owings Mills Town Center	M16A	FALSE	TRUE	1	40	60
;M-16B--Chartey-Owings Mills Town Center	M16B	FALSE	TRUE	1	40	
;Annapolis Transit Brown	ANNBRO	FALSE	FALSE	9	60	60
;Annapolis Transit Green	ANNGRE	TRUE	FALSE	9	60	60
;Annapolis Transit Orange	ANNORA	FALSE	TRUE	9	30	30
;Annapolis Transit Red	ANNRED	FALSE	TRUE	9	30	30
;Annapolis Transit Yellow	ANNYEL	TRUE	FALSE	9	30	30
;HATS Blue	HATSBL	FALSE	FALSE	8	60	60
;HATS Brown	HATSBR	FALSE	FALSE	8	60	60
;HATS Green	HATSGR	FALSE	TRUE	8	60	60
;HATS Orange	HATSOR	TRUE	FALSE	8	60	60
;HATS Purple	HATSPU	TRUE	FALSE	8	30	30

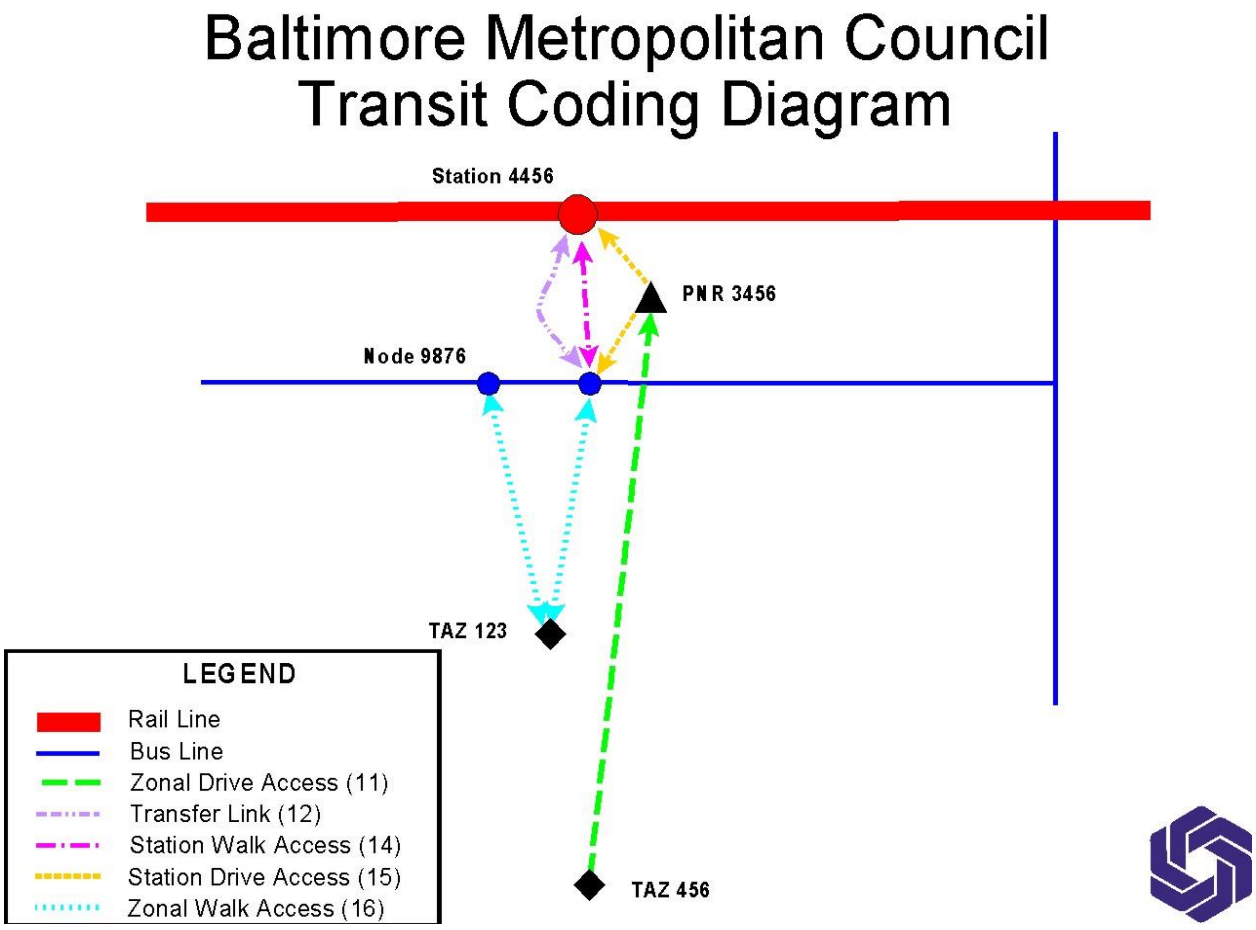
RouteName/End Points	Coded Name	OneWay	AllStop	Mode	AM Hdwy.	MD Hdwy.
;HATS Red	HATSRD	FALSE	FALSE	8	60	60
;HATS Yellow	HATSYE	FALSE	FALSE	8	60	60
;Harford County--Havre de Grace to Bel Air	HCTS1	FALSE	FALSE	7	120	120
;Harford County--Joppatowne to Bel Air	HCTS2	FALSE	FALSE	7	120	120
;Harford County--Edgewood to Aberdeen	HCTS6	FALSE	FALSE	7	120	120
;I-95 Flyer--Columbia to Washington via MD 175	995EX	TRUE	FALSE	3	20	
;I-95 Flier--Columbia to Washington via MD 108	995LC	TRUE	FALSE	3	60	
;I-95 Flier--Columbia to Washington from Harpers Village	995HV	TRUE	FALSE	3	60	
;US 29 Flier--Columbia to Washington via MD 175 & US 29	929EX	TRUE	FALSE	3	10	
;US 29 Flier: Columbia to Washington via MD 108	929LC	TRUE	FALSE	3	30	
;US 29 Flier--Columbia to Washington from Harpers Village	929HV	TRUE	FALSE	3	40	
;US 29 Flier--Silver Spring to Harper's Village (peak and off peak)	929HV1	TRUE	FALSE	3	120	180
;US 29 Flier--Harper's Village to Silver Spring (off peak)	929HV2	TRUE	FALSE	3	0	180
;921A -- Kent Island/Annapolis- New Carrollton	921A	TRUE	FALSE	3	30	180
;921B -- New Carrollton/Kent Island - Annapolis	921B	TRUE	FALSE	3	60	180
;922 -- Kent Island/Annapolis - Washington DC	922N	TRUE	FALSE	3	30	
;922 -- Kent Island/Annapolis - Washington DC	922P	TRUE	FALSE	3	40	
;922 -- Kent Island/Annapolis - Washington DC	922I	TRUE	FALSE	3	60	
;Connect-a-Ride A	CARA	TRUE	TRUE	8	30	30
;Connect-a-Ride C	CARC	TRUE	TRUE	8	30	30
;Connect-a-Ride D	CARD	TRUE	FALSE	8	30	30
; MTA 13P -- Express From Providence Road to Johns Hopkins Hospitals	MTA13P	TRUE	FALSE	2	60	
; MTA13T -- Express Towson - Johns Hopkins Hospital	MTA13T	TRUE	FALSE	2	60	
; 923 -- Crofton - New Carollton	923	TRUE	FALSE	3	30	

5.2 Guideway Coding

Non-highway transit routes (i.e., rail) are coded by first including the stations explicitly in the highway network. The following node number ranges are used for guideway routes: for rail (light rail, Metro), 4105 – 4499 and for MARC, 4000 – 4100. Explicit distances and speeds are calculated from the published timetables and are coded on TRNBUILD LINK records, stored in the RAILLINK.DAT file. In this file, distance is coded in hundredths of a mile and speed in miles per hour. The speeds include station dwell time. For each LINK record, the fields coded are NODES, DIST, SPEED, and MODES. A description of the link is also provided.

As with many models that include a guideway system, a specific convention has been established for station coding. Figure 5.1 shows the generalized methodology that must be followed.

Figure 5.1
Station Coding



As this diagram indicates, the user must identify specific nodes for the station and the PnR lot. These must be added directly to the highway network. The convention is that the guideway PnR lot node number is the station node number minus 1000. The nodes along the guideway itself must be added to the highway network and the guideway links must be specified (i.e., manually coded) in the RAILLINK.DAT file.

Bus PnR lots are coded with node numbers beginning at 3501. All PnR nodes (rail and bus) should be connected to the nearest appropriate highway node in the highway network with a Functional Type 13 link. This allows the assignment of drive-to-transit trips during the highway assignment process.

The bus nodes and links, of course, must already be in the highway network. The line descriptions for both bus and guideway routes are specified in LINE.DAT. The access links are specified as shown in Table 5.3.

Table 5.3
Guideway Coding

Mode	File	Description	Coded Using	How Coded
11	DRVACCpp.DAT	Zone-to-PnR one-way drive access	SUPPLINK	computed
12	WKXFERpp.DAT	Connects bus stops to guideway stations, for use in transferring	SUPPORT	manually
13	SIDEWALK.DAT	Walk links connecting transit stops in developed areas (sidewalk network)	SUPPORT	manually
14	WKXFERpp.DAT	Connects bus stops to guideway stations, for use by zonal access	ZONEACCESS	manually
15	DRVACCpp.DAT	PnR-to-stop one-way links (provides access to bus stop or rail station for drive-access trips)	SUPPLINK	manually
16	WLKACCpp.DAT	Zone-to-bus stop walk access	SUPPLINK	computed

Note: pp = time period: PK or OP.

5.3 Access Coding

Basic line coding more or less follows standard practice in models of this type and is not extremely complicated. On the other hand, coding the access links is an intricate procedure. Fortunately, several automated steps have been developed to perform this process. Basically, these steps take the highway network and the line file and synthesize a set of walk- and drive-access links for each time period (AM peak, midday). ArcView, TP+, and Microsoft Access are required to apply this methodology, which is described in detail in Appendix F.

5.4 Fares

This model uses the base cash fare to represent the cost of a transit trip. During model development, considerable thought was given to using a discounted fare – something approximating the average revenue per passenger – to represent the use of passes and various discounts, but this was rejected. Thus, it is not feasible to estimate the impacts of changes to the fare payment system using this model.

Fares are coded by using TP+'s XFARE parameter to identify the fare to board the first transit vehicle or to transfer between transit modes. A handful of FARELINKS records are also used to define fare zones for the bus and rail systems. Fares are coded in cents, in year 2000 dollars. For the 2030 base run, the fares were coded as they increased on 1 July 2003. The values from that date were then deflated by 8% to convert them to year 2000 dollars and those values

are used for 2030. Both XFARE and FARELINKS records are stored in the FARE.DAT file.

In addition to the basic fare file, a second file is used to hold some adjustments to the MARC fares. During the development of the network, it was discovered that the basic fare methodology of boarding and transfer fares, and fare zones still did not produce MARC fares that were sufficiently accurate. Thus, a set of external adjustments was devised. After each transit skim step, a MATRIX step is run to apply certain adjustments to the initially computed MARC fares. Using the Penn Line as an example (see Table 5.4), the MARC fare structure appears to have a $4.00 base with a $1.00 increment for crossing between the following station pairs:

Perryville-Aberdeen
Aberdeen-Edgewood
Edgewood-Martin Airport
Martin Airport-Penn Station
West Baltimore-Halethorpe
BWI Airport-Odenton
Bowie State-Seabrook
New Carrollton-Union Station

However, the first crossing does not increment the fare. Thus, some way was needed to count the zone crossings so that the appropriate fare could be determined.

A large value ($10) was imposed for a zone crossing fare, since it would overwhelm any other fares imposed and would therefore indicate how many zones had been traversed. After transit pathbuilding, fares could be examined and the appropriate amount subtracted from the pathbuilder fare to yield the correct fare.

Table 5.5 shows the calculations used. Note that 2005 fares (column 1) are scaled to year 2000 dollars (column 2). The third column shows the "pre-process" fares after adding the $10 zone increments. Column 4 is the difference between the pre-process fare and the 2000$ fare.

A series of IF/ELSEIF statements check the fare to determine if it is in a specific range and subtracts the adjustment fare. MARCFARE.DAT has parameters representing the different pre-process fare levels and the adjustment value.

Table 5.4
MARC Fares (2000)

	Balto/Penn Station	Aberdeen	Bowie State	BWI Airport	Edgewood	Halethorpe	Martin State Airport	New Carrollton	Odenton	Perryville	Seabrook	Washington, D.C.	West Baltimore
Balto/Penn Station		6.00	5.00	4.00	5.00	4.00	4.00	6.00	5.00	7.00	6.00	7.00	4.00
Aberdeen	6.00		8.00	7.00	4.00	7.00	5.00	9.00	8.00	4.00	9.00	10.00	6.00
Bowie State	5.00	8.00		4.00	7.00	4.00	6.00	4.00	4.00	9.00	4.00	5.00	5.00
BWI Airport	4.00	7.00	4.00		6.00	4.00	5.00	5.00	4.00	8.00	5.00	6.00	4.00
Edgewood	5.00	4.00	7.00	6.00		6.00	4.00	8.00	7.00	5.00	8.00	9.00	5.00
Halethorpe	4.00	7.00	4.00	4.00	6.00		5.00	5.00	4.00	8.00	5.00	6.00	4.00
Martin State Airport	4.00	5.00	6.00	5.00	4.00	5.00		7.00	6.00	6.00	7.00	8.00	4.00
New Carrollton	6.00	9.00	4.00	5.00	8.00	5.00	7.00		4.00	10.00	4.00	4.00	6.00
Odenton	5.00	8.00	4.00	4.00	7.00	4.00	6.00	4.00		9.00	4.00	5.00	5.00
Perryville	7.00	4.00	9.00	8.00	5.00	8.00	6.00	10.00	9.00		10.00	11.00	7.00
Seabrook	6.00	9.00	4.00	5.00	8.00	5.00	7.00	4.00	4.00	10.00		4.00	6.00
Washington, D.C.	7.00	10.00	5.00	6.00	9.00	6.00	8.00	4.00	5.00	11.00	4.00		7.00
West Baltimore	4.00	6.00	5.00	4.00	5.00	4.00	4.00	6.00	5.00	7.00	6.00	7.00	

Note: values shown in dollars.

Table 5.5
MARC Fare Adjustments

Actual MARC Fare	MARC Fare 2000 $	Pre-Process Fare	Difference for Fare Adjustment
400	370	1370	1000
500	463	2370	1907
600	556	3370	2814
700	648	4370	3722
800	741	5370	4629
900	833	6370	5537
1000	926	7370	6444
1100	1019	8370	7351

Note: values shown in cents.

5.5 Other Coding Guidelines

As Table 5.3 shows, two types of links are used to connect guideway stations to the rest of the network. Mode 14 links are designed to provide access specifically from/to zone centroids. Mode 12 links are designed to allow transfers to occur between bus stops and rail stations. In general, mode 12 links are used to connect rail stations to any bus stops in the immediate vicinity of the station. However, mode 12 links are also used to connect nearby bus stops to each other, especially outside of the Baltimore CBD.

The speed on mode 12 and 14 links is assumed to be 2.5 mph. The distance coded on these links is a function of policy and calibration, not actual distance, as shown in Table 5.6. The mode 12 distances are always shorter, to ensure that these links are used if possible for transferring between transit routes, while zonal access trips are prohibited from using mode 12 links. This is the convention established during model development and should be followed for all scenarios. These links are coded in WKXFERpp.DAT.

Table 5.6
Transfer Link Distances

Transit Mode	Mode 12 Distance	Mode 14 Distance
Light rail	9	10
Metro rail	1	2
MARC commuter rail	5	6

Note: Distances shown in units of 0.01 mile, and are coded that way.

Two mode 12 transfer links between the Central Light Rail Line and Metro have a special distance of 0.20 miles (State Center/Cultural Center=4243 4115) and 0.10 miles (Lexington Market=4245 4116).

Mode 15 (park and ride lot to station) links are coded by the user in PNRpp.DAT, which is used in the access pre-processing step. They are output in DRVACCpp.DAT, along with the Mode 11 (zone drive to park and ride) links generated by the pathbuilder and winnowed during pre-processing. Mode 16 (zone walk to network) links are generated by the pathbuilder and winnowed during pre-processing.

Within the Baltimore CBD, mode 13 links are used to represent the sidewalk network. These links provide connections between transit lines that might be separated by only a block or two and they also serve to prevent illogical transferring, by allowing riders to walk a couple of blocks between a reasonable alighting point and their centroid of destination (or origin). The SIDEWALK.DAT file specifies the connections that are allowed, which is most every street in downtown Baltimore, except for limited access roadways. The sidewalk speed is assumed to be 2.5 mph.

6.0 External Trips

6.1 Cordon Volumes

The total daily traffic volume at each cordon station, by vehicle type, is a basic input to the model. This is specified in the file EXTERNAL.DAT. This is a free-format ASCII file with one record per external station and each record having five items of data: station (zone) number, passenger car volume, commercial vehicle volume, medium truck volume, and heavy truck volume. In this model, these vehicle types are defined as follows:

- heavy truck: any vehicle with three or more axles
- medium truck: any truck with two axles and six tires (typically, delivery vans and bread trucks and the like, but also includes heavy-duty pickup trucks with dual rear wheels and most buses)
- commercial: any passenger car or light-duty truck (two axles, four tires) that bears text or a logo, identifying the vehicle's owner, or that is towing a trailer or carrying equipment that is obviously of a commercial nature (includes taxis, government vehicles, privately owned fleet vehicles, and all other commercial-use vehicles not included above)
- passenger car: passenger cars and light-duty trucks used for personal use

A header record may be included if the first character in the line is a semi-colon.

Table 6.1 shows the base 2000 and 2030 values at each station. The 2030 values were developed from data in a spreadsheet "ExternalStationProjections.xls", which contains projections obtained from Maryland DOT (MDOT) by station, for 2005, 2015, 2020, and 2030. This spreadsheet could be used to develop values for other forecast years.

The MDOT forecasts are not broken down by vehicle type, so the consultant assumed that the MDOT growth rate at each station applies equally to all vehicle types. The resulting values are rounded to the nearest 10.

The growth rates vary considerably by station. The overall growth rate is 63%, which is equivalent to 1.64% annually over 30 years. This seems like a rather modest rate of growth.

Table 6.1
External Volumes

	2000				2030			
station	PC	CV	MT	HT	PC	CV	MT	HT
2932	9,580	800	560	460	9,030	750	530	430
2933	29,020	2,280	1,150	3,950	55,810	4,380	2,210	7,600
2934	4,670	410	210	110	7,520	660	340	180
2935	67,360	5,460	1,890	8,490	135,120	10,950	3,790	17,030
2936	25,670	1,850	800	480	38,240	2,760	1,190	720
2937	163,390	11,460	5,110	17,840	269,120	18,880	8,420	29,380
2938	229,140	13,330	4,080	3,450	272,490	15,850	4,850	4,100
2939	62,770	4,500	700	2,030	95,190	6,820	1,060	3,080
2940	92,380	5,720	1,400	500	140,790	8,720	2,130	760
2941	58,340	3,600	640	1,420	126,340	7,800	1,390	3,080
2942	20,200	1,370	320	110	43,520	2,950	690	240
2943	191,170	14,770	6,780	9,930	290,300	22,430	10,300	15,080
2944	13,460	1,020	760	1,560	22,430	1,700	1,270	2,600
2945	7,560	410	180	250	12,330	670	290	410
2946	12,690	1,000	720	1,490	18,760	1,480	1,060	2,200
2947	4,260	580	180	180	6,720	910	280	280
2948	3,130	290	210	170	7,410	690	500	400
2949	47,970	3,630	1,310	8,290	71,330	5,400	1,950	12,330
2950	2,170	190	90	50	3,300	290	140	80
2951	1,560	140	60	40	4,680	420	180	120
2952	7,550	670	390	590	12,310	1,090	640	960
2953	11,490	950	670	2,490	19,890	1,640	1,160	4,310
2954	990	90	60	60	2,560	230	160	160
2955	3,530	330	210	230	7,720	720	460	500
2956	6,580	620	350	450	10,120	950	540	690
2957	6,460	200	510	330	10,080	310	800	510
2958	9,690	830	580	2,100	15,050	1,290	900	3,260
2959	2,460	220	220	200	5,160	460	460	420
2960	2,480	230	170	120	7,030	650	480	340
2961	8,250	710	180	60	19,100	1,640	420	140
2962	26,820	1,290	610	7,280	49,540	2,380	1,130	13,450
2963	2,140	190	90	80	5,220	460	220	200
2964	780	70	30	20	2,080	190	80	50
2965	2,940	260	90	110	6,740	600	210	250
2966	7,880	500	490	330	14,220	900	880	600
2967	1,020	100	30	150	1,960	190	60	290
2968	300	20	20	10	2,060	140	140	70
2969	870	80	40	10	2,520	230	120	30
2970	6,990	640	300	370	12,130	1,110	520	640
2971	54,410	4,150	2,780	15,860	100,790	7,690	5,150	29,380
2972	21,050	1,580	780	1,590	40,080	3,010	1,490	3,030
2973	50,470	3,900	3,060	7,770	102,950	7,960	6,240	15,850
totals	1,281,640	90,440	38,810	101,010	2,079,740	148,350	64,830	175,230
grand total	1,511,900				2,468,150			

6.2 Through Trips

Through trips are forecasted by Frataring a base year (2000) trip matrix, by vehicle type, using the same four vehicle types described in the preceding section. The base year totals by type are shown in Table 2.4. Table 6.2 shows the base year E/E trip ends by vehicle type. Through trip ends are twice the number of through trips, since each through trip crosses the cordon twice.

For forecasting, the trip generation model computes a set of Fratar factors by station and vehicle type, based on the internal and external trip generation calculations. The I/E and E/I trips are computed from the internal zone land use. These trip ends are subtracted from the total input cordon volume at each station, and the remainder must be the E/E trip ends. These are divided by the base year E/E trip ends to derive a growth factor, by station and vehicle type. That file of growth factors is applied to the base year E/E tables using a maximum of 20 iterations or an RMSE of 5%, whichever occurs first.

This method ensures that the through trips and external trips always sum to the total cordon volume by station and vehicle type. If this balancing is not possible, the trip generation program will issue a warning (in the listing file) and attempt to continue. Should this happen, the user should revise the input cordon volumes.

Table 6.2
Base Through Trip Ends

station	PC	CV	MT	HT
2932	336	0	0	0
2933	1,820	306	148	748
2934	29	0	0	0
2935	8,323	104	36	423
2936	1,436	35	17	24
2937	35,600	1,444	655	3,383
2938	6,248	1,679	524	654
2939	349	87	14	102
2940	6,999	803	182	93
2941	321	79	12	71
2942	111	0	0	0
2943	17,811	1,745	895	1,887
2944	2,521	0	0	0
2945	41	0	0	0
2946	1,588	134	95	283
2947	105	0	0	0
2948	0	0	0	0
2949	15,305	486	171	1,578
2950	0	0	0	0
2951	0	0	0	0
2952	180	0	0	0
2953	3,120	21	13	123
2954	0	0	0	0
2955	87	0	0	0
2956	161	0	0	0
2957	39	0	0	0
2958	655	0	0	0
2959	0	0	0	0
2960	0	0	0	0
2961	49	0	0	0
2962	7,202	297	80	1,384
2963	0	0	0	1
2964	0	0	0	0
2965	0	0	0	0
2966	184	0	0	0
2967	0	0	0	0
2968	0	0	0	0
2969	0	0	0	0
2970	414	0	0	0
2971	27,026	624	363	3,023
2972	1,251	132	62	239
2973	22,825	524	399	1,482
total	162,136	8,500	3,666	15,498
grand total	189,800			

Note: through trip ends = through trips * 2.

7.0 Output Files

Table 7.1 lists the intermediate and final output files that will be stored in the scenario directory after each successful model run. Following this table is an explanation of the format of each file. For ASCII (.DAT) files, the fields and columns are indicated. For matrix files (.TRP, .SKM), the order, name, and definition of tables are shown. For these files, the format shown is as specified in the TP+ manual (S = single precision, 2 = 2 digit). For non-TP+ DBF files, the field names are listed. The *.PRN file, which is the primary model listing file, is assigned a name by the TP+ processor, consisting of the four-character run ID entered by the user and a four-digit number that is incremented by one for each listing file created in that directory.

In the File Formats section, the formats are as follows: Ix = integer data, x places wide; Ax = alphanumeric (character) data, x places wide; Fx.y = real (fractional) data, x places wide with y figures to the right of the decimal.

Table 7.1
Output Files

New File Name	Description
*.prn	model run listing file
accinc.dat	highway accessibility to jobs by job type
attrext.dat	external attractions by purpose and zone
attrint.dat	I/I attractions by purpose and zone
atype.dat	area type by zone
basedacc.trp	final AM drive-transit vehicle trip table, saved for possible use in a New Starts run
baseveh.trp	final AM vehicle trip table, saved for possible use in a New Starts run
daccveh.trp	drive access to transit vehicle trips
dbusofpk.dbf	off-peak drive-bus network file
dbusofpk.skm	off-peak drive-bus skims
dbusoplk.dbf	loaded transit dbf: off-peak drive bus
dbuspeak.skm	peak drive-bus skims
dbuspeak2.dbf	peak drive-bus network file (final)
dbuspklk.dbf	loaded transit dbf: peak drive bus
dcrlofpk.dbf	off-peak drive-commuter rail network file
dcrlofpk.skm	off-peak drive-commuter rail skims
dcrloplk.dbf	loaded transit dbf: off-peak drive commuter rail
dcrlpeak.dbf	peak drive-commuter rail network file
dcrlpeak2.skm	peak drive-commuter rail skims (final)
dcrlpklk.dbf	loaded transit dbf: peak drive commuter rail
distcor.dat	distance to nearest external station, by zone
dralofpk.dbf	off-peak drive-rail network file
dralofpk.skm	off-peak drive-rail skims
draloplk.dbf	loaded transit dbf: off-peak drive rail
dralpeak.dbf	peak drive-rail network file
dralpeak.skm	peak drive-rail skims (final)
dralpklk.dbf	loaded transit dbf: peak drive rail
extrpend.dat	external trip ends by zone

New File Name	Description
hhincco.dat	% of HHs by income, by jurisdiction
hwyofpk.skm	off-peak highway skims
hwypeak2.skm	peak highway skims (final)
loaded.net	loaded highway net (final)
modehbo.trp	HBO I/I person trip table by mode
modehbs.trp	HBS I/I person trip table by mode
modehbw.trp	HBW I/I person trip table by mode
modejaw.trp	JAW I/I person trip table by mode
modejtw.trp	JTW I/I person trip table by mode
modeobo.trp	OBO I/I person trip table by mode
modesch.trp	SCH I/I person trip table by mode
parkcost.dat	parking cost by zone and purpose
perhbo.trp	HBO I/I person trip table by income
perhbs.trp	HBS I/I person trip table by income
perhbw.trp	HBW I/I person trip table by income
perjaw.trp	JAW I/I person trip table
perjtw.trp	JTW I/I person trip table
perobo.trp	OBO I/I person trip table
persch.trp	SCH I/I person trip table
pnrzone.net	highway network with transit station zone system
prodext.dat	external productions by purpose and zone
prodint.dat	I/I productions by purpose and zone
sizinc.dat	HHs by size and income
spdcap.net	highway network updated with proper speeds and capacities
sqzper1.prn	SQZ listing file: district-district I/I person trips by purpose
sqzper2.prn	SQZ listing file: district-district vehicle trips: EXT,CV,MT,HT
sqztrn.prn	SQZ listing file: district-district transit trips: work,non-work,total
sqzveh.prn	SQZ listing file: district-district vehicle trips: SOV,HOV,MTK,HTK,XX,total
szintot.dat	HH totals by size and income
tline.dbf	TGFLOAD output line file
tlink.dbf	TGFLOAD output link file
tload.prn	TGFLOAD output listing file
tnet.dbf	transit link dbf: peak walk to best transit
tnode.dbf	TGFLOAD output node file
trnload.dbf	TGFLOAD output network file (viewable in Cube)
trnofpk.skm	off-peak best path transit skims
trnofpk.trp	off-peak transit trips
trnpeak.trp	peak transit trips
trnpeak2.skm	peak walk-transit best path skims (final)
tstat.dbf	TGFLOAD output statistics file
ubenhbo.bin	HBO user benefit Summit file
ubenhbs.bin	HBS user benefit Summit file
ubenhbw.bin	HBW user benefit Summit file
ubenjaw.bin	JAW user benefit Summit file
ubenjtw.bin	JTW user benefit Summit file
ubenobo.bin	OBO user benefit Summit file
ubensch.bin	SCH user benefit Summit file
veham.trp	AM vehicle trip table
vehcmtk.trp	COM/MTK/HTK I/I trip tables
vehextop.trp	off-peak external trip tables
vehextpk.trp	peak external trip tables

New File Name	Description
vehmd.trp	MD vehicle trip table
vehnt.trp	NT vehicle trip table
vehpm.trp	PM vehicle trip table
walkofpk.skm	off-peak O/D walk time skims
walkpeak2.skm	peak O/D walk time skims (final)
wbusofpk.dbf	off-peak walk-bus network file
wbusofpk.skm	off-peak walk-bus skims
wbusoplk.dbf	loaded transit dbf: off-peak walk bus
wbuspeak.dbf	peak walk-bus network file
wbuspeak2.skm	peak walk-bus skims (final)
wbuspklk.dbf	loaded transit dbf: peak walk bus
wcrlofpk.dbf	off-peak walk-commuter rail network file
wcrlofpk.skm	off-peak walk-commuter rail skims
wcrloplk.dbf	loaded transit dbf: off-peak walk commuter rail
wcrlpeak.dbf	peak walk-commuter rail network file
wcrlpeak2.skm	peak walk-commuter rail skims (final)
wcrlpklk.dbf	loaded transit dbf: peak walk commuter rail
wkrinc.dat	HHs by workers and income
wralofpk.dbf	off-peak walk-rail network file
wralofpk.skm	off-peak walk-rail skims
wraloplk.dbf	loaded transit dbf: off-peak walk rail
wralpeak.dbf	peak walk-rail network file
wralpeak2.skm	peak walk-rail skims (final)
wralpklk.dbf	loaded transit dbf: peak walk rail
xx.trp	forecast year X/X trip table by vehicle type
xxfact.dat	X/X growth factors

File Formats

ACCINC.DAT

Field	Name	Format	Description
1	zone	I5	Zone number
2	aret	I10	Off-peak highway accessibility to retail employment
3	aoff	I10	Off-peak highway accessibility to office employment
4	aind	I10	Off-peak highway accessibility to industrial employment
5	aoth	I10	Off-peak highway accessibility to other employment
6	ahh1	I10	Off-peak highway accessibility to income 1 HHs
7	ahh2	I10	Off-peak highway accessibility to income 2 HHs
8	ahh3	I10	Off-peak highway accessibility to income 3 HHs
9	ahh4	I10	Off-peak highway accessibility to income 4 HHs

ATTREXT.DAT, PRODEXT.DAT

Field	Name	Format	Description
1		I5	Zone number
2		F13.4	I/X work productions or attractions (vehicle trips)
3		F13.4	I/X non-work productions or attractions (vehicle trips)
4		F13.4	I/X commercial productions or attractions
5		F13.4	I/X medium truck productions or attractions
6		F13.4	I/X heavy truck productions or attractions
7		F13.4	X/I work productions or attractions (vehicle trips)
8		F13.4	X/I non-work productions or attractions (vehicle trips)

Field	Name	Format	Description
9		F13.4	X/I commercial productions or attractions
10		F13.4	X/I medium truck productions or attractions
11		F13.4	X/I heavy truck productions or attractions

ATTRINT.DAT, PRODINT.DAT

Field	Name	Format	Description
1		I5	Zone number
2		F13.4	HBW income 1 productions or attractions (I/I)
3		F13.4	HBW income 2 productions or attractions (I/I)
4		F13.4	HBW income 3 productions or attractions (I/I)
5		F13.4	HBW income 4 productions or attractions (I/I)
6		F13.4	SCH productions or attractions (I/I)
7		F13.4	HBS income 1 productions or attractions (I/I)
8		F13.4	HBS income 2 productions or attractions (I/I)
9		F13.4	HBS income 3 productions or attractions (I/I)
10		F13.4	HBS income 4 productions or attractions (I/I)
11		F13.4	HBO income 1 productions or attractions (I/I)
12		F13.4	HBO income 2 productions or attractions (I/I)
13		F13.4	HBO income 3 productions or attractions (I/I)
14		F13.4	HBO income 4 productions or attractions (I/I)
15		F13.4	JTW productions or attractions (I/I)
16		F13.4	JAW productions or attractions (I/I)
17		F13.4	OBO productions or attractions (I/I)
18		F13.4	COM productions or attractions (I/I)
19		F13.4	MTK productions or attractions (I/I)
20		F13.4	HTK productions or attractions (I/I)

ATYPE.DAT

Field	Name	Format	Description
1	Zone	I8	Zone number
2	TempDenCode	I5	Employment density class (1-10)
3	HHDenCode	I5	Household density class (1-10)
4	AreaType	I5	Area type (1-9)

BASEDACC.TRP

Table	Name	Format	Description
1	daccam	S	AM peak drive-access transit vehicle trips (2nd iteration)

BASEVEH.TRP

Table	Name	Format	Description
1	amsov	S	AM peak SOV vehicle trips (final iteration)
2	amhov	S	AM peak HOV vehicle trips (final iteration)
3	ammtk	S	AM peak MTK vehicle trips (final iteration)
4	amhtk	S	AM peak HTK vehicle trips (final iteration)
5	amxx	S	AM peak X/X vehicle trips (final iteration)

DACCVEH.TRP

Table	Name	Format	Description
1	daccam	S	AM peak drive-access transit vehicle trips (final iteration)
2	daccmd	S	MD drive-access transit vehicle trips (final iteration)
3	daccpm	S	PM peak drive-access transit vehicle trips (final iteration)
4	daccnt	S	NT drive-access transit vehicle trips (final iteration)

DBUSOFPK.DBF, DBUSPEAK2.DBF, DCRLOFPK.DBF, DCRLPEAK2.DBF, DRALOFPK.DBF, DRALPEAK2.DBF, WBUSOFPK.DBF, WBUSPEAK2.DBF, WCRLOFPK.DBF, WCRLPEAK2.DBF, WRALOFPK.DBF, WRALPEAK2.DBF, TNET.DBF

Field	Name	Format	Description
1	a	I5	A node
2	b	I5	B node
3	time	I5	Link time, 0.01 minutes
4	mode	I3	Transit mode number
5	plot	I1	(not used – always 0)
6	color	I2	Plot color
7	stop_a	I1	1 if A node is a stop node, else 0
8	stop_b	I1	1 if Bnode is a stop node, else 0
9	dist	I4	Link distance, 0.01 miles
10	name	A12	Line name, for transit links, or *MM for non-transit links, where MM = mode number
11	seq	I3	Sequence number, for transit lines (indicates the order in which the line is coded) (0 for non-transit links)
12	owner	A10	Line owner, as coded on LINE record

DBUSOFPK.SKM, DBUSPEAK.SKM, DCRLOFPK.SKM, DCRLPEAK.SKM, DRALOFPK.SKM, DRALPEAK.SKM, WBUSOFPK.SKM, WBUSPEAK.SKM, WCRLOFPK.SKM, WCRLPEAK.SKM, WRALOFPK.SKM, WRALPEAK.SKM

Table	Name	Format	Description
1	initwait	2	Wait time for first transit vehicle, minutes
2	xferwait	2	Total wait time for all subsequent transit vehicles, minutes
3	walktime	2	Network transit access and egress walk time, minutes (not used)
4	autotime	2	Network transit access drive time, minutes
5	autodist	2	Network transit access drive distance, miles
6	tranfare	2	Transit fare, cents
7	numxfers	2	Number of transfers
8	bustime	2	In-vehicle time on bus, minutes
9	railtime	2	In-vehicle time on rail, minutes
10	marctime	2	In-vehicle time on MARC, minutes
11	firstmode	0	Mode number of first transit mode accessed on path
12	xfernode	0	B node number of last mode 12 transfer link
13	station	0	A node number of first mode 15 PnR link

DBUSOPLK.DBF, DBUSPKLK.DBF, DCRLOPLK.DBF, DCRLPKLK.DBF, DRALOPLK.DBF, DRALPKLK.DBF, WBUSOPLK.DBF, WBUSPKLK.DBF, WCRLOPLK.DBF, WCRLPKLK.DBF, WRALOPLK.DBF, WRALPKLK.DBF

Field	Name	Format	Description
1	a	I5	A node
2	b	I5	B node
3	time	I5	Link time, 0.01 minutes
4	mode	I3	Transit mode number
5	plot	I1	(not used – always 0)
6	color	I2	Plot color
7	stop_a	I1	1 if A node is a stop node, else 0
8	stop_b	I1	1 if Bnode is a stop node, else 0
9	dist	I4	Link distance, 0.01 miles
10	name	A12	Line name, for transit links, or *MM for non-transit links, where MM

Field	Name	Format	Description
			= mode number
11	seq	I3	Sequence number, for transit lines (indicates the order in which the line is coded) (0 for non-transit links)
12	owner	A10	Line owner, as coded on LINE record
13	ab_vol	I6	Volume on link, A-B direction
14	ab_brda	I6	Volume boarding at A node, A-B direction
15	ab_xita	I6	Volume exiting at A node, A-B direction
16	ab_brdb	I6	Volume boarding at B node, A-B direction
17	ab_xitb	I6	Volume exiting at B node, A-B direction
18	ba_vol	I6	Volume on link, B-A direction
19	ba_brda	I6	Volume boarding at A node, B-A direction
20	ba_xita	I6	Volume exiting at A node, B-A direction
21	ba_brdb	I6	Volume boarding at B node, B-A direction
22	ba_xitb	I6	Volume exiting at B node, B-A direction

DISTCOR.DAT

Field	Name	Format	Description
1	zone	I5	Zone number
2	minzn	I5	Number of external station that is nearest this zone
3	nearest	F7.2	Distance from this zone to the nearest external station, miles

EXTRPEND.DAT

Field	Name	Format	Description
1	zone	I5	Zone number
2	ixwtot	F12.4	I/X work productions or attractions (person trips)
3	ixntot	F12.4	I/X non-work productions or attractions (person trips)
4	ixctot	F12.4	I/X commercial productions or attractions
5	ixmtot	F12.4	I/X medium truck productions or attractions
6	ixhtot	F12.4	I/X heavy truck productions or attractions
7	xiwtot	F12.4	X/I work productions or attractions (person trips)
8	xintot	F12.4	X/I non-work productions or attractions (person trips)
9	xictot	F12.4	X/I commercial productions or attractions
10	ximtot	F12.4	X/I medium truck productions or attractions
11	xihtot	F12.4	X/I heavy truck productions or attractions

HHINCCO.DAT

Field	Name	Format	Description
1	zone	I5	Zone number
2	hh1	F8.4	Proportion of HHs in income group 1 in this zone's county (0.0-1.0)
3	hh2	F8.4	Proportion of HHs in income group 2 in this zone's county (0.0-1.0)
4	hh3	F8.4	Proportion of HHs in income group 3 in this zone's county (0.0-1.0)
5	hh4	F8.4	Proportion of HHs in income group 4 in this zone's county (0.0-1.0)

HWYOFPK.SKM, HWYPEAK2.SKM

Table	Name	Format	Description
1	SOVTime	2	Time on SOV path, minutes
2	SOVDist	2	Distance on SOV path, miles
3	SOVToll	2	Toll on SOV path, cents
4	HOVTime	2	Time on HOV path, minutes
5	HOVDist	2	Distance on HOV path, miles
6	HOVToll	2	Toll on HOV path, cents
7	TDTime	2	Time used in trip distribution: HOV time, including intrazonal time and O + D terminal times, minutes

LOADED.NET
(fields appended to HIGHWAY.NET in assignment)

Field	Name	Description
1	congtime	Congested time, mph
2	volam	AM peak volume
3	vcam	AM peak V/C ratio
4	timeam	AM peak time, minutes
5	volmd	Midday volume
6	vcmd	Midday V/C ratio
7	timemd	Midday time, minutes
8	volpm	PM peak volume
9	vcpm	PM peak V/C ratio
10	timepm	PM peak time, minutes
11	volnt	Night volume
12	vcnt	Night V/C ratio
13	timent	Night time, minutes
14	vol24	24-hour volume
15	vol24r	24-hour volume, rounded to 100
16	volsov	SOV volume
17	volhov	HOV volume
18	volmtk	MTK volume
19	volhtk	HTK volume
20	voldtr	Drive-transit vehicle volume
21	volxx	X/X volume
22	totvol	Sum of volumes in A-B and B-A directions
23	losam	Link level of service, AM peak (A-F)
24	lospm	Link level of service, PM peak (A-F)
25	levelam	Link LOS numeric code, AM peak (1-6)
26	levelpm	Link LOS numeric code, PM peak (1-6)

MODEHBO.TRP, MODEHBS.TRP, MODEHBW.TRP, MODEJAW.TRP, MODEJTW.TRP, MODEOBO.TRP, MODESCH.TRP

Table	Name	Format	Description
1	da	S	Drive alone person trips
2	s2	S	Shared ride 2 person trips
3	s3	S	Shared ride 3 person trips
4	wb	S	Walk-bus transit trips
5	wr	S	Walk-rail transit trips
6	wc	S	Walk-commuter rail (MARC) transit trips
7	db	S	Drive-bus transit trips
8	dr	S	Drive-rail transit trips
9	dc	S	Drive-commuter rail (MARC) transit trips

Note: trips are in P/A format

PARKCOST.DAT

Field	Name	Format	Description
1	zone	I8	Zone number
2	hrprkwork	I6	Parking cost per hour for workers, cents
3	hrprknonwork	I6	Parking cost per hour for non-workers, cents

PERHBO.TRP, PERHBS.TRP, PERHBW.TRP

Table	Name	Format	Description
1	*ppp*1	S	Person trips for purpose *ppp*, income 1 (I/I)
2	*ppp*2	S	Person trips for purpose *ppp*, income 2 (I/I)
3	*ppp*3	S	Person trips for purpose *ppp*, income 3 (I/I)
4	*ppp*4	S	Person trips for purpose *ppp*, income 4 (I/I)

Note: *ppp* = HBO, HBS, or HBW; trips are in P/A format

PERJAW.TRP, PERJTW.TRP, PEROBO.TRP, PERSCH.TRP

Table	Name	Format	Description
1	*ppp*	S	Person trips for purpose *ppp* (I/I)

Note: *ppp* = JAW, JTW, OBO, or SCH; trips are in P/A format

SIZINC.DAT

Field	Name	Format	Description
1	zone	I5	Zone number
2	s1i1	F12.3	HHs with 1 person, income group 1
3	s1i2	F12.3	HHs with 1 person, income group 2
4	s1i3	F12.3	HHs with 1 person, income group 3
5	s1i4	F12.3	HHs with 1 person, income group 4
6	s2i1	F12.3	HHs with 2 persons, income group 1
7	s2i2	F12.3	HHs with 2 persons, income group 2
8	s2i3	F12.3	HHs with 2 persons, income group 3
9	s2i4	F12.3	HHs with 2 persons, income group 4
10	s3i1	F12.3	HHs with 3 persons, income group 1
11	s3i2	F12.3	HHs with 3 persons, income group 2
12	s3i3	F12.3	HHs with 3 persons, income group 3
13	s3i4	F12.3	HHs with 3 persons, income group 4
14	s4i1	F12.3	HHs with 4 persons, income group 1
15	s4i2	F12.3	HHs with 4 persons, income group 2
16	s4i3	F12.3	HHs with 4 persons, income group 3
17	s4i4	F12.3	HHs with 4 persons, income group 4
18	s5i1	F12.3	HHs with 5+ persons, income group 1
19	s5i2	F12.3	HHs with 5+ persons, income group 2
20	s5i3	F12.3	HHs with 5+ persons, income group 3
21	s5i4	F12.3	HHs with 5+ persons, income group 4

SZINTOT.DAT

Field	Name	Format	Description
1	zone	I5	Zone number
2	siz1	F12.3	HHs with 1 person
3	siz2	F12.3	HHs with 2 persons
4	siz3	F12.3	HHs with 3 persons
5	siz4	F12.3	HHs with 4 persons
6	siz5	F12.3	HHs with 5+ persons
7	inc1	F12.3	HHs in income group 1
8	inc2	F12.3	HHs in income group 2
9	inc3	F12.3	HHs in income group 3
10	inc4	F12.3	HHs in income group 4

TLINE.DBF

Field	Name	Format	Description
1	line_name	A18	Line name as created by TGFLOAD
2	raw_name	A18	Input line name
3	suffix	A6	Line name suffix (if needed)
4	mode	I5	Transit mode code (1-10)
5	owner	I5	Line owner
6	color	I5	Line plot color
7	freq1	I5	AM peak headway
8	freq2	I5	Midday headway
9	freq3	I5	Period 3 headway (not used in this model)
10	freq4	I5	Period 4 headway (not used in this model)
11	freq5	I5	Period 5 headway (not used in this model)
12	runtime	I5	Scheduled run time (not used in this model)
13	owner_name	A10	Name of line owner
14	key	A20	Bookkeeping field used by TGFLOAD

TLINK.DBF

Field	Name	Format	Description
1	anode	I5	A node
2	bnode	I5	B node
3	mode	I3	Mode code
4	line_name	A18	Line name as created by TGFLOAD
5	raw_name	A18	Input line name
6	suffix	A6	Line name suffix (if needed)
7	ab	A2	Link directionality: "AB" or "BA"
8	sequence	I5	Link sequence within this line, in AB direction
9	time_peak	F6.2	AM peak time, minutes
10	time_offpk	F6.2	Midday time, minutes
11	time_daily	F6.2	(not used)
12	dist	F6.2	Link distance, miles
13	door_a	A2	If "door open" at A node (i.e., A is a stop node), "O", else "C"
14	door_b	A2	If "door open" at B node (i.e., B is a stop node), "O", else "C"
15	vol_total	I7	Total volume, all paths
16	vol_pkwkbs	I7	Volume on peak walk-bus path
17	vol_pkdrbs	I7	Volume on peak walk-rail path
18	vol_pkwkrl	I7	Volume on peak walk-commuter rail path
19	vol_pkdrrl	I7	Volume on peak drive-bus path
20	vol_pkwkcr	I7	Volume on peak drive-rail path
21	vol_pkdrcr	I7	Volume on peak drive-commuter rail path
22	vol_opwkbs	I7	Volume on off-peak walk-bus path
23	vol_opdrbs	I7	Volume on off-peak walk-rail path
24	vol_opwkrl	I7	Volume on off-peak walk-commuter rail path
25	vol_opdrrl	I7	Volume on off-peak drive-bus path
26	vol_opwkcr	I7	Volume on off-peak drive-rail path
27	vol_opdrcr	I7	Volume on off-peak drive-commuter rail path
28	plot	I1	Plot code (not used)
29	color	I2	Line plot color
30	sequenceba	I5	Link sequence within this line, in BA direction
31	key	A20	Bookkeeping field used by TGFLOAD

TNODE.DBF

Field	Name	Format	Description
1	node	I5	Node number
2	line_name	A18	Line name as created by TGFLOAD
3	raw_name	A18	Input line name
4	suffix	A6	Line name suffix (if needed)
5	ab	A2	Link directionality: "AB" or "BA"
6	sequence	I5	Link sequence within this line, in AB direction
7	mode	I3	Mode code
8	door	I3	If "door open" at node (i.e., node is a stop node), "O", else "C"
9	brd_total	I7	Total boardings at node
10	xit_total	I7	Total alightings at node
11	brd_pkwkbs	I7	Boardings at node on peak walk-bus path
12	xit_pkwkbs	I7	Alightings at node on peak walk-bus path
13	brd_pkdrbs	I7	Boardings at node on peak drive-bus path
14	xit_pkdrbs	I7	Alightings at node on peak drive-bus path
15	brd_pkwkrl	I7	Boardings at node on peak walk-rail path
16	xit_pkwkrl	I7	Alightings at node on peak walk-rail path
17	brd_pkdrrl	I7	Boardings at node on peak drive-rail path
18	xit_pkdrrl	I7	Alightings at node on peak drive-rail path
19	brd_pkwkcr	I7	Boardings at node on peak walk-commuter rail path
20	xit_pkwkcr	I7	Alightings at node on peak walk-commuter rail path
21	brd_pkdrcr	I7	Boardings at node on peak drive-commuter rail path
22	xit_pkdrcr	I7	Alightings at node on peak drive-commuter rail path
23	brd_opwkbs	I7	Boardings at node on off-peak walk-bus path
24	xit_opwkbs	I7	Alightings at node on off-peak walk-bus path
25	brd_opdrbs	I7	Boardings at node on off-peak drive-bus path
26	xit_opdrbs	I7	Alightings at node on off-peak drive-bus path
27	brd_opwkrl	I7	Boardings at node on off-peak walk-rail path
28	xit_opwkrl	I7	Alightings at node on off-peak walk-rail path
29	brd_opdrrl	I7	Boardings at node on off-peak drive-rail path
30	xit_opdrrl	I7	Alightings at node on off-peak drive-rail path
31	brd_opwkcr	I7	Boardings at node on off-peak walk-commuter rail path
32	xit_opwkcr	I7	Alightings at node on off-peak walk-commuter rail path
33	brd_opdrcr	I7	Boardings at node on off-peak drive-commuter rail path
34	xit_opdrcr	I7	Alightings at node on off-peak drive-commuter rail path

TRNLOAD.DBF

Field	Name	Format	Description
1	a	I5	A node
2	b	I5	B node
3	name	A12	Line name ("-" appended to reverse direction by TP+)
4	seq	I3	Node sequence in line
5	stop_a	I1	1 if A node is a stop node, else 0
6	stop_b	I1	1 if Bnode is a stop node, else 0
7	mode	I3	Mode code
8	ab_vol24	I6	A-B link volume, 24 hours
9	ab_volpk	I6	A-B link volume, peak
10	ab_volop	I6	A-B link volume, off-peak
11	ab_volam	I6	A-B link volume, AM
12	ab_volmid	I6	A-B link volume, midday
13	ab_volpm	I6	A-B link volume, PM
14	ab_volnit	I6	A-B link volume, night
15	ab_brda24	I6	A-B direction boardings at A, 24 hours
16	ab_xita24	I6	A-B direction alightings at A, 24 hours

Field	Name	Format	Description
17	ab_brdb24	I6	A-B direction boardings at B, 24 hours
18	ab_xitb24	I6	A-B direction alightings at B, 24 hours
19	ab_brdapk	I6	A-B direction boardings at A, peak
20	ab_xitapk	I6	A-B direction alightings at A, peak
21	ab_brdbpk	I6	A-B direction boardings at B, peak
22	ab_xitbpk	I6	A-B direction alightings at B, peak
23	ab_brdaop	I6	A-B direction boardings at A, off-peak
24	ab_xitaop	I6	A-B direction alightings at A, off-peak
25	ab_brdbop	I6	A-B direction boardings at B, off-peak
26	ab_xitbop	I6	A-B direction alightings at B, off-peak
27	ba_vol24	I6	B-A link volume, 24 hours
28	ba_volpk	I6	B-A link volume, peak
29	ba_volop	I6	B-A link volume, off-peak
30	ba_volam	I6	B-A link volume, AM
31	ba_volmid	I6	B-A link volume, midday
32	ba_volpm	I6	B-A link volume, PM
33	ba_volnit	I6	B-A link volume, night
34	ba_brda24	I6	B-A direction boardings at A, 24 hours
35	ba_xita24	I6	B-A direction alightings at A, 24 hours
36	ba_brdb24	I6	B-A direction boardings at B, 24 hours
37	ba_xitb24	I6	B-A direction alightings at B, 24 hours
38	ba_brdapk	I6	B-A direction boardings at A, peak
39	ba_xitapk	I6	B-A direction alightings at A, peak
40	ba_brdbpk	I6	B-A direction boardings at B, peak
41	ba_xitbpk	I6	B-A direction alightings at B, peak
42	ba_brdaop	I6	B-A direction boardings at A, off-peak
43	ba_xitaop	I6	B-A direction alightings at A, off-peak
44	ba_brdbop	I6	B-A direction boardings at B, off-peak
45	ba_xitbop	I6	B-A direction alightings at B, off-peak

TRNOFPK.SKM, TRNPEAK2.SKM

Table	Name	Format	Description
1	totalivt	2	Total in-vehicle time, all transit modes, minutes
2	initwait	2	Wait time for first transit vehicle, minutes
3	xferwait	2	Total wait time for all subsequent transit vehicles, minutes
4	walktime	2	Network transit access and egress walk time, minutes (not used)
5	firstmode	0	Mode number of first transit mode accessed on path
6	xfernode	0	B node number of last mode 12 transfer link

TRNOFPK.TRP, TRNPEAK.TRP

Table	Name	Format	Description
1	wb	S	Walk-bus transit trips
2	wr	S	Walk-rail transit trips
3	wc	S	Walk-commuter rail (MARC) transit trips
4	db	S	Drive-bus transit trips
5	dr	S	Drive-rail transit trips
6	dc	S	Drive-commuter rail (MARC) transit trips

TSTAT.DBF

Field	Name	Format	Description
1	line_name	A18	Line name as created by TGFLOAD
2	group_flag	A1	"L" if individual line, "G" if a line group
3	mode	I3	Mode code ("1" for line groups)

Field	Name	Format	Description
4	distance	F9.2	Line length, miles
5	runtime_pk	F9.2	Line run time, peak, minutes
6	runtime_op	F9.2	Line run time, off-peak, minutes
7	runtime_24	F9.2	Line run time, daily average, minutes
8	stops	I8	Number of stops on line
9	nruns_pk	I7	Number of scheduled vehicle runs, peak
10	nruns_op	I7	Number of scheduled vehicle runs, off-peak
11	nruns_24	I7	Number of scheduled vehicle runs, daily
12	nruns_am	I7	Number of scheduled vehicle runs, AM peak (not used)
13	nruns_mid	I7	Number of scheduled vehicle runs, midday (not used)
14	nruns_pm	I7	Number of scheduled vehicle runs, PM peak (not used)
15	nruns_nit	I7	Number of scheduled vehicle runs, night (not used)
16	tfreqpk	I3	Headway, peak, minutes
17	tfreqop	I3	Headway, off-peak, minutes
18	tfreq24	I3	Headway, daily, minutes (not used)
19	tfreqam	I3	Headway, AM peak, minutes (not used)
20	tfreqmid	I3	Headway, midday, minutes (not used)
21	tfreqpm	I3	Headway, PM peak, minutes (not used)
22	tfreqnit	I3	Headway, night, minutes (not used)
23	losttime	I6	Lost time, minutes
24	boardspkab	I7	Boardings on this line, A-B direction, peak
25	boardsopab	I7	Boardings on this line, A-B direction, off-peak
26	boards24ab	I7	Boardings on this line, A-B direction, daily
27	boardspkba	I7	Boardings on this line, B-A direction, peak
28	boardsopba	I7	Boardings on this line, B-A direction, off-peak
29	boards24ba	I7	Boardings on this line, B-A direction, daily
30	maxlodpkab	I7	Maximum load, A-B direction, peak
31	maxlodopab	I7	Maximum load, A-B direction, off-peak
32	maxlod24ab	I7	Maximum load, A-B direction, daily
33	maxlodpkba	I7	Maximum load, B-A direction, peak
34	maxlodopba	I7	Maximum load, B-A direction, off-peak
35	maxlod24ba	I7	Maximum load, B-A direction, daily
36	maxlnkpkab	A12	Maximum load link, A-B direction, peak
37	maxlnkopab	A12	Maximum load link, A-B direction, off-peak
38	maxlnk24ab	A12	Maximum load link, A-B direction, daily
39	maxlnkpkba	A12	Maximum load link, B-A direction, peak
40	maxlnkopba	A12	Maximum load link, B-A direction, off-peak
41	maxlnk24ba	A12	Maximum load link, B-A direction, daily
42	psgrmipkab	F12.1	Passenger-miles, A-B direction, peak
43	psgrmiopab	F12.1	Passenger-miles, A-B direction, off-peak
44	psgrmi24ab	F12.1	Passenger-miles, A-B direction, daily
45	psgrmipkba	F12.1	Passenger-miles, B-A direction, peak
46	psgrmiopba	F12.1	Passenger-miles, B-A direction, off-peak
47	psgrmi24ba	F12.1	Passenger-miles, B-A direction, daily
48	psgrhrpkab	F12.1	Passenger-hours, A-B direction, peak
49	psgrhropab	F12.1	Passenger-hours, A-B direction, off-peak
50	psgrhr24ab	F12.1	Passenger-hours, A-B direction, daily
51	psgrhrpkba	F12.1	Passenger-hours, B-A direction, peak
52	psgrhropba	F12.1	Passenger-hours, B-A direction, off-peak
53	psgrhr24ba	F12.1	Passenger-hours, B-A direction, daily
54	nvehpkab	F8.1	Number of vehicles required, A-B direction, peak
55	nvehpkba	F8.1	Number of vehicles required, B-A direction, peak
56	nvehopab	F8.1	Number of vehicles required, A-B direction, off-peak
57	nvehopba	F8.1	Number of vehicles required, B-A direction, off-peak
58	nveh24ab	F8.1	Number of vehicles required, A-B direction, daily

Field	Name	Format	Description
59	nveh24ba	F8.1	Number of vehicles required, B-A direction, daily
60	scdvehpk	F8.1	Scheduled vehicles, peak period
61	scdvehop	F8.1	Scheduled vehicles, off-peak period
62	scdveh24	F8.1	Scheduled vehicles, daily
63	nconpkab	F8.1	Number of consists required, A-B direction, peak
64	nconpkba	F8.1	Number of consists required, B-A direction, peak
65	nconopab	F8.1	Number of consists required, A-B direction, off-peak
66	nconopba	F8.1	Number of consists required, B-A direction, off-peak
67	ncon24ab	F8.1	Number of consists required, A-B direction, daily
68	ncon24ba	F8.1	Number of consists required, B-A direction, daily
69	vehmipkab	F12.1	Vehicle-miles, A-B direction, peak
70	vehmiopab	F12.1	Vehicle-miles, A-B direction, off-peak
71	vehmi24ab	F12.1	Vehicle-miles, A-B direction, daily
72	vehmipkba	F12.1	Vehicle-miles, B-A direction, peak
73	vehmiopba	F12.1	Vehicle-miles, B-A direction, off-peak
74	vehmi24ba	F12.1	Vehicle-miles, B-A direction, daily
75	vehhrpkab	F12.1	Vehicle-hours, A-B direction, peak
76	vehhropab	F12.1	Vehicle-hours, A-B direction, off-peak
77	vehhr24ab	F12.1	Vehicle-hours, A-B direction, daily
78	vehhrpkba	F12.1	Vehicle-hours, B-A direction, peak
79	vehhropba	F12.1	Vehicle-hours, B-A direction, off-peak
80	vehhr24ba	F12.1	Vehicle-hours, B-A direction, daily
81	costnveh	F12.2	Daily operating cost, computed from number of vehicles
82	costvehmi	F12.2	Daily operating cost, computed from vehicle-miles
83	costvehhr	F12.2	Daily operating cost, computed from vehicle-hours
84	costpnveh	F12.2	Peak operating cost, computed from number of vehicles
85	costonveh	F12.2	Off-peak operating cost, computed from number of vehicles
86	costpvehmi	F12.2	Peak operating cost, computed from vehicle-miles
87	costovehmi	F12.2	Off-peak operating cost, computed from vehicle-miles
88	costpvehhr	F12.2	Peak operating cost, computed from vehicle-hours
89	costovehhr	F12.2	Off-peak operating cost, computed from vehicle-hours

UBENHBO.BIN, UBENHBS.BIN, UBENHBW.BIN, UBENJAW.BIN, UBENJTW.BIN, UBENOBO.BIN, UBENSCH.BIN

Field	Name	Format	Description
1	pzone	I*2	Production zone
2	azone	I*2	Attraction zone
3	inc	I*2	Income group
4	totpsn	R*4	Total person trips
5	motpsn	R*4	Motorized person trips
6	eau	R*4	Exponentiated auto disutility
7	wkacc	R*4	Percent walk to transit
8	trnwk	R*4	Percent transit in walk-access area
9	dracc	R*4	Percent drive to transit
10	trndr	R*4	Percent transit in drive-access area, income 1

Note: Format shown is for data records. File also contains one header record.

VEHAM.TRP, VEHMD.TRP, VEHNT.TRP, VEHPM.TRP

Table	Name	Format	Description
1	PPsov	S	SOV vehicle trips (O/D)
2	PPhov	S	HOV vehicle trips (O/D)
3	PPmtk	S	MTK vehicle trips (O/D)

Table	Name	Format	Description
4	PPhtk	S	HTK vehicle trips (O/D)
5	PPxx	S	X/X vehicle trips (O/D)

Note: PP = time period = AM, MD, NT, PM

VEHEXTOP.TRP

Table	Name	Format	Description
1	ixn	S	I/X non-work vehicle trips (P/A)
2	ixc	S	I/X COM vehicle trips
3	ixm	S	I/X MTK vehicle trips
4	ixh	S	I/X HTK vehicle trips
5	xin	S	X/I non-work vehicle trips (P/A)
6	xic	S	X/I COM vehicle trips
7	xim	S	X/I MTK vehicle trips
8	xih	S	X/I HTK vehicle trips

VEHEXTPK.TRP

Table	Name	Format	Description
1	ixw	S	I/X work vehicle trips (P/A)
2	xiw	S	X/I work vehicle trips (P/A)

XX.TRP

Table	Name	Format	Description
1	xxpc	S	X/X passenger car vehicle trips (O/D)
2	xxcv	S	X/X commercial vehicle trips (O/D)
3	xxmt	S	X/X medium truck vehicle trips (O/D)
4	xxht	S	X/X heavy truck vehicle trips (O/D)

XXFACT.DAT

Field	Name	Format	Description
1	zone	I5	Zone number
2	xxfacpc	F8.2	X/X growth factor, passenger car
3	xxfaccv	F8.2	X/X growth factor, commercial vehicle
4	xxfacmt	F8.2	X/X growth factor, medium truck
5	xxfacht	F8.2	X/X growth factor, heavy truck

8.0 Reporting

8.1 General

Once a model run is completed, whether a full run or a New Starts run, TP+ creates a listing file for the entire run. This file is created in the scenario's directory and is named xxxx0000.PRN, where "xxxx" is the four-character project prefix entered by the user and "0000" is a sequential number starting with 1 that is incremented and assigned automatically by TP+. Although this file is rather large (about 8 Mb), it is worth perusing on a regular basis. This file contains all of the trace statements, parameter values, and return codes that must be checked in order to verify that a run has completed properly.

Among many other things, the listing file contains the following:

- Area type model report, showing the number of zones, houses, and jobs, by area type
- Documentation of all parameter files used in the model, such as the main parameter file, highway toll file, turn penalty file, transit fare file, etc.
- Highway path traces
- Selected highway skim data
- Trip ends by purpose and zone
- Trace of trip generation calculations for selected zone
- Trip length frequency distributions
- Trace of mode choice calculations for selected O/D pair
- VMT/VHT summary from highway assignment

The SQZ program is applied at the end of each model run to produce four sets of district-district trip tables:

- I/I motorized person trips by purpose (P/A format)
- Transit trips for work, non-work, and total (P/A)
- Vehicle trips for external, COM, MTK, and HTK trip types (P/A)
- Vehicle trips for SOV, HOV, MTK, HTK, and X/X trips (O/D)

Table 8.1 shows the transit tables for 2000.

8.2 Highway

The level of highway reporting currently built into the model is relatively simple. The very last step of the job is a HWYNET run that computes VMT, free-flow VHT, and congested VHT, and crosstabulates these by facility type group and area type, and facility type group and jurisdiction. Table 8.2 shows the 2000 values.

Table 8.1
Transit Trip Tables

Date: 8/ 5/2006
Time: 4:56

Baltimore Regional Travel Model
2000 Base Run
Est Work Transit Linked Trips (P/A)

		Destination District										
		1	2	3	4	5	6	7	8	9	10	Total
O	1 BaltCity	31938	1800	30743	0	0	622	1664	228	133	0	67128
r	2 AnArundl	7207	2291	1143	0	0	89	2202	151	65	0	13148
i	3 Balt Co	17172	448	13352	0	8	147	1919	124	35	0	33205
g	4 Carroll	335	0	69	0	0	0	21	0	0	0	425
i	5 Harford	3033	69	437	0	354	29	93	35	31	0	4081
n	6 Howard	2312	60	480	0	0	425	719	278	134	0	4408
	7 DC	704	153	1353	0	0	75	100966	24928	10619	0	138798
D	8 Mont Co	886	10	125	0	0	16	40863	11942	2527	0	56369
i	9 PrGeo Co	1119	82	1013	0	0	81	48204	10798	6245	0	67542
s	10 Fred Co	0	0	0	0	0	0	443	197	1	108	749
	Total	64706		48715		362		197094		19790		385853
			4913		0		1484		48681		108	

Date: 8/ 5/2006
Time: 4:56

Baltimore Regional Travel Model
2000 Base Run
Est Non-Work Transit Linked Trips (P/A)

		Destination District										
		1	2	3	4	5	6	7	8	9	10	Total
O	1 BaltCity	38193	585	6465	0	0	0	105	0	0	0	45348
r	2 AnArundl	2615	825	1090	0	0	0	116	0	6	0	4652
i	3 Balt Co	11345	470	3548	0	0	0	143	0	0	0	15506
g	4 Carroll	5	0	3	0	0	0	0	0	0	0	8
i	5 Harford	17	0	3	0	155	0	0	0	0	0	175
n	6 Howard	96	3	16	0	0	242	10	43	37	0	447
	7 DC	799	28	668	0	0	22	78675	9519	6914	0	96625
D	8 Mont Co	2	0	1	0	0	8	15475	5464	2447	0	23397
i	9 PrGeo Co	26	6	20	0	0	7	9649	4765	2735	0	17208
s	10 Fred Co	0	0	0	0	0	0	0	0	0	5	5
	Total	53098		11814		155		104173		12139		203371
			1917		0		279		19791		5	

Date: 8/ 5/2006
Time: 4:56

Baltimore Regional Travel Model
2000 Base Run
Est Total Transit Linked Trips (P/A)

		Destination District										
		1	2	3	4	5	6	7	8	9	10	Total
O	1 BaltCity	70131	2385	37208	0	0	622	1769	228	133	0	112476
r	2 AnArundl	9822	3116	2233	0	0	89	2318	151	71	0	17800
i	3 Balt Co	28517	918	16900	0	8	147	2062	124	35	0	48711
g	4 Carroll	340	0	72	0	0	0	21	0	0	0	433
i	5 Harford	3050	69	440	0	509	29	93	35	31	0	4256
n	6 Howard	2408	63	496	0	0	667	729	321	171	0	4855
	7 DC	1503	181	2021	0	0	97	179641	34447	17533	0	235423
D	8 Mont Co	888	10	126	0	0	24	56338	17406	4974	0	79766
i	9 PrGeo Co	1145	88	1033	0	0	88	57853	15563	8980	0	84750
s	10 Fred Co	0	0	0	0	0	0	443	197	1	113	754
	Total	117804	6830	60529	0	517	1763	301267	68472	31929	113	589224

Table 8.2
2000 Highway Report

```
CROSSTAB ROW=AREATYPE COL=_ft2 VAR=vmt
             Freeway    Arterial   Collector
                   1           2           3       Total
-------- ----------- ----------- ----------- -----------
 1 -  1   19,395,303  17,489,632         948  36,885,882
 2 -  2   16,777,431  11,433,412         979  28,211,822
 3 -  3   12,042,737   9,290,857         364  21,333,958
 4 -  4    1,293,616   2,861,636         151   4,155,403
 5 -  5    1,936,362   4,175,367         200   6,111,929
 6 -  6      604,927     771,206          59   1,376,193
 7 -  7      263,371   1,266,845         100   1,530,317
 8 -  8      129,836     345,918           0     475,755
 9 -  9      227,315   1,083,991           0   1,311,306
 1 -  9   52,670,900  48,718,864       2,801 101,392,565

CROSSTAB ROW=AREATYPE COL=_ft2 VAR=fvht (free-flow VHT)

                   1           2           3       Total
-------- ----------- ----------- ----------- -----------
 1 -  1      308,718     424,031          32     732,780
 2 -  2      281,044     298,422          39     579,505
 3 -  3      203,871     273,398          15     477,283
 4 -  4       22,598      88,011           6     110,615
 5 -  5       35,996     142,971          10     178,977
 6 -  6       12,512      28,745           3      41,261
 7 -  7        5,386      48,594           5      53,985
 8 -  8        2,953      13,518           0      16,471
 9 -  9        5,831      43,619           0      49,450
 1 -  9      878,907   1,361,310         109   2,240,327

CROSSTAB ROW=AREATYPE COL=_ft2 VAR=cvht (congested speed VHT)

                   1           2           3       Total
-------- ----------- ----------- ----------- -----------
 1 -  1      340,285     457,129          32     797,446
 2 -  2      322,644     330,529          39     653,212
 3 -  3      265,911     306,175          15     572,100
 4 -  4       26,647     124,180           6     150,834
 5 -  5       48,986     176,395          10     225,391
 6 -  6       48,130      34,033           3      82,166
 7 -  7        5,529      56,672           5      62,206
 8 -  8        2,987      15,300           0      18,288
 9 -  9        8,575      49,416           0      57,991
 1 -  9    1,069,695   1,549,830         109   2,619,635

CROSSTAB ROW=AREATYPE COL=_ft2 COMP=vmt/fvht (free-flow speed)

             1     2     3 Total
-------- ----- ----- ----- -----
 1 -  1   62.8  41.2  30.0  50.3
 2 -  2   59.7  38.3  25.0  48.7
 3 -  3   59.1  34.0  25.0  44.7
 4 -  4   57.2  32.5  25.0  37.6
 5 -  5   53.8  29.2  20.0  34.1
 6 -  6   48.3  26.8  20.0  33.4
 7 -  7   48.9  26.1  20.0  28.3
 8 -  8   44.0  25.6   0.0  28.9
 9 -  9   39.0  24.9   0.0  26.5
 1 -  9   59.9  35.8  25.6  45.3
```

```
 CROSSTAB ROW=AREATYPE COL=_ft2 COMP=vmt/cvht (congested speed)

            1     2     3 Total
-------- ----- ----- ----- -----
 1 -  1   57.0  38.3  30.0  46.3
 2 -  2   52.0  34.6  25.0  43.2
 3 -  3   45.3  30.3  25.0  37.3
 4 -  4   48.5  23.0  25.0  27.5
 5 -  5   39.5  23.7  20.0  27.1
 6 -  6   12.6  22.7  20.0  16.7
 7 -  7   47.6  22.4  20.0  24.6
 8 -  8   43.5  22.6   0.0  26.0
 9 -  9   26.5  21.9   0.0  22.6
 1 -  9   49.2  31.4  25.6  38.7

CROSSTAB ROW=JUR COL=_ft2 VAR=vmt

                   1           2           3       Total
-------- ----------- ----------- ----------- -----------
 1 -  1    2,666,260   4,543,855         512   7,210,626
 2 -  2    7,025,507   5,088,139         640  12,114,287
 3 -  3   10,691,127   7,248,139         908  17,940,174
 4 -  4      120,366   2,617,739           0   2,738,105
 5 -  5    2,032,602   2,846,450           9   4,879,061
 6 -  6    5,455,753   2,769,632          62   8,225,447
 7 -  7    2,740,493   5,541,184           0   8,281,677
 8 -  8    7,053,321   9,024,793          14  16,078,129
 9 -  9   10,699,966   7,416,618         656  18,117,239
10 - 10    4,185,504   1,622,315           0   5,807,820
 1 - 10   52,670,900  48,718,864       2,801 101,392,565

CROSSTAB ROW=JUR COL=_ft2 VAR=fvht (free-flow VHT)

                   1           2           3       Total
-------- ----------- ----------- ----------- -----------
 1 -  1       48,291     148,186          24     196,501
 2 -  2      119,331     131,703          23     251,056
 3 -  3      176,808     197,150          33     373,992
 4 -  4        2,099      63,798           0      65,897
 5 -  5       31,445      71,915           0     103,361
 6 -  6       88,213      74,197           2     162,413
 7 -  7       53,251     193,087           0     246,338
 8 -  8      118,335     244,996           0     363,331
 9 -  9      175,617     195,390          26     371,033
10 - 10       65,518      40,887           0     106,404
 1 - 10      878,907   1,361,310         109   2,240,327

CROSSTAB ROW=JUR COL=_ft2 VAR=cvht (congested VHT)

                   1           2           3       Total
-------- ----------- ----------- ----------- -----------
 1 -  1       50,833     155,242          24     206,099
 2 -  2      127,292     141,839          23     269,154
 3 -  3      190,539     202,759          33     393,331
 4 -  4        2,140      64,866           0      67,006
 5 -  5       33,161      72,900           0     106,061
 6 -  6       95,318      76,185           2     171,505
 7 -  7      107,271     280,915           0     388,186
 8 -  8      154,974     282,425           0     437,400
 9 -  9      237,158     223,680          26     460,864
10 - 10       71,009      49,019           0     120,028
 1 - 10    1,069,695   1,549,830         109   2,619,635
```

```
CROSSTAB ROW=JUR COL=_ft2 COMP=vmt/fvht (free-flow speed)

             1     2     3 Total
-------- ----- ----- ----- -----
 1 -  1   55.2  30.7  21.3  36.7
 2 -  2   58.9  38.6  28.2  48.3
 3 -  3   60.5  36.8  27.2  48.0
 4 -  4   57.3  41.0   0.0  41.6
 5 -  5   64.6  39.6  25.8  47.2
 6 -  6   61.8  37.3  25.5  50.6
 7 -  7   51.5  28.7   0.0  33.6
 8 -  8   59.6  36.8  30.0  44.3
 9 -  9   60.9  38.0  25.3  48.8
10 - 10   63.9  39.7   0.0  54.6
 1 - 10   59.9  35.8  25.6  45.3

CROSSTAB ROW=JUR COL=_ft2 COMP=vmt/cvht (congested speed)

             1     2     3 Total
-------- ----- ----- ----- -----
 1 -  1   52.5  29.3  21.3  35.0
 2 -  2   55.2  35.9  28.2  45.0
 3 -  3   56.1  35.7  27.2  45.6
 4 -  4   56.3  40.4   0.0  40.9
 5 -  5   61.3  39.0  25.8  46.0
 6 -  6   57.2  36.4  25.5  48.0
 7 -  7   25.5  19.7   0.0  21.3
 8 -  8   45.5  32.0  30.0  36.8
 9 -  9   45.1  33.2  25.3  39.3
10 - 10   58.9  33.1   0.0  48.4
 1 - 10   49.2  31.4  25.6  38.7
```

The syntax used to produce this report is shown in MODEL.JOB. Various other similar reports can be prepared from the main loaded network file, LOADED.NET. The fields included in this network are shown in Chapter 7, under "File Formats".

8.3 Transit

Because this model was developed with a principal focus on transit and because transit reporting is particularly challenging, a special program was obtained to report the results of the transit assignment. This is TGFLOAD.EXE. It is a stand-alone program written in compiled xBase form using the Alaska Software compiler. It is written to work with standard TP+ loaded transit network files in DBF format. TGFLOAD sums the 12 transit assignment files (by access mode, submode, and period) and produces a nicely-formatted report of the loadings by line, along with numerous associated statistics. The program can also aggregate lines into groups, which is helpful since many of the real transit lines are each represented by several coded lines, relating to different branches or headways.

The program also performs a rudimentary conversion of directionality. This model follows the standard convention that all transit trips are assigned in P/A format, generally representing the home to non-home direction. Thus, the loadings produced by TP+ do not portray the correct directionality. TGFLOAD balances the loadings by

direction, which results in the proper directionality on a daily basis. The program can also report PnR activity and can report the trips by access mode at each guideway station.

Appendix B provides more information on installing TGFLOAD and creating its setup file, along with a copy of the base year (2000) setup file. The complete program documentation is contained in a separate file, TGFLOAD_328.PDF. Table 8.3 shows some excerpts of the transit assignment report. The full report is stored in the file nominally named TLOAD.PRN.

Table 8.3
Transit Assignment Report (excerpts)

```
Baltimore Travel Forecasting Model

TRANSIT BOARDING AND UTILIZATION REPORT
------------------+------------------------------------------------------+-------------------------------------+
                  | Headway 1:   8.0      No. of Stops            14     |              Peak  Off-Pk  Daily   |                    Page    9
LINE: METRO       | Headway 2:  10.0      Run Distance     (mi.):  14.56  | Boardings A-B  14913   9592  24505 |
MODE:  5          |                       Run Time Peak    (min):  30.06  |             B-A   8946   6368  15314 | <<<Ridership data has not been converted
                  |                                OffPeak (min):  30.06  |           Total  23859  15960  39819 | <<<from Production-Attraction format
                  |                                Daily   (min):  30.06  | Max Vol   A-B  10769   7207  17976 | <<<to Origin-Destination format
                  |                       Lost Time        (min):  20.00  | Max Vol   B-A   4456   3644   8100 |
```

	A TO B DIRECTION (Production-Attraction Format) PEAK	OFF-PEAK	DAILY	B TO A DIRECTION (Production-Attraction Format) PEAK	OFF-PEAK	DAILY	TOTAL DAILY
Boardings:	14913	9592	24505	8946	6368	15314	39819
Max Load Point:							
Link A-B	4114-4115	4114-4115	4114-4115	4115-4116	4115-4116	4115-4116	
Psgr Volume	10769	7207	17976	4456	3644	8100	26076
Sched. Rails	45.0	72.0		45.0	72.0		
Psgrs/Rail	239.3	100.1		99.0	50.6		
Required Headway	4	11		9	22		
Psgr Miles:	79046	51276	130323	47275	31736	79011	209334
Psgr Hours:	2937	1928	4865	1678	1168	2845	7710
Avg Trip Length:							
Psgr Miles	5.3	5.3	5.3	5.3	5.0	5.2	5.3
Psgr Minutes	11.8	12.1	11.9	11.3	11.0	11.1	11.6
Required Rails	6.3	5.0		6.3	5.0		
Rail Miles:	655	1048	1704	655	1048	1704	3407
Rail Hours:	38	60	98	38	60	98	195

		A TO B DIRECTION (Origin-Destination Format)									B TO A DIRECTION (Origin-Destination Format)									TOTAL		
		PEAK			OFF-PEAK			DAILY			PEAK			OFF-PEAK			DAILY			DAILY		
ANODE	BNODE	ON @ ANODE	VOL A-B	OFF @ BNODE	ON @ ANODE	VOL A-B	OFF @ BNODE	ON @ ANODE	VOL A-B	OFF @ BNODE	ON @ BNODE	VOL B-A	OFF @ ANODE	ON @ BNODE	VOL B-A	OFF @ ANODE	ON @ BNODE	VOL B-A	OFF @ ANODE	ON @ ANODE	VOL A-B	OFF @ BNODE
4105	4106	1964	1964	0	1172	1172	0	3136	3136	0	0	1964	1964	0	1172	1172	0	3136	3136	3136	6272	3136
4106	4107	0	1964	34	0	1172	36	0	3136	70	34	1964	0	36	1172	0	70	3136	0	70	6272	70
4107	4108	562	2493	99	522	1659	70	1083	4151	169	99	2493	562	70	1659	522	169	4151	1083	1252	8302	1252
4108	4109	1348	3742	137	711	2299	91	2059	6041	228	137	3742	1348	91	2299	711	228	6041	2059	2287	12081	2287
4109	4110	896	4500	465	658	2867	222	1554	7367	686	465	4500	896	222	2867	658	686	7367	1554	2240	14733	2240
4110	4111	1612	5646	188	860	3505	61	2472	9151	249	188	5646	1612	61	3505	860	249	9151	2472	2720	18302	2720
4111	4112	534	5993	556	221	3664	244	754	9656	800	556	5993	534	244	3664	221	800	9656	754	1554	19312	1554
4112	4113	1242	6679	250	1136	4556	208	2378	11234	458	250	6679	1242	208	4556	1136	458	11234	2378	2835	22468	2835
4113	4114	744	7174	130	698	5045	94	1442	12219	223	130	7174	744	94	5045	698	223	12219	1442	1665	24438	1665
4114	4115	282	7326	599	241	5193	393	522	12519	991	599	7326	282	393	5193	241	991	12519	522	1513	25038	1513
4115	4116	782	7509	2931	615	5416	2049	1397	12925	4980	2931	7509	782	2049	5416	615	4980	12925	1397	6377	25849	6377
4116	4117	1317	5896	2821	710	4076	1673	2027	9971	4493	2821	5896	1317	1673	4076	710	4493	9971	2027	6520	19942	6520
4117	4118	560	3635	1487	380	2783	1102	940	6417	2588	1487	3635	560	1102	2783	380	2588	6417	940	3528	12834	3528
4118	4119	89	2238	2238	59	1740	1740	147	3978	3978	2238	2238	89	1740	1740	59	3978	3978	147	4125	7955	4125
TOTAL		11930		11930	7979		7981	19909		19910	11930		11930	7981		7979	19910		19909	39819		39819

TRANSIT STATION REPORT Page 29

STATION Name: Rogers Ave

------NODE ACTIVITY------			----Boarding Passengers-----			-----Exiting Passengers-----		
Node	Route	Mode	Peak	Off-Peak	Daily	Peak	Off-Peak	Daily
4110	METRO	5	2235	1209	3444	373	167	540
4110	METRO	5	556	276	832	989	510	1499
	TOTAL		2791	1485	4276	1362	677	2039

The following transfer counts ARE included in the above Boarding/Exiting totals....

----------TRANSFERS----------				------Passenger Volume------			
A-Node	B-Node	Route	Mode	Peak	Off-Peak	Daily	
3110	4110	*15	15	33	19	52	rail PnR
5005	4110	*12	12	618	13	631	sta xfer link
		*14	14	0	0	0	sta xfer link
5259	4110	*12	12	23	18	41	sta xfer link
		*14	14	569	424	993	sta xfer link
5256	4110	*12	12	809	254	1063	sta xfer link
		*14	14	0	0	0	sta xfer link
5262	4110	*12	12	715	593	1308	sta xfer link
		*14	14	362	302	664	sta xfer link
3110	5262	*15	15	56	35	91	bus PnR
		TOTAL		3185	1658	4843	

9.0 SUMMIT

Because the new Baltimore regional model was intended for use on an FTA New Starts study of the Red Line Corridor, it was necessary to incorporate the capability to run Summit. Summit is FTA's program to summarize and report "user benefits". In this context, user benefits represent the difference in total disutility between a transit scenario and a baseline condition, converted to equivalent minutes. This is computed for each O/D pair, by trip purpose, and by income group. The total disutility is the natural log of the sum of the exponentiated disutilities for all available travel modes, i.e., the denominator of the logit mode share equation. This value represents the sum of the impedances associated with each mode, effectively weighted by that mode's share. Dividing this value by the coefficient on in-vehicle time converts it into "equivalent minutes of impedance". This permits an equitable comparison of alternative scenarios.

Any change in transit condition – wait time, run time, number of transfers, fare, service coverage, new availability of a transit submode, or loss of availability of a transit submode – is reflected in the user benefit calculation. This calculation is thus an excellent way to determine if an alternative is "better" than the base case, for transit users. It is also useful in analyzing the quality control of an alternative, to ensure that the coded representation accurately reflects the design of that alternative. If transit service is supposed to be improved, user benefits should increase. Unfortunately, it is very common for a network to be coded in such a way that the *model user* thinks that transit service is better, but the *model* indicates otherwise. Detailed analysis of user benefits helps identify such situations.

This interpretation and usage of the user benefit calculation depends on two conditions: 1) the only thing that changes for a scenario is the transit system (if the highway system also changes, it is not possible to determine which effects are due to which change); and 2) the person trips used for the baseline case must also be used for each alternative case (using a different set of person trips invalidates the basic user benefit calculation).

The mode choice application program has been modified to output a matrix file of user benefit data. One such file is created for each trip purpose (thus, seven files). Each of those matrix files contains seven tables per income group and the files are named UBENppp.MTX, where ppp is the trip purpose code. The seven tables are:

(1) total person trips

(2) motorized person trips (in this model, this is the same as "total person trips", since the non-motorized person trips were removed in the trip generation step)

(3) exponentiated auto disutility, i.e., exp(U(auto)) (actually, the *non-transit* disutility, which includes the School Bus mode for SCH trips)

(4) percent walk to transit (this does not vary by income group, but must be output separately by income group because of how Summit is set up)

(5) percent transit in the walk-access area

(6) percent drive to transit

(7) percent transit in the drive-access area

At the end of each model run (both a full run and a New Starts run), a Citilabs utility program, TPP2UB, is applied to convert each of these TP+ matrix files to the binary format required by Summit, including the addition of a header record. This produces seven files named UBENppp.BIN. The .MTX files are then deleted, because they take up so much disk space. If disk space is available, it could be helpful to keep these files for use in debugging any problems with the scenario. These files can be kept by commenting out the following line in the model setups (put a semicolon in column 1):

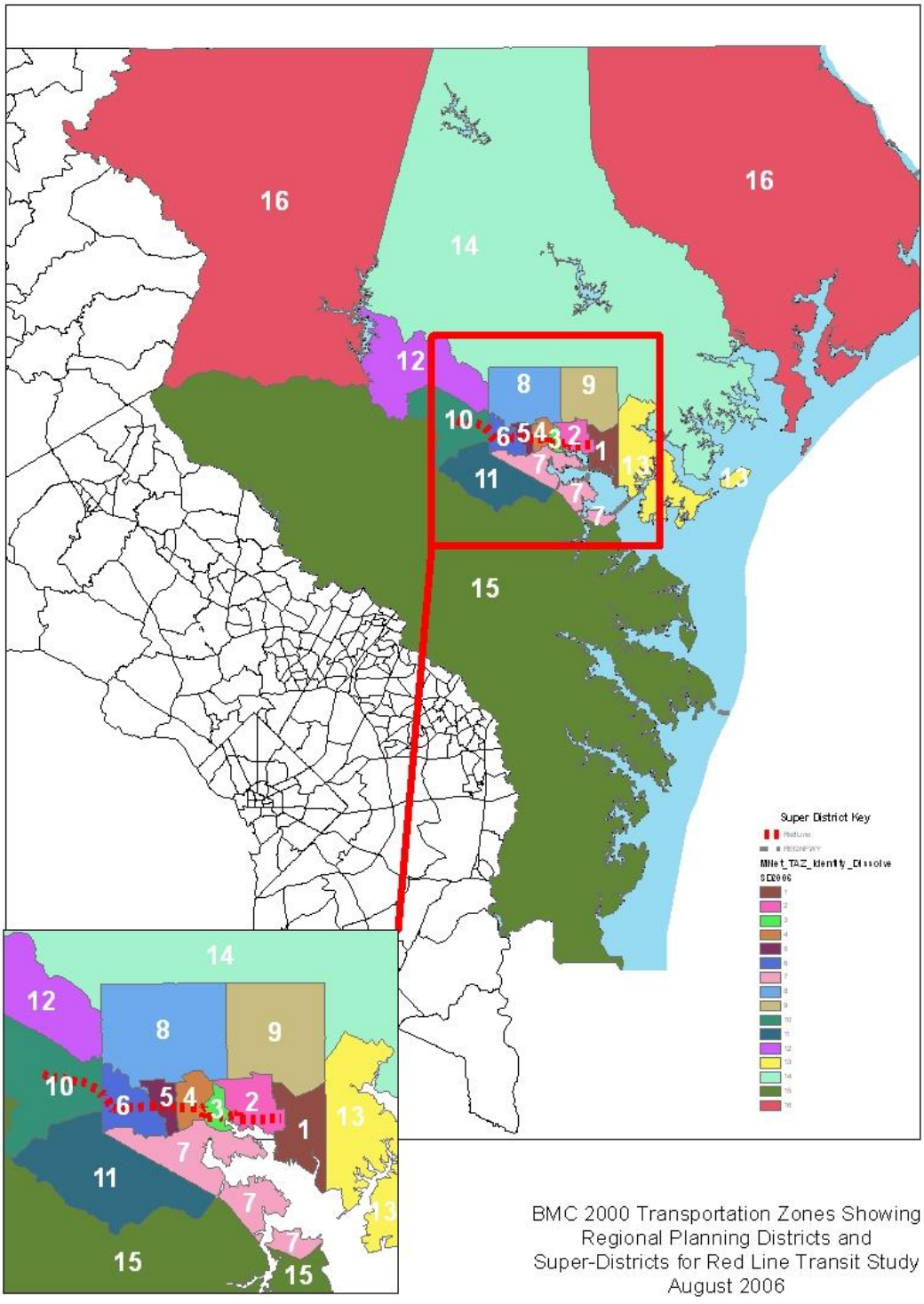
```
*del uben*.mtx
```

This line appears at approximately line 14967 of MODEL.JOB and line 7632 of NEWSTART.JOB.

For a New Starts project, the normal model application protocol is to apply the full model (MODEL.JOB) only for the baseline scenario for a forecast year. Then, all alternative scenarios are analyzed using NEWSTART.JOB. NEWSTART.JOB uses the baseline vehicle trips for feedback (to get the final skims) and the baseline person trips for mode choice. Both of those setups create the necessary binary user benefit files. Once two scenarios have been run and two sets of user benefit files have been created, it is possible to run Summit. A TP+ setup, SUMMIT.JOB, has been created to provide a user interface for this step, as shown in section 2.6. This setup applies Summit eight times: once for each trip purpose and once to sum the data for all purposes.

A supplemental input file, ZD16.DAT, has been developed (stored in \MODEL) to hold the zone/district equivalencies for the Summit reports. This file uses 16 districts that are set up to be useful to analyses of the Red Line corridor. These districts are shown in Figure 9.1.

Figure 9.1
Districts for User Benefit Summary



SUMMIT.JOB produces the following outputs:

- UBENppp.TLF: user benefit trip length frequency distributions. As used here, this consists of 9 tables of person trips stratified by the change in user benefits, in 5 minute increments. The 9 tables correspond to the different transit access markets:
  1 = can walk to baseline transit, can walk to alternative transit
  2 = can walk to baseline transit, must drive to alternative transit
  3 = can walk to baseline transit, no access to alternative transit
  4 = must drive to baseline transit, can walk to alternative transit
  5 = must drive to baseline transit, must drive to alternative transit
  6 = must drive to baseline transit, no access to alternative transit
  7 = no access to baseline transit, can walk to alternative transit
  8 = no access to baseline transit, must drive to alternative transit
  9 = no access to baseline transit, no access to alternative transit
- UBENppp.RCS: row and column summary of selected tables. As used here, the selected table is #5, total user benefits. This file is used to create the zone-level thematic maps of user benefits.
- UBENppp.RCV: row and column vector for selected tables and zones. As used here, the selected tables are #1 (baseline person trips) and #5 (total user benefits) and the selected zones are specified in the IZVALS and JZVALS parameters in the Summit setup.
- UBENppp.STR: stratified trip tables, in MINUTP binary format. These represent person trips for this purpose, stratified by different levels of the change in transit price, as indicated in the BPSTRATS parameter.
- UBENppp.D2D: district-to-district internal tables in ASCII format. Format is production district (I4), attraction district (I4), then the 80 standard Summit internal table values for that district-district P/A pair.
- UBENppp.RCU: zone-level row and column sums for all 80 internal tables (not used in this study).
- UBENppp.RPT: Summit listing file. This summarizes person trips and user benefits and produces district-district tables as selected by the user.

As of this writing, Summit has not been formally released by FTA. The version being used in this project is 0.994a, 9/14/04. The consultant is not aware of any formal documentation for this program. Table 9.1 shows an annotated example of a Summit setup file and Table 9.2 shows excerpts from a Summit report.

Table 9.1
Sample Summit Setup File

```
&FNAMES
fequiv   = '..\model\zd16.dat'
ftable1  = '..\{bname}\ubenhbw.bin'
ftable2  = 'ubenhbw.bin'

ftlfd    = 'ubenhbw.tlf'               ! trip length frequency distributions
frcsums  = 'ubenhbw.rcs'               ! row/col sum on selected user tables
frcvals  = 'ubenhbw.rcv'               ! row/col vector for sel user tbl & zones
fstrats  = 'ubenhbw.str'               ! stratified trip tabs, softtabo fmt
fddub    = 'ubenhbw.d2d'               ! ASCII district-district tables (80)
frcub    = 'ubenhbw.rcu'               ! row/col sum for all 80 internal tbls
freport  = 'ubenhbw.rpt'               ! report listing file
pqfiles  = 1,2
&END

&PARAMS
ndists   = 16
nzones   = 2928
maxdp    = 45,9999,9999,9999,45,9999,9999,9999,45
softtabi = 'minutp'
softtabo = 'minutp'
softmap  = 'generic'
prteqv   = f
&END

&PAGES
pageh    = 50
&END

&TABLES
t1  = 'u510'                   ! all incomes, base person trips
t2  = 'u520-t1'                ! all incomes, alt - base person trips
t3  = 'u530'                   ! all incomes, base transit trips
t4  = 'u540-t3'                ! all incomes, alt - base transit trips
t5  = 'u550'                   ! all incomes, total user benefits
t6  = 'u560'                   ! all incomes, auto user benefits
t7  = 'u570'                   ! all incomes, transit user benefits
t8  = 'u580'                   ! all incomes, user ben from trip asymmetry
t9  = 'u590'                   ! all incomes, user ben from rec asymmetry

t21 = 'u501'                   ! all incomes, CW->CW person trips
t22 = 'u502'                   ! all incomes, CW->MD person trips
t23 = 'u503'                   ! all incomes, CW->NT person trips
t24 = 'u504'                   ! all incomes, MD->CW person trips
t25 = 'u505'                   ! all incomes, MD->MD person trips
t26 = 'u506'                   ! all incomes, MD->NT person trips
t27 = 'u507'                   ! all incomes, NT->CW person trips
t28 = 'u508'                   ! all incomes, NT->MD person trips
t29 = 'u509'                   ! all incomes, NT->NT person trips

t31 = 'u541'                   ! all incomes, tot UB, CW->CW
t32 = 'u542'                   ! all incomes, tot UB, CW->MD
t33 = 'u543'                   ! all incomes, tot UB, CW->NT
t34 = 'u544'                   ! all incomes, tot UB, MD->CW
t35 = 'u545'                   ! all incomes, tot UB, MD->MD
t36 = 'u546'                   ! all incomes, tot UB, MD->NT
t37 = 'u547'                   ! all incomes, tot UB, NT->CW
t38 = 'u548'                   ! all incomes, tot UB, NT->MD
t39 = 'u549'                   ! all incomes, tot UB, NT->NT
&END

&analysis
pafmt = T
tlf1 = 21,31                   ! tlf, psn trip vs UB, CW->CW
tlf2 = 22,32                   ! tlf, psn trip vs UB, CW->MD
tlf3 = 23,33                   ! tlf, psn trip vs UB, CW->NT
```

```
tlf4 = 24,34                    ! tlf, psn trip vs UB, MD->CW
tlf5 = 25,35                    ! tlf, psn trip vs UB, MD->MD
tlf6 = 26,36                    ! tlf, psn trip vs UB, MD->NT
tlf7 = 27,37                    ! tlf, psn trip vs UB, NT->CW
tlf8 = 28,38                    ! tlf, psn trip vs UB, NT->MD
tlf9 = 29,39                    ! tlf, psn trip vs UB, NT->NT
intvltlf = 5.0                  ! tlf interval = 5 min

trcsums   = 5                   ! row/col sum on table 5 (total UB) -> RCS file

trcvals  = 1,5                  ! selected table for row/col vectors on RCV file
izvals   = 1,101,201            ! selected iz for row vector on RCV file
jzvals   = 295,296,297          ! selected jz for col vector on RCV file

! controls for stratified trip table output
tstrat   = 21,31
bpstrats = -45.0,-10.0,-0.0001,0.0001,10.0,45.0
tline1   = 'Report 2-#'
tline2   = 'HBW Person Trips Stratified by Change in Transit Price'
tline3   = 'All Incomes, CW->CW'
tline4   = '(Price in Minutes)'
&end

&TRPT
t=1
pafmt=T
places=7
tline1='Table 1'
tline2='Person Trips in the {bname} Scenario'
tline3='All Transit Access Markets'
tline4='Home-Based Work Trips'
source='{pname}'
&END

&TRPT
t=2
pafmt=T
places=7
tline1='Table 2'
tline2='Change in Person Trips: {sname} minus {bname}'
tline3='All Transit Access Markets'
tline4='Home-Based Work Trips'
source='{pname}'
&END

&TRPT
t=3
pafmt=T
places=7
tline1='Table 3'
tline2='Transit Person Trips in the {bname} Scenario'
tline3='All Transit Access Markets'
tline4='Home-Based Work Trips'
source='{pname}'
&END

&TRPT
t=4
pafmt=T
places=7
tline1='Table 4'
tline2='Change in Transit Person Trips: {sname} minus {bname}'
tline3='All Transit Access Markets'
tline4='Home-Based Work Trips'
source='{pname}'
&END

&TRPT
t=5
pafmt=T
places=7
```

```
scale=0.01666667
tline1='Table 5'
tline2='User Benefits (hours) for the {sname} Scenario'
tline3='Total'
tline4='All Transit Access Markets'
tline5='Home-Based Work'
source='{pname}'
&END

&TRPT
t=6
pafmt=T
places=7
scale=0.01666667
tline1='Table 6'
tline2='User Benefits (hours) for the {sname} Scenario'
tline3='Caused by Changes in the Price of Auto Travel'
tline4='All Transit Access Markets'
tline5='Home-Based Work'
source='{pname}'
&END

&TRPT
t=7
pafmt=T
places=7
scale=0.01666667
tline1='Table 7'
tline2='User Benefits (hours) for the {sname} Scenario'
tline3='Caused by Changes in the Price of Transit Travel'
tline4='All Transit Access Markets'
tline5='Home-Based Work'
source='{pname}'
&END

&TRPT
t=8
pafmt=T
places=7
scale=0.01666667
tline1='Table 8'
tline2='User Benefits (hours) for the {sname} Scenario'
tline3='Caused by Trip Asymmetry'
tline4='All Transit Access Markets'
tline5='Home-Based Work'
source='{pname}'
&END

&TRPT
t=9
pafmt=T
places=7
scale=0.01666667
tline1='Table 9'
tline2='User Benefits (hours) for the {sname} Scenario'
tline3='Caused by Record Asymmetry'
tline4='All Transit Access Markets'
tline5='Home-Based Work'
source='{pname}'
&END
```

Table 9.2
Summit Report File (excerpts)

Summary of User Benefit Calculations

Table	Contents	Conditions	Markets		Total
1	trips	all	BASE	CW-CW	629178 trips
2	trips	all	BASE	CW-MD	0 trips
3	trips	all	BASE	CW-NT	0 trips
4	trips	all	BASE	MD-CW	0 trips
5	trips	all	BASE	MD-MD	414089 trips
6	trips	all	BASE	MD-NT	0 trips
7	trips	all	BASE	NT-CW	0 trips
8	trips	all	BASE	NT-MD	0 trips
9	trips	all	BASE	NT-NT	511608 trips
10	trips	all	BASE	TOTAL	1554873 trips
11	trips	all	ALT	CW-CW	629178 trips
12	trips	all	ALT	CW-MD	0 trips
13	trips	all	ALT	CW-NT	0 trips
14	trips	all	ALT	MD-CW	0 trips
15	trips	all	ALT	MD-MD	414089 trips
16	trips	all	ALT	MD-NT	0 trips
17	trips	all	ALT	NT-CW	0 trips
18	trips	all	ALT	NT-MD	0 trips
19	trips	all	ALT	NT-NT	511608 trips
20	trips	all	ALT	TOTAL	1554873 trips
21	trips	trn	BASE	CW-CW	134939 trips
22	trips	trn	BASE	CW-MD	0 trips
23	trips	trn	BASE	CW-NT	0 trips
24	trips	trn	BASE	MD-CW	0 trips
25	trips	trn	BASE	MD-MD	5577 trips
26	trips	trn	BASE	MD-NT	0 trips
27	trips	trn	BASE	NT-CW	0 trips
28	trips	trn	BASE	NT-MD	0 trips
29	trips	trn	BASE	NT-NT	0 trips
30	trips	trn	BASE	TOTAL	140516 trips
31	trips	trn	ALT	CW-CW	149606 trips
32	trips	trn	ALT	CW-MD	0 trips
33	trips	trn	ALT	CW-NT	0 trips
34	trips	trn	ALT	MD-CW	0 trips
35	trips	trn	ALT	MD-MD	8523 trips
36	trips	trn	ALT	MD-NT	0 trips
37	trips	trn	ALT	NT-CW	0 trips
38	trips	trn	ALT	NT-MD	0 trips
39	trips	trn	ALT	NT-NT	0 trips
40	trips	trn	ALT	TOTAL	158129 trips
41	userbens	total		CW-CW	1959894 minutes
42	userbens	total		CW-MD	0 minutes
43	userbens	total		CW-NT	0 minutes
44	userbens	total		MD-CW	0 minutes
45	userbens	total		MD-MD	150788 minutes
46	userbens	total		MD-NT	0 minutes
47	userbens	total		NT-CW	0 minutes
48	userbens	total		NT-MD	0 minutes
49	userbens	total		NT-NT	0 minutes
50	userbens	total		TOTAL	2110679 minutes
51	userbens	auto		CW-CW	0 minutes
52	userbens	auto		CW-MD	0 minutes
53	userbens	auto		CW-NT	0 minutes
54	userbens	auto		MD-CW	0 minutes
55	userbens	auto		MD-MD	0 minutes
56	userbens	auto		MD-NT	0 minutes
57	userbens	auto		NT-CW	0 minutes

```
  58    userbens   auto              NT-MD           0 minutes
  59    userbens   auto              NT-NT           0 minutes
  60    userbens   auto              TOTAL           0 minutes

  61    userbens   transit           CW-CW     1959894 minutes
  62    userbens   transit           CW-MD           0 minutes
  63    userbens   transit           CW-NT           0 minutes
  64    userbens   transit           MD-CW           0 minutes
  65    userbens   transit           MD-MD      150788 minutes
  66    userbens   transit           MD-NT           0 minutes
  67    userbens   transit           NT-CW           0 minutes
  68    userbens   transit           NT-MD           0 minutes
  69    userbens   transit           NT-NT           0 minutes
  70    userbens   transit           TOTAL     2110679 minutes

  71    userbens   trip  asym        CW-CW           0 minutes
  72    userbens   trip  asym        CW-MD           0 minutes
  73    userbens   trip  asym        CW-NT           0 minutes
  74    userbens   trip  asym        MD-CW           0 minutes
  75    userbens   trip  asym        MD-MD           0 minutes
  76    userbens   trip  asym        MD-NT           0 minutes
  77    userbens   trip  asym        NT-CW           0 minutes
  78    userbens   trip  asym        NT-MD           0 minutes
  79    userbens   trip  asym        NT-NT           0 minutes
  80    userbens   trip  asym        TOTAL           0 minutes


        person trips total      BASE recrds     1554892 trips
        person trips total      ALT  recrds     1554892 trips
        person trips motorized  BASE recrds     1554892 trips
        person trips motorized  ALT  recrds     1554892 trips
        transit trips CW        BASE recrds      134940 trips
        transit trips CW        ALT  recrds      149606 trips
        transit trips MD        BASE recrds        5577 trips
        transit trips MD        ALT  recrds        8523 trips
        transit trips total     BASE recrds      140517 trips
        transit trips total     ALT  recrds      158130 trips

        total expenditure       BASE           57801439 minutes
        total expenditure       ALT            55133614 minutes
        user benefits (d expnd) BASE - ALT      2667825 minutes

        trips from data field 1 (1=total; 2=motorized)


Change in UBs from capped price changes (minutes)
Segment:   Total       1       2       3       4
         ------- ------- ------- ------- -------
  CW-CW  -515004  -43831  -69162  -36567 -365443
  CW-MD        0       0       0       0       0
  CW-NT        0       0       0       0       0
  MD-CW        0       0       0       0       0
  MD-MD   -42129    -322   -5715   -2310  -33782
  MD-NT        0       0       0       0       0
  NT-CW        0       0       0       0       0
  NT-MD        0       0       0       0       0
  NT-NT        0       0       0       0       0
  Totals -557133  -44153  -74877  -38877 -399226

wrtfinal 6601 (i) pagination summary:
              page height report width
              ---- ------ ------ -----
               t 1    23      1   112
               t 2    23      2   112
               t 3    23      3   112
               t 4    23      4   112
               t 5    24      5   112
               t 6    24      6   112
               t 7    24      7   112
               t 8    24      8   112
```

```
 t 9    24      9   112
 t10    22     10   106
 t11    22     11   106
 t12    22     12   106
 t13    22     13   106
 t14    22     14   106
 t15    22     15   106
 t16    22     16   106
```

Table 1
Person-Trips in the 2030 Base Scenario
All Transit Access Markets
Home-Based Work Trips

Production District	Attraction District 1	2	3	4	5	6	7	8	9	10	Total
1	20675	6570	9841	7145	7334	10414	2689	480	22020	0	87168
2	5752	4421	2377	2227	2926	2348	803	105	12613	0	33572
3	17511	4901	20145	9145	5598	25915	4004	447	12941	0	100607
4	16205	4915	16210	25483	3176	26761	15992	505	13260	0	122507
5	20708	6083	10788	4393	12553	20204	1148	2574	34073	0	112523
6	29894	6370	32239	25072	6766	90899	12642	9417	19816	0	233115
7	16463	6069	9824	30250	1702	20602	35727	5479	17342	0	143459
8	21078	6528	15183	15044	3905	30615	13153	142725	26176	0	274407
9	39227	11283	7065	4709	9601	7594	2714	3215	362109	0	447515
10	0	0	0	0	0	0	0	0	0	0	0
Total	187514		123671		53561		88871		520349		1554873
		57139		123467		235352		164948		0	

Source: Baltimore LRP, 2030

Table 5
User Benefits (hours) for the Test Scenario
Total
All Transit Access Markets
Home-Based Work

Production District	Attraction District 1	2	3	4	5	6	7	8	9	10	Total
1	3188	71	887	416	93	510	56	0	244	0	5466
2	984	13	238	103	32	100	11	0	83	0	1566
3	3582	49	1247	496	101	932	53	0	176	0	6636
4	3668	51	958	603	73	604	23	0	140	0	6120
5	1890	9	325	79	14	164	6	0	56	0	2543
6	3186	8	631	172	17	400	8	0	19	0	4441
7	2022	10	294	126	17	170	3	0	26	0	2666
8	1454	2	133	53	2	51	4	0	7	0	1707
9	3505	12	221	41	27	123	10	0	95	0	4033
10	0	0	0	0	0	0	0	0	0	0	0
Total	23480		4935		377		174		847		35178
		223		2089		3053		0		0	

Source: Baltimore LRP, 2030

10.0 Run Statistics

Table 10.1 documents some of the basic results from the 2000 and 2030Base runs, as an aid to the user in checking run results.

Table 10.1
Run Statistics

Statistic	Description	2000	2030
Area Type Submodel			
Number of TAZes by area type, Baltimore region	AT 1	373	302
	AT 2	303	280
	AT 3	234	289
	AT 4	70	89
	AT 5	71	82
	AT 6	18	23
	AT 7	42	33
	AT 8	11	21
	AT 9	29	32
Household Submodel			
HHs by size	1 person	526,255	727,229
	2 persons	561,929	723,507
	3 persons	333,734	403,498
	4 persons	261,938	297,615
	5+ persons	207,324	226,070
HHs by income	income group 1	190,234	238,524
	income group 2	284,666	357,444
	income group 3	378,937	476,318
	income group 4	1,037,343	1,305,633
HHs by workers	0 worker	406,747	443,380
	1 worker	700,914	851,887
	2 workers	632,678	873,599
	3+ workers	150,842	209,053
Trip Generation			
Motorized I/I person trip ends by purpose and income	HBW 1	92,196	151,355
	HBW 2	277,952	396,959
	HBW 3	596,548	793,879
	HBW 4	1,904,685	2,481,098
	SCH	941,965	1,054,671
	HBS 1	160,839	186,718
	HBS 2	308,638	365,426
	HBS 3	517,946	622,353
	HBS 4	1,554,462	1,864,468
	HBO 1	258,166	304,330
	HBO 2	462,163	554,105
	HBO 3	878,104	1,058,990
	HBO 4	2,820,225	3,412,843
	JTW	1,084,178	1,449,403
	JAW	706,323	929,022
	OBO	2,193,546	2,643,763
	COM	1,032,482	1,386,062

Statistic	Description	2000	2030
	MTK	233,541	296,598
	HTK	176,273	229,758
External trip ends by purpose	I/X Work	225,317	307,559
	I/X Non-Work	190,075	238,635
	I/X COM	40,876	49,939
	I/X MTK	17,561	22,239
	I/X HTK	42,574	55,867
	X/I Work	419,659	524,834
	X/I Non-Work	279,730	350,923
	X/I COM	40,876	49,939
	X/I MTK	17,561	22,239
	X/I HTK	42,574	55,867
Through trips by vehicle type	PC	82,281	320,636
	COM	4,335	21,351
	MTK	1,835	8,632
	HTK	7,926	29,697
Trip Distribution	HBW 1	18.49	20.02
Average trip length, composite time,	HBW 2	17.75	18.54
minutes, by purpose and income	HBW 3	19.80	19.88
(first pass)	HBW 4	21.92	22.42
	SCH	9.28	13.03
	HBS 1	10.76	10.35
	HBS 2	9.30	9.49
	HBS 3	11.13	11.03
	HBS 4	10.54	11.04
	HBO 1	11.38	11.45
	HBO 2	12.28	12.53
	HBO 3	12.55	12.73
	HBO 4	12.58	13.32
	JTW	15.79	16.37
	JAW	11.14	11.59
	OBO	10.98	11.29
(COM and all following purposes	COM	13.28	13.98
use straight highway time)	MTK	15.02	15.52
	HTK	24.54	25.94
	I/X Work	24.83	25.42
	I/X Non-Work	22.56	22.90
	I/X COM	21.80	22.77
	I/X MTK	26.57	28.24
	I/X HTK	35.39	34.72
	X/I Work	22.45	23.91
	X/I Non-Work	21.62	22.20
	X/I COM	21.97	22.77
	X/I MTK	26.20	27.69
	X/I HTK	33.36	32.90
Mode Choice			
HBW trips by mode, Baltimore	DA (drive alone)	1,071,791	1,325,262
(first pass)	S2 (shared ride 2/car)	132,821	167,154
	S3 (shared ride 3+/car)	58,548	81,166
	WB (walk-bus)	60,351	71,720

Statistic	Description	2000	2030
	WR (walk-rail)	31,175	42,568
	WC (walk-commuter rail)	3,467	4,006
	DB (drive-bus)	10,289	14,763
	DR (drive-rail)	7,184	6,368
	DC (drive-commuter rail)	3,374	4,529
HBS trips by mode, Baltimore	DA	678,515	787,687
	S2	561,078	652,155
	S3	332,385	387,653
	WB	3,874	4,504
	WR	1,306	1,397
	WC	3	4
	DB	21	22
	DR	14	17
	DC	0	0
HBO trips by mode, Baltimore	DA	683,792	777,956
	S2	618,240	704,493
	S3	564,946	648,910
	WB	25,458	27,977
	WR	10,475	12,449
	WC	336	393
	DB	577	501
	DR	654	656
	DC	367	6
JTW trips by mode, Baltimore (first pass)	DA	259,958	318,832
	S2	42,993	53,257
	S3	18,674	24,091
	WB	5,045	4,868
	WR	2,648	2,714
	WC	72	68
	DB	5	6
	DR	2	2
	DC	0	0
JAW trips by mode, Baltimore	DA	163,557	193,550
	S2	39,804	47,534
	S3	14,879	17,988
	WB	560	568
	WR	330	332
	WC	17	14
	DB	0	0
	DR	0	0
	DC	0	0
OBO trips by mode, Baltimore	DA	320,059	367,541
	S2	432,702	498,115
	S3	332,550	385,414
	WB	3,675	3,878
	WR	1,535	1,564
	WC	36	35
	DB	2	2
	DR	2	2
	DC	150	0
SCH trips by mode, Baltimore	DA	15,859	18,864
	S2	104,618	127,477
	S3	164,057	222,732
	WB	13,211	8,814
	WR	3,616	4,578

Statistic	Description	2000	2030
	WC	1	3
	DB	358	249
	DR	260	210
	DC	0	0
	SB (school bus)	216,504	182,145
HBW trips by mode, Baltimore (final pass)	DA	1,074,747	1,317,600
	S2	133,343	164,169
	S3	58,116	86,461
	WB	61,004	75,380
	WR	30,592	43,050
	WC	2,785	1,840
	DB	10,403	15,145
	DR	7,093	6,475
	DC	2,774	4,723
JTW trips by mode, Baltimore (final pass)	DA	260,747	317,263
	S2	43,199	52,170
	S3	18,736	22,533
	WB	5,112	5,070
	WR	2,570	2,714
	WC	48	24
	DB	5	6
	DR	2	2
	DC	0	0
Time of Day			
Vehicle trips by type, AM peak	SOV	1,731,899	2,218,446
	HOV	519,790	642,975
	MTK	82,816	101,183
	HTK	69,824	85,312
	X/X	19,212	76,850
Vehicle trips by type, midday	SOV	3,016,726	3,791,141
	HOV	1,343,126	1,641,304
	MTK	129,193	157,846
	HTK	125,684	153,561
	X/X	26,792	107,251
Vehicle trips by type, PM peak	SOV	2,413,728	3,076,160
	HOV	732,489	904,820
	MTK	69,566	84,994
	HTK	55,859	68,249
	X/X	27,207	108,218
Vehicle trips by type, night	SOV	1,693,148	2,122,281
	HOV	696,640	849,175
	MTK	49,690	60,710
	HTK	97,754	119,437
	X/X	21,949	86,779
Highway Assignment			
VMT by facility type	freeway	52,670,900	78,517,611
	arterial	48,718,864	66,266,689
	collector/local	2,801	4,070
	total	101,392,565	144,788,370
VMT by area type	1	36,885,882	48,693,996
	2	28,211,822	35,657,801
	3	21,333,958	35,459,105
	4	4,155,403	8,066,690

Statistic	Description	2000	2030
	5	6,111,929	7,635,483
	6	1,376,193	3,824,546
	7	1,530,317	2,292,141
	8	475,755	760,371
	9	1,311,306	2,398,237
Transit Assignment	(from TLOAD.PRN)		
Boardings by rail line	CLRL	25,083	29,142
	Metro	39,819	45,721
	MARC Camden	2,873	2,918
	MARC Penn	9,704	10,527
Total transit boardings by period	Peak	214,411	254,235
	Off-Peak	135,416	163,747
	Total	349,827	417,982

APPENDIX A SQZ DOCUMENTATION

```
SQZ Version 3.0

&FNAME Section
--------------
You can read one or two tranplan matrices--UNIT11 is the first and if you
have a second, use UNIT12.  Set them equal to the filenames (only 60
characters are allowed, therefore, avoid using long paths)

FEQUIV is the list of zone-to-district equivalencies.  Attached at the end is an
example equiv file showing the format required.

FRPT is the output listing file that can be printed on a laser printer.  This
is a plain text file that is usually imported into Word.  If more than about
10 districts are used, the font size will have to be really small for it to
fit on one page.

&PARAM Section
--------------
NZONES is the number of zones; this MUST match the number on both input
matrices    (max value: 2500)
NDISTS is the number of districts (max value: 30)


&OPTION Section
---------------
This is the heart of SQZ.  You tell it which tables to report and whether
to manipulate or scale them.

TRNPLN  T for TRANPLAN binary format, F for MINUTP.
DRYRUN  is either T or F, if F then SQZ won't actually run the program but
        will just check to make sure the files are there and the control
        file looks okay. Set to T to actually run the squeeze.
SQZ     is set to T to squeeze into districts; set to F to just report a
        small matrix (less than 40 zones).  Usually set to T.
PRTEQV  will print the zone-to-district equivalency in the report file. Don't
        usually need this unless you change your equivs a lot, so set to F.
PLAYBK  is either T or F, set to F to suppress the reporting of the title
        page.  Strongly recommend using T or you won't know why it bombs.  Then,
        set to F for the final version.
OPER    describes what you want the SQZ to show for each report.  There can
        be up to 25 reports, so OPER is subscripted; i.e. the first operation
        is OPER(1).  SQZ can do five things to tables:
                Report one table;    set OPER(x) to 'R'
                Add two tables;      set OPER(x) to '+'
                Subtract two tables; set OPER(x) to '-'
                Divide two tables;   set OPER(x) to '/'
                Multiply two tables; set OPER(x) to '*'
TABLEA  Up to 25 tables can be reported from the matrix files.  This variable
        uses the old UTPS convention -- the best way to explain it is
        by example.  If you want the first report to be table 3 out of unit 11,
        set TABLEA(1)=103.  If the second report is table 5 out of unit 12,
        set TABLEA(2)=205.
        The REPORT number is the subscript, the UNIT is the hundreds
        digit, and the table number is the tens and ones.
```

TABLEB uses the same convention. You only need to specify TABLEB if you want to perform operations BETWEEN two tables. For example if you want the first report to be a summary of the SUM of unit 11's table 4 and unit 12's table 4, then use the following:
TABLEA(1)=104,OPER(1)='+',TABLEB(1)=204

PL is subscripted and tells how many characters wide you want each entry to take; usually set to 5 for 28 districts, however, 6 might fit on a page also. i.e. PL(1) = 5.

DPL is the number of decimal places to show in each report; DPL(3)=0 will set the third report to have no decimal places shown.

SCALE will factor the values in a table. If you want to report skims in table 1 but they are in tenths of minutes, set SCALE(1)=0.1.

Example:

To (a) report unit 11, table 1, no decimal places, plain scale, in report 1,
and (b) report unit 12, table 4, scale values by one tenth, with 6 places,
and (c) report the difference in table 3 between units, with scale of 0.01,
and (d) divide unit 11,table 5, by unit 12,table 1, with 2 decimals, then:

```
TABLEA(1)=101,OPER(1)='R',              PL(1)=5,DPL(1)=0,SCALE(1)=1
TABLEA(2)=204,OPER(2)='R',              PL(2)=6,DPL(2)=0,SCALE(2)=0.1
TABLEA(3)=103,OPER(3)='-',TABLEB(3)=203,PL(3)=5,DPL(3)=0,SCALE(3)=0.01
TABLEA(4)=105,OPER(4)='/',TABLEB(4)=201,PL(4)=5,DPL(4)=2,SCALE(4)=1
```

You can have up to 25 reports in one SQZ control file.

&LABEL Section

This section provides report titles, and labels the districts.

STAGGR will stagger the totals on the bottom line of the report so that big totals don't run together. Set to T or F.

DNAMIN if set to T will put the district names in the first column of the report (uses lots of space), if set to F will put a key at the bottom of the report.

DNAME lists the names of each district. District names are limited to eight characters but can include any ASCII characters other than apostrophe. Be sure to put a name for each district, i.e. dname(18)='E Columb'

TITLE gives titles for each report. You can have five title lines at the top of each report, and each report can have different titles. TITLE is double-subscripted--the first is the report number, the second is the line number. Titles are automatically centered. Example: for the first report, a title that says:

Local Skims
1986 Peak Hour Only

Table 1: IVT

```
TITLE(1,1)='Local Skims'
TITLE(1,2)='1986 Peak Hour Only'
TITLE(1,4)='Table 1: IVT'
```

```
        Notice that TITLE(1,3) was skipped to produce a blank line.  Or you
        could have set TITLE(1,3) to '  '.


This completes the documentation on control file.  A forward slash "/"
is required at the end of each &section of the control file; I've included
an example control file to portray the features discussed above.


Sample Control File

Setup file (a.k.a. "driver" or "control" file) for Jim Ryan's
SQZ program (version 2.1, 30 Apr 91)
Annotated by bill allen 28 Jan 92

File names (max: 24 characters)
  unit11  first input matrix file
  unit12  second input matrix file (optional)
  fequiv  zone-district equivalency file (only if compressing)
                (format: DIST 1=1-10,20-30     =DIST must be in caps=
                         DIST 2=40,50
                         etc.)
  frpt    output listing file
  fout    output compressed binary MINUTP matrix (optional)
  fprn    output compressed ASCII matrix (optional)

&FNAME
  UNIT11='AG8919.DAT'
  UNIT12='OD8916.DAT'
  FEQUIV='EQUIV13.CTL'
  FRPT='sqz00.prn'
  /

Parameters
  nzones  is the number of zones (max: 2500)
  ndists  is the number of districts (max: 30)

&PARAM
  NZONES=97
  NDISTS=13
  /

Options
  dryrun    if 'T' just check input parameters, don't run program
  sqz       if 'T' compress input matrix to districts
  prteqv    if 'T' print the zone/district equivalencies
  prnwid    field width for output compressed ASCII matrix file
  tablea(M) ID of first input matrix for output matrix M (max M: 25)
                ID format: Umm, where U is 2nd digit of unit and
                mm is table number (max mm: 15)
  tableb(M) ID of second input matrix for output matrix M (opt.)
  oper(M)   math operand for output compressed matrix M:
                R : report (i.e., compress and print only)
                + : add (tablea + tableb)
                - : subtract (tablea - tableb)
                * : multiply (tablea * tableb)
```

```
                / : divide (tablea/tableb)
  pl(M)     output matrix cell print width for matrix M, in columns
  dpl(M)    output matrix cell decimal places for matrix M
  scale(M)  scale factor for matrix M cell values
  utps      if 'T' output ASCII trip file in UTPS format (?)
  emme2     if 'T' output ASCII trip file in EMME/2 format (?)
  playbk    if 'T' echo parameter values on output listing

&OPTION
  DRYRUN=F
  PLAYBK=F
  SQZ=T
  PRTEQV=F
  TABLEA(1)=101,OPER(1)='R',PL(1)=6,DPL(1)=0,SCALE(1)=1.0
  TABLEA(2)=201,OPER(2)='R',PL(2)=6,DPL(2)=0,SCALE(2)=1.0
  TABLEA(3)=101,OPER(3)='/',TABLEB(3)=201,PL(3)=6,DPL(3)=2,SCALE(3)=1.0
  TABLEA(4)=101,OPER(4)='-',TABLEB(4)=201,PL(4)=6,DPL(4)=0,SCALE(4)=1.0
  /

Labels
  id       45-character label for output matrix file
  staggr   if 'T' stagger row and column totals
  dnamin   if 'T' print district names instead of row numbers
  dname(D) 8-character name for district D (max D: 40)
  title(M,L)  60-character title line for matrix M, line L (max L: 5)

&LABEL
  TITLE(1,1)='Augusta Third Bridge Study'
  TITLE(1,2)='1989 Daily Vehicle Trips'
  TITLE(1,3)='Trips Crossing Memorial & Fr. Curran Bridges'
  TITLE(1,4)='Current Model Estimate'

  TITLE(2,1)='Augusta Third Bridge Study'
  TITLE(2,2)='1989 Daily Vehicle Trips'
  TITLE(2,3)='Trips Crossing Memorial & Fr. Curran Bridges'
  TITLE(2,4)='Maine DOT Survey Trips'

  TITLE(3,1)='Augusta Third Bridge Study'
  TITLE(3,2)='1989 Daily Vehicle Trips'
  TITLE(3,3)='Trips Crossing Memorial & Fr. Curran Bridges'
  TITLE(3,4)='Estimated/Surveyed'

  TITLE(4,1)='Augusta Third Bridge Study'
  TITLE(4,2)='1989 Daily Vehicle Trips'
  TITLE(4,3)='Trips Crossing Memorial & Fr. Curran Bridges'
  TITLE(4,4)='Estimated - Surveyed'

  STAGGR=F
  DNAMIN=T
  DNAME(1)='Northwst'
  DNAME(2)='NearWest'
  DNAME(3)='Far West'
  DNAME(4)='N,W Bank'
  DNAME(5)='NearEast'
  DNAME(6)='N,E Bank'
  DNAME(7)='Far NE  '
  DNAME(8)='Near NE '
```

```
  DNAME(9)='Far East'
  DNAME(10)='Hallowel'
  DNAME(11)='Frmgdale'
  DNAME(12)='Southwst'
  DNAME(13)='Far SE  '
  /


Sample Zone/District Equivalency File

DIST 1=1,2,11,14,24,78
DIST 2=4-10
DIST 3=12,13,79
DIST 4=3,15,25,26,76,77,95
DIST 5=16,18,20,21
DIST 6=19,27,75
DIST 7=28,73,74
DIST 8=17,22,23,31
DIST 9=71,91,94,97
DIST 10=32-38,43,80,81
DIST 11=41,42,46,48-50,54
DIST 12=45,47,51-53,55,56,84,86,87,96
DIST 13=61-65,88
```

Appendix B TGFLOAD Notes

TGFLOAD is a stand-alone executable program written by Urbitran Associates that is used to summarize the results of a TP+ transit assignment and produce nicely formatted reports. This program is documented in the file \MODEL\TGFLOAD_328.PDF (version 3.28).

The executable program, TGFLOAD.EXE, is stored in the \MODEL directory. It is executed by typing the following at the command prompt:

```
..\model\tgfload {tctl} {tprn}
```

where {tctl} is the name of the input setup (control) file (nominally called TLOAD.CTL) and {tprn} is the name of the output listing file (nominally called TLOAD.PRN).

TGFLOAD is written in compiled Alaska Software. Successful execution of the program first requires the user to install certain files that are needed by the compiler. These are the 16 DLL files stored in \MODEL\ALASKA.ZIP. These must be un-zipped and stored in a directory that is "known" to the operating system. It is recommended that these files be stored in C:\WINDOWS. TGFLOAD currently operates in a Windows XP environment. Operation under other operating systems, such as Windows 2003 Server, is under development.

The TGFLOAD setup file is nominally called TLOAD.CTL and is stored in the \Scenario\INPUTS directory, because it will usually need to change with each alternative transit scenario. Most of this setup file will not change from run to run. The main changes will involve the following:

- addition of a new line or line group to be reported
- creation of a new line group
- deletion of an existing line or line group being reported
- addition of a new rail or MARC station to be reported
- deletion of an existing rail or MARC station being reported

The concept of a "line group" is a very handy way to sum and report the data for several coded lines that represent one actual line. The line group must have a unique name and is defined on the LINEGROUP record. Since the different lines in a line group usually have different node strings, caution must be used in reading the on-off report for a line group. Station reporting consists of reporting the activity (inbound volume, boardings, alightings, outbound volume) at each selected rail or MARC node. In addition, the volume on each PnR or transfer link can also be reported, if the specific links are identified in the STATION record.

Appendix C TPP2UB Notes

TPP2UB.EXE is a utility program written by Citilabs, to convert TP+ matrices containing user benefit data into the binary format required by Summit. It exists as \MODEL\TPP2UB.EXE and is run as follows:

```
..\model\tpp2ub ubenhbw.mtx ubenhbw.bin ub.ctl
```

There are three parameters on the command line. The first parameter is the name of the input TP+ matrix file, the second parameter is the name of the output binary file, and the third parameter is the name of the setup file. TPP2UB must be applied once per file, meaning once per trip purpose.

The input TP+ matrix file must have seven tables per input group, as described in Chapter 9. These correspond to the data items expected by Summit. In this model, the HBW, HBS, and HBO purposes have four income levels, so those .MTX files have 28 tables each. The other purposes use only one income level, so those .MTX files have seven tables each.

In addition to converting the TP+ matrix data to binary format, TPP2UB adds a header record that provides certain parameters to Summit. These parameters must be described in a setup file for TPP2UB. This is an ASCII file with five lines, that looks like this:

```
UBTRNCOEF  = -0.025
UBAUTOCOEF = -0.025
UBPURPOSE  = 'HBW'
UBTOD      = 'Peak'
UBALTNAME  = '{sname}:HBW'
```

UBTRNCOEF and UBAUTOCOEF represent the mode choice model's coefficient on in-vehicle time for transit and auto, respectively. In general, Summit expects these values to be the same, but they must be entered twice, as shown. UBPURPOSE is an alphanumeric code (max. 6 characters) identifying the trip purpose. UBTOD is an alphanumeric code (max. 6 characters) identifying the time period associated with this file. UBALTNAME is an alphanumeric string (max. 60 characters) identifying the run and is used to label the Summit reports.

In MODEL.JOB and NEWSTART.JOB, the TP+ COPY…ENDCOPY command is used to create these setup files "on the fly" for each purpose, run TPP2UB, and then delete the setup files and TP+ matrices. The TP+ matrices take up a lot of disk space, but they can be very helpful in debugging a run and understanding user benefits.

APPENDIX D SETUP TO CREATE COGTRN.MTX

The following TP+ setup was used to create the COGTRN.MTX file, from data produced by the MWCOG travel model.

```
loop y = 1,3

if (y = 1)
  pth='c:\ffx\v21d\2000_tip0005_rnd64a\'
  yr ='00'
endif

if (y = 2)
  pth='c:\watf\2004clrp_aqc_cgv21d_50\2005\'
  yr ='05'
endif

if (y = 3)
  pth='c:\watf\2004clrp_aqc_cgv21d_50\2030mp\'
  yr ='30'
endif

run pgm=matrix

; cogmc.job

  id = "Extract MWCOG transit, person trips for year @yr@

  mati[1] = @pth@mc_hbwi6.fin
  mati[2] = @pth@mc_hbsi6.fin
  mati[3] = @pth@mc_hboi6.fin
  mati[4] = @pth@mc_nhbi6.fin

  mato    = temp@yr@.trp, mo=1-8

; Get transit trips and person trips by purpose.
; Transit.
  mw[1] = mi.1.3 + mi.1.4
  mw[2] = mi.2.3 + mi.2.4
  mw[3] = mi.3.3 + mi.3.4
  mw[4] = mi.4.3 + mi.4.4

; Person.
  mw[5] = mw[1] + mi.1.2 + mi.1.6
  mw[6] = mw[2] + mi.2.2
  mw[7] = mw[3] + mi.3.2
  mw[8] = mw[4] + mi.4.2

  if (i = 1-6) printrow mw = 1,5, form = 7.0, base1 = y, maxperline = 10

; Convert to BMC numbering system.
  renumber file = ctazbtaz.prn, missingzi = m, missingzo = m

endrun
```

```
;--------------------------------------------------------------------
run pgm=matrix

  id = "Calc MWCOG % transit for BMC zones, year @yr@

  mati = temp@yr@.trp

  mato = cogtrn@yr@.mtx, mo= 11-14, name=hbwtrn,hbstrn,hbotrn,nhbtrn

;                    transit     person
;                    wk sh ot nh wk sh ot nh
  fillmw mw[1] = mi.1.1, 2, 3, 4, 5, 6, 7, 8

; Compute transit share.  Check for strange values due to
;  bucket rounding.
  jloop

    if (mw[5] > 0) mw[11] = min(mw[1]/mw[5], 1.0)
    if (mw[6] > 0) mw[12] = min(mw[2]/mw[6], 1.0)
    if (mw[7] > 0) mw[13] = min(mw[3]/mw[7], 1.0)
    if (mw[8] > 0) mw[14] = min(mw[4]/mw[8], 1.0)

  endjloop

  if (i = 1900) printrow mw = 11, form = 7.3, base1 = y, maxperline = 10

endrun

endloop

*del temp*.*
```

APPENDIX E MODEL STEPS

The following TP+ steps are used to apply the full model (MODEL.JOB).

Step	Module	Description
1	MATRIX	Area type model
2	HWYNET	Update highway net speeds and capacities
3	HWYLOAD	Skim highway network - time, distance, and cost
4	MATRIX	Update highway skims
5	MATRIX	Create Walk Access Support Link File with One-Way Parameter
6	MATRIX	Create Walk Access Support Link File with One-Way Parameter
7	TRNBUILD	Off-Peak Walk to Bus Paths/Skims
8	TRNBUILD	Off-Peak Walk to Rail Paths/Skims
9	TRNBUILD	Off-Peak Walk to MARC Paths/Skims
10	TRNBUILD	Off-Peak Drive to Bus Paths/Skims
11	TRNBUILD	Off-Peak Drive to Rail Paths/Skims
12	TRNBUILD	Off-Peak Drive to MARC Paths/Skims
13	MATRIX	Adjust Off-Peak Walk to Bus Paths/Skims
14	MATRIX	Adjust Off-Peak Walk to Rail Paths/Skims
15	MATRIX	Adjust Off-Peak Walk to MARC Paths/Skims
16	MATRIX	Adjust Off-Peak Drive to Bus Paths/Skims
17	MATRIX	Adjust Off-Peak Drive to Rail Paths/Skims
18	MATRIX	Adjust Off-Peak Drive to MARC Paths/Skims
19	TRNBUILD	Off-Peak Walk to Transit Pathbuilding--No Mode Favored
20	MATRIX	Convert off-peak best transit time to minutes
21	MATRIX	Compute off-peak walk times
22	TRNBUILD	Peak Walk to Bus Paths/Skims
23	TRNBUILD	Peak Walk to Rail Paths/Skims
24	TRNBUILD	Peak Walk to MARC Paths/Skims
25	TRNBUILD	Peak Drive to Bus Paths/Skims
26	TRNBUILD	Peak Drive to Rail Paths/Skims
27	TRNBUILD	Peak Drive to MARC Paths/Skims
28	MATRIX	Adjust Peak Walk to Bus Paths/Skims
29	MATRIX	Adjust Peak Walk to Rail Paths/Skims
30	MATRIX	Adjust Peak Walk to MARC Paths/Skims
31	MATRIX	Adjust Peak Drive to Bus Paths/Skims
32	MATRIX	Adjust Peak Drive to Rail Paths/Skims
33	MATRIX	Adjust Peak Drive to MARC Paths/Skims
34	TRNBUILD	Peak Walk to Transit Pathbuilding--No Mode Favored
35	MATRIX	Convert peak best transit time to minutes
36	MATRIX	Compute peak walk times
37	MATRIX	Distance to nearest external station
38	MATRIX	Output year 2000 X/X trip ends
39	MATRIX	Prepare for HH normalization routine
40	TRIPGEN	Compute HHs by size and income
41	TRIPGEN	Compute HHs by workers and income
42	MATRIX	highway accessibility for attraction income split model
43	MATRIX	Sum HHs by income by county
44	TRIPGEN	Calculate trip ends
45	TRIPGEN	Calculate external trip ends
46	FRATAR	Fratar X/X trips
47	MATRIX	Composite time, off-peak
48	MATRIX	Expand non-School district K factors
49	MATRIX	Expand School district K factors
50	MATRIX	Create zone-level K factors
51	TRIPDIST	Trip Distribution: SCH
52	MATRIX	Estimated TLF: SCH
53	TRIPDIST	Trip Distribution: HBS

Step	Module	Description
54	MATRIX	Estimated TLF: HBS
55	TRIPDIST	Trip Distribution: HBO
56	MATRIX	Estimated TLF: HBO
57	TRIPDIST	Trip Distribution: JAW
58	MATRIX	Estimated TLF: JAW
59	TRIPDIST	Trip Distribution: OBO
60	MATRIX	Estimated TLF: OBO
61	TRIPDIST	Trip Distribution: COM,MTK,HTK
62	MATRIX	Estimated TLF: COM, MTK, HTK
63	TRIPDIST	Trip Distribution: External Off-Peak
64	MATRIX	Estimated TLF: External Off-Peak
65	MATRIX	Composite time, peak
66	TRIPDIST	Trip Distribution: HBW
67	MATRIX	Estimated TLF: HBW
68	TRIPDIST	Trip Distribution: JTW
69	MATRIX	Estimated TLF: JTW
70	TRIPDIST	Trip Distribution: External Peak
71	MATRIX	Estimated TLF: External Peak
72	MATRIX	hourly parking cost model
73	MATRIX	Mode Choice Model
74	MATRIX	Check Baltimore bus-guideway trips
75	MATRIX	Report mode choice results
76	MATRIX	Mode Choice Model
77	MATRIX	Check Baltimore bus-guideway trips
78	MATRIX	Report mode choice results
79	MATRIX	Mode Choice Model
80	MATRIX	Check Baltimore bus-guideway trips
81	MATRIX	Report mode choice results
82	MATRIX	Mode Choice Model
83	MATRIX	Check Baltimore bus-guideway trips
84	MATRIX	Report mode choice results
85	MATRIX	Mode Choice Model
86	MATRIX	Check Baltimore bus-guideway trips
87	MATRIX	Report mode choice results
88	MATRIX	Mode Choice Model
89	MATRIX	Check Baltimore bus-guideway trips
90	MATRIX	Report mode choice results
91	MATRIX	School Mode Choice Model
92	MATRIX	Check Baltimore bus-guideway trips
93	MATRIX	Report mode choice results
94	MATRIX	Report intra-county school bus trips
95	MATRIX	Convert auto to vehicle trips, fdbk pass 1
96	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 1
97	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 1
98	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 1
99	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 1
100	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 1
101	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 1
102	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 1
103	MATRIX	Calc vehicle trips for AM, fdbk pass 1
104	MATRIX	Calc AM drive-to-trn vehicle trp, fdbk pass 1
105	HWYNET	Expand hwy net zones, fdbk pass 1
106	HWYLOAD	Highway assignment for AM, fdbk pass 1
107	HWYNET	Set bound on AM constrained speed, fdbk pass 1
108	HWYLOAD	Feedback skim on AM hwy net, fdbk pass 1
109	MATRIX	Update highway skims, fdbk pass 1
110	TRNBUILD	Peak Walk to Bus Paths/Skims
111	TRNBUILD	Peak Walk to Rail Paths/Skims

Step	Module	Description
112	TRNBUILD	Peak Walk to MARC Paths/Skims
113	TRNBUILD	Peak Drive to Bus Paths/Skims
114	TRNBUILD	Peak Drive to Rail Paths/Skims
115	TRNBUILD	Peak Drive to MARC Paths/Skims
116	MATRIX	Adjust Peak Walk to Bus Paths/Skims
117	MATRIX	Adjust Peak Walk to Rail Paths/Skims
118	MATRIX	Adjust Peak Walk to MARC Paths/Skims
119	MATRIX	Adjust Peak Drive to Bus Paths/Skims
120	MATRIX	Adjust Peak Drive to Rail Paths/Skims
121	MATRIX	Adjust Peak Drive to MARC Paths/Skims
122	TRNBUILD	Peak Walk to Transit Pathbuilding--No Mode Favored
123	MATRIX	Convert peak best transit time to minutes
124	MATRIX	Compute peak walk times
125	MATRIX	Composite time, peak
126	TRIPDIST	Trip Distribution: HBW
127	MATRIX	Estimated TLF: HBW income 1
128	MATRIX	Estimated TLF: HBW income 2
129	MATRIX	Estimated TLF: HBW income 3
130	MATRIX	Estimated TLF: HBW income 4
131	TRIPDIST	Trip Distribution: JTW
132	MATRIX	Estimated TLF: JTW
133	TRIPDIST	Trip Distribution: External Peak
134	MATRIX	Estimated TLF: External Peak
135	MATRIX	Report trips comparable to survey: peak
136	MATRIX	Mode Choice Model
137	MATRIX	Check Baltimore bus-guideway trips
138	MATRIX	Report mode choice results
139	MATRIX	Mode Choice Model
140	MATRIX	Check Baltimore bus-guideway trips
141	MATRIX	Report mode choice results
142	MATRIX	Convert auto to vehicle trips, fdbk pass 2
143	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 2
144	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 2
145	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 2
146	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 2
147	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 2
148	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 2
149	MATRIX	Extract drive-to-trn vehicle trp, fdbk pass 2
150	MATRIX	Calc vehicle trips for AM, fdbk pass 2
151	MATRIX	Calc AM drive-to-trn vehicle trp, fdbk pass 2
152	HWYNET	Expand hwy net zones, fdbk pass 2
153	HWYLOAD	Highway assignment for AM, fdbk pass 2
154	HWYNET	Set bound on AM constrained speed, fdbk pass 2
155	HWYLOAD	Feedback skim on AM hwy net, fdbk pass 2
156	MATRIX	Update highway skims, fdbk pass 2
157	TRNBUILD	Peak Walk to Bus Paths/Skims
158	TRNBUILD	Peak Walk to Rail Paths/Skims
159	TRNBUILD	Peak Walk to MARC Paths/Skims
160	TRNBUILD	Peak Drive to Bus Paths/Skims
161	TRNBUILD	Peak Drive to Rail Paths/Skims
162	TRNBUILD	Peak Drive to MARC Paths/Skims
163	MATRIX	Adjust Peak Walk to Bus Paths/Skims
164	MATRIX	Adjust Peak Walk to Rail Paths/Skims
165	MATRIX	Adjust Peak Walk to MARC Paths/Skims
166	MATRIX	Adjust Peak Drive to Bus Paths/Skims
167	MATRIX	Adjust Peak Drive to Rail Paths/Skims
168	MATRIX	Adjust Peak Drive to MARC Paths/Skims
169	TRNBUILD	Peak Walk to Transit Pathbuilding--No Mode Favored

Step	Module	Description
170	MATRIX	Convert peak best transit time to minutes
171	MATRIX	Compute peak walk times
172	MATRIX	Composite time, peak
173	TRIPDIST	Trip Distribution: HBW
174	MATRIX	Estimated TLF: HBW income 1
175	MATRIX	Estimated TLF: HBW income 2
176	MATRIX	Estimated TLF: HBW income 3
177	MATRIX	Estimated TLF: HBW income 4
178	TRIPDIST	Trip Distribution: JTW
179	MATRIX	Estimated TLF: JTW
180	TRIPDIST	Trip Distribution: External Peak
181	MATRIX	Estimated TLF: External Peak
182	MATRIX	Report trips comparable to survey: peak
183	MATRIX	Mode Choice Model
184	MATRIX	Check Baltimore bus-guideway trips
185	MATRIX	Report mode choice results
186	MATRIX	Mode Choice Model
187	MATRIX	Check Baltimore bus-guideway trips
188	MATRIX	Report mode choice results
189	MATRIX	Convert auto trips to vehicle trips
190	MATRIX	Extract drive-to-transit vehicle trips
191	MATRIX	Extract drive-to-transit vehicle trips
192	MATRIX	Extract drive-to-transit vehicle trips
193	MATRIX	Extract drive-to-transit vehicle trips
194	MATRIX	Extract drive-to-transit vehicle trips
195	MATRIX	Extract drive-to-transit vehicle trips
196	MATRIX	Extract drive-to-transit vehicle trips
197	MATRIX	Calc vehicle trips by period
198	MATRIX	Calc drive-to-transit vehicle trips by period
199	MATRIX	Transit time of day
200	HWYNET	Expand hwy net zones to load drive-transit veh trips
201	HWYLOAD	Highway assignment for period AM
202	HWYLOAD	Highway assignment for period MD
203	HWYLOAD	Highway assignment for period PM
204	HWYLOAD	Highway assignment for period NT
205	HWYNET	Round volumes, re-name network fields
206	HWYNET	Final speed feedback convergence tab
207	TRNBUILD	Peak Walk to Bus Assignment
208	TRNBUILD	Peak Walk to Rail Assignment
209	TRNBUILD	Peak Walk to MARC Assignment
210	TRNBUILD	Peak Drive to Bus Assignment
211	TRNBUILD	Peak Drive to Rail Assignment
212	TRNBUILD	Peak Drive to MARC Assignment
213	TRNBUILD	Off-Peak Walk to Bus Assignment
214	TRNBUILD	Off-Peak Walk to Rail Assignment
215	TRNBUILD	Off-Peak Walk to MARC Assignment
216	TRNBUILD	Off-Peak Drive to Bus Assignment
217	TRNBUILD	Off-Peak Drive to Rail Assignment
218	TRNBUILD	Off-Peak Drive to MARC Assignment
219	MATRIX	Convert person trips
220	MATRIX	Convert transit trips
221	MATRIX	Convert vehicle trips
222	HWYNET	Assignment VMT summary

APPENDIX F TRANSIT ACCESS CODING GUIDELINES

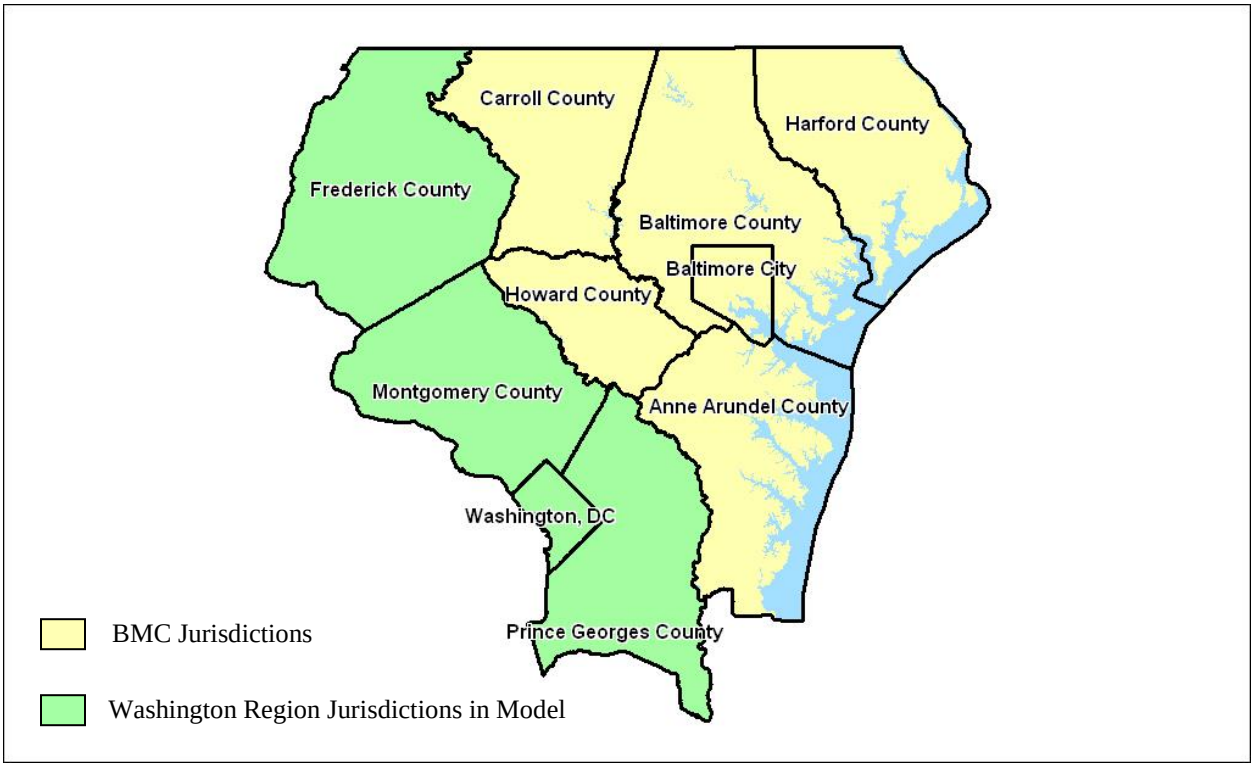
(written by Matthew de Rouville, BMC)

TRANSIT NETWORK

The Baltimore Region Travel Demand Model transit network consists of several files. This section describes the files and coding conventions used.

The BMC model covers Baltimore City and the Maryland counties of Anne Arundel, Baltimore, Carroll, Harford, and Howard. Also included in the model are the District of Columbia and the Maryland counties of Frederick, Prince George's, and Montgomery. These four latter jurisdictions are included to improve the model response in the Baltimore region, but data are not reported for the four. The map below shows the modeled region.

The transit network used is the one primarily serving the Baltimore Region. Bus and rail service of the Maryland Transit Administration is included, as are the locally operated transit systems in Annapolis, Harford County, and Howard County. The Connect-a-Ride system centered on Laurel is also included. Transit service in the Washington region is only that connecting with the Baltimore Region: MTA commuter express buses from the Baltimore region to Washington and the Maryland Rail Commuter (MARC) trains on the Penn and Camden Lines.



TP+ modeling software TP+ (Version 3.2.1) is used. The transit files input into the model include:

- LINE.DAT—Transit line file
- WKXFERPK.DAT–Peak Walk access file
- WKXFEROP.DAT–Peak Walk access file
- RAILLINK.DAT–Rail links file
- SIDEWALK.DAT–Downtown sidewalk network file
- WASHPK.DAT—Peak Washington, DC access links
- WASHOP.DAT—Off-peak Washington, DC access links
- FARE.DAT–Transit fare file
- WLKACCPK.DAT–Peak walk access links file
- WLKACCOP.DAT –Off-peak walk access links file
- WKACCPK1.DAT–Peak one-way walk access links file
- WKACCOP1.DAT –Off-peak one-way walk access links
- DRVACCPK.DAT–Peak drive access links
- DRVACCPK.DAT–Off-peak drive access links
- PNRPK.DAT–Peak park and ride file
- PNROP.DAT–Off-peak park and ride file

Transit Line File

The transit line file contains route-specific data for each line in the transit network.

Transit lines are identified by a comment line listing the name and endpoints. Then comes a LINE statement with the following keywords

NAME= Name of route

ONEWAY= True for lines that run one way only (default), false for lines that run both ways (most of them).

FREQ[1]= Peak period headway, in minutes

FREQ[2]= Off-peak period headway, in minutes

ALLSTOPS= True if all nodes are stop nodes. Overrides any stop nodes set in the node string

MODE=

1 MTA Core Bus

2 MTA Express Bus

3 MTA Commuter Express

4 MTA Light Rail

5 MTA Metro

6 MARC

7 Harford County Transit Services

8 Howard Transit

9 Annapolis Transit

COLOR= Value from 1-14 for display in VIPER/CUBE Base

OWNER= Coded for some routes but not used

N=. Nodes are listed in their order from beginning to end of the line. A non-stopping node is indicated by a negative node number. Within the node string you fill find delay statements. DELAY_C=0.5 normally follows the first node and provides a continuous delay of ½ minute per stop. A delay statement must be followed by an N= to resume the node string. In cases where there are non-stopping nodes, a DELAY=0 is used. Resume delay by inserting another DELAY_C or DELAY statement.

Park and Ride File

This file consists of a SUPPORT and several NODES statements which provide access from park and ride lots to adjoining bus lines. These are followed by PNR statements which identify the park and ride lots, link them to the transit network, and identify which zones have access to them.

Walk Access File

This file provides ZONEACCESS and SUPPORT statements to provide walk access to the various rail stations. Zone walk access is mode 14, and transfer links (SUPPORT links) are mode 12. MARC transfer links are coded as 0.05 miles compared to the 0.06 mile access links to ensure that former links are used for transfer connections. Light rail links are 0.09 and 0.10, respectively, while Metro links are 0.01 and 0.02, respectively.

Rail Links File

This file contains the rail links, with distances, speeds, and modes. Speeds were calculated to include dwell time.

Downtown Sidewalk Network File

This is a list of SUPPORT links providing walk access in downtown Baltimore (RPD 118). These represent the sidewalk network and were developed from all the highway links in the RPD. (Two-way movement is allowed for the walk links).

Washington DC Access File

This file contains SUPPLINK statements that provide walk access (mode 16) links between each zone in the District of Columbia and Union Station. This is meant to simulate the WMATA transit network and provide transit accessibility to the District. There are separate peak and off-peak files created from skim data provided by the Metropolitan Washington Council of Governments (MWCOG).

Transit Fare File

This file contains XFARE statements which allow the pathbuilder to calculate transit fare when changing mode, either boarding from a non-transit mode or transferring from mode to mode.

Walk Access Links

This file is generated in the transit access development pre-process described below. There are peak and off-peak links created. One-way versions (WKACCPK1.DAT and WKACCOP1.DAT) are created during the model run for auto drive access (providing walk egress from transit to each zone within the walk shed.)

Drive Access Links

This file is generated in the transit access development pre-process described below. There are peak and off-peak links created.

TRANSIT NETWORK ACCESS PRE-PROCESS

This document describes the process used to generate transit walk and drive links for the Baltimore Region Travel Demand model. First, the process is described. Second, step-by-step instructions are given to complete this process. This process was developed in 2005 and 2006 as part of the model update in support of the Red Line study for the Maryland Transit Administration.

Software Requirements

This process was developed using TP+ 3.2.1, CUBE Base 3.2.1, ArcMap 9.1 (ArcInfo License), and Microsoft Access 2003.

Walk Access

Walk access is developed through a mostly automated process using TP+, CUBE Base, ArcMap and Microsoft Access software. An Access/ArcMap compatible geodatabase (WALKACCESS.MDB) was created containing the necessary tables and a VBA macro. An ArcMap map file (WALKACCESS.MXD) was also created, which contains the ArcMap VBA application.

The first step is to run the TP+ script WALKACC.JOB. This runs under TP+. This first produces a highway network called HIGHWAYTT.NET, with peak (based on input congested speed) and off-peak (based on input free-flow speed) travel times. The program then produces peak and off-peak walk access transit networks that generate walk access links of up to four miles in length. The respective transit networks are WACP.DBF and WACO.DBF.

No mode weights are used for transit or non-transit modes. The maximum number of links per zone for each mode are 9,2,2,2,2,2,4,4,4. (MTA Local Bus, MTA Express Bus, MTA Premium Express Bus, Light Rail, Metro, MARC, Harford County Transit Services, Howard Transit, and Annapolis Transit, respectively.)

This job stream also produces a file of links that are actually used for transit paths. These files are WACP.TXT and WACO.TXT. Files of network coordinates are also produced, WACPXY.DBF and WACOXY.DBF, for peak and off-peak, respectively.

When overlaid with the highway network, the two .DBF transit networks (WACP.DBF and WACO.DBF) can be exported from Viper/CUBE Base as ESRI shape files and added to the geodatabase.

The VBA macro WalkAcc() found in the WALKACCESS.MXD file is run. There are several steps which are completed for the peak and then the off-peak transit networks.

- Import transit shape and coordinate files

- Identify transit stop nodes and separate into express bus, rail, and MARC stops
- Create separate buffers of the three types of transit stop nodes with a 0.5 mile radius.
- Combine (dissolve) the stops buffers separately into one object for faster processing.
- Open and dissolve transit network for modes 1,7,8,9 (*i.e.* for the local MTA and locally-operated buses).
- Buffer transit network within 0.5 mile of the dissolved transit lines. This assumes that there will be access at various points along the line, rather than just at stops/stations, as assumed for express bus and rail lines.
- Dissolve the line buffer.
- Create a bus transit buffer by combining the express stops buffer with the transit line buffer
- Create a master buffer by combining all buffers (bus, rail, and MARC) and dissolving.
- Find the intersection of the master buffer and TAZs and calculate the percentage of each TAZ within the walk area buffer.
- Find the intersection of the individual buffers and TAZs to create separate subzones by mode.
- Split zones by bus lines for the bus to create subzones
- Find the centroid of each of these subzones by mode.
- Find the distance from each subzonal centroid to the nearest transit feature of the appropriate mode.

Tables of interest produced by this process include:

- peak_walk_pointsB–Data for the peak bus network for each walk-access subzone, including TAZ (TAZ00_1), percent of entire TAZ within walk shed (PCTWalk), distance to nearest stop in feet (NEAR_DIST), distance to nearest transit line in feet (NEAR_DIST_L), and area of walk-access subzone (Split_Area).
- peak_walk_pointsR–Data for the peak rail network for each walk-access subzone, including TAZ (TAZ00_1), percent of entire TAZ within walk shed (PCTWalk), distance to nearest stop in feet (NEAR_DIST), distance to nearest transit line in feet (NEAR_DIST_L), and area of walk-access subzone (Split_Area).
- peak_walk_pointsM–Data for the peak MARC network for each walk-access subzone, including TAZ (TAZ00_1), percent of entire TAZ within walk shed (PCTWalk), distance to nearest stop in feet

(NEAR_DIST), distance to nearest transit line in feet (NEAR_DIST_L), and area of walk-access subzone (Split_Area).

- opeak_walk_pointsB, opeak_walk_pointsR, opeak_walk_pointsM–Data for the off-peak transit network, with the same data as above.

Once this is completed, the ArcMap program can be closed and Microsoft Access opened. The same file (WALKACCESS.MDB) can be opened. The VBA module WalkAcc() can be run, which completes the following steps.

- Runs queries to compute the weighted average distance for each TAZ (using the area of each zonal subarea as a weighting factor) to the nearest bus line and the nearest transit bus, rail, and MARC stop (assuming 2.5 mile per hour walk speed).

- Runs query to combine separate peak and off-peak data for lines and stops into one table.

- Produces a file (WALKTIME.DAT) with peak and off peak zonal walk percentages and average walk times for bus (the shorter of the walk to stop or walk to a line), rail, and commuter rail for each TAZ, both peak and off-peak, with special handling for District of Columbia zones, where all the walk shares are 100% and the rail walk time is the minimum of the actual non-zero rail walk time or the WMATA transit time (based on data the WASHPK.DAT and WASHOP.DAT files).

- Produces walk links for the peak and off-peak networks (WLKACCPK.DAT and WLKACCOP.DAT, respectively).

- Produces files of unused walk links in the format used by TP+ in case the user wished to add those links manually: UNUSEDWP.TXT and UNUSEDWO.TXT for peak and off-peak, respectively.

The walk links selected are nine shortest of the possible links generated by TRNBUILD. A maximum walk distance corresponding to the cube root of the zonal area in square miles (this function was suggested by the consultant; although it may seem unusual, it has been shown to produce reasonable results in other areas) serves as a cut-off, so fewer than nine links may be selected. In cases were a zone has no links generated but is within the walk shed (0.5 miles) of a transit stop or line, the user is prompted to enter a stop node so that a walk link can be created, with the distance set to the average walk distance.

Drive Access

Drive access is created using TP+ and Microsoft Access. The WALKACCESS.MDB file and VBA macro is used, so some of the drive access steps should be completed before attempting to run the VBA macro.

The first step is to run the TP+ script DRIVEACC.JOB. This first reads HIGHWAYTT.NET created during the walk access process and produces a highway network HIGHWAYTTT.NET, Tolls are included in this time, with a user-selected value of time, added to the peak and off-peak times. This job stream then produces peak and off-peak drive access transit networks that generate drive access links of up to thirty minutes in travel time (including a value of time of any tolls). The respective transit networks are DACP.DBF and DACO.DBF.

No mode weights are used for either transit modes or non-transit modes. Other parameters are set to match those used for the transit pathbuilder. The maximum number of walk links per zone for each mode are 9,2,2,2,2,2,4,4,4. (MTA Local Bus, MTA Express Bus, MTA Premium Express Bus, Light Rail, Metro, MARC, Harford County Transit Services, Howard Transit, and Annapolis Transit, respectively.) There is no maximum number of drive links.

This job stream also produces a file of drive links that are actually used for transit paths. These files are DACP.TXT and DACO.TXT.

The Microsoft Access database WALKACCESS.MDB contains a VBA macro WalkAcc(), which also generates drive access links.

This process completes the following steps:

- Runs a query to chose express bus and rail drive access links that are actually used during pathbuilding
- Orders links by increasing travel time for each TAZ
- Produces drive-access link files DRVACCPK.DAT and DRVACCOP.DAT for peak and off-peak, respectively.

Step-by-Step Instructions

1. Create a Directory (called ACCESS) under the specific scenario you are working in.
2. Build Transit Network
   - Collect files needed and copy into the INPUTS directory, which is at the same level as the ACCESS directory under the scenario directory.
     - HIGHWAY.NET (highway network)
     - LINE.DAT (transit line file)
     - PNRPK.DAT (peak drive access file)
     - PNROP.DAT (off-peak drive access file)
     - WKXFERPK.DAT (walk access file)
     - WKXFEROP.DAT (walk access file)

  - SIDEWALK.DAT (downtown sidewalk network file)
  - FARE.DAT (fare file)
  - RAILLINK.DAT (rail link file)
  - WASHPK.DAT (Washington DC peak transit access links)
  - WASKOP.DAT (Washington DC off-peak transit access links)
- Collect files need and copy into the ACCESS directory.
  - WALKACC.JOB (job stream)
  - DRIVEACC.JOB (job stream)
  - WASHPK.DAT (Washington DC peak transit access links)
  - WASKOP.DAT (Washington DC off-peak transit access links)
- Run WALKACC.JOB from the ACCESS directory.
- Open Viper/CUBE Base.
- Read HIGHWAY.NET file from the INPUTS directory
- Add WACP.DBF peak transit layer from the ACCESS directory.
- Export (File|Export) peak transit shape file into the ACCESS. Be sure to choose the correct file type (Transit Shape Files) from the drop-down box in the dialog box. Remember the name you used (preferably specifically referencing peak).
- Replace transit layer with WACO.DBF off-peak layer from the ACCESS directory.
- Export (File|Export) off-peak transit shape file into the ACCESS directory. Be sure to choose the correct file type from the drop-down box in the dialog box. Remember the name you used (preferably specifically referencing off-peak and being similar to the peak name).
- Run DRIVEACC.JOB from the ACCESS directory

3. Run ArcMap program
   - Copy the ArcGIS map document WALKACCESS.MXD to the ACCESS directory.
   - Copy the Microsoft Access database WALKACCESS.MDB to the ACCESS directory
   - Open ArcGIS Desktop Administrator and choose the ArcInfo License from the Software Product folder.
   - Open ArcMap and load WALKACCESS.MXD.
   - If you have not run this program before on your computer, open Visual Basic Editor (Tools|Macro|Visual Basic Editor). Click on Tools|Refrences and make sure Microsoft DAO 3.6 Object Library is checked. Close Visual Basic Editor
   - Start macro WalkAcc() (Tools|Macros|Macros|Run).
   - You will be prompted to enter a prefix (leave blank) and a buffer distance (use the default, 0.5).
   - You will be prompted with a file dialog box to enter first the peak transit network and later the off-peak transit network. These are the files you exported from Viper/CUBE Base.
4. Run Microsoft Access program
   - Open Microsoft Access

- Load WALKACCESS.MDB
- Find the Macros page of database box and click on WalkAcc to start the macro, or invoke it from the menu. (Tools|Macro|Run Macro)
- You may be prompted to enter a transit node number to provide access from a zone within the walk shed. This occurs when an access link is not generated because the distance from the centroid is more than the four mile maximum. You only need find and enter the nearest transit-served node to a zone. Click "OK" when done. If you wish to skip this zone because walk access is not practical for this zone, you may click the "Skip" button.

This process will produce the above-mentioned walk and drive link files that should give appropriate coverage for transit access. They will no longer be generated by the model after this first pre-process. This process should be carried out for each different transit scenario or for changes in the transit network, but need not be run for each model run.

The normal WALKACC.MDB file size is around 100 MB. Should it be much higher than that, you may wish to run the Tools|Database Utilities|Compact and Repair Database command when the WALKACCESS.MDB file is completed in Microsoft Access.

The files generated by this process can be copied into the INPUTS directory:

WALKTIME.DAT
WLKACCPK.DAT
WKLACCOP.DAT
DRVACCPK.DAT
DRVACCOP