Triangle Regional Travel Demand Model

Users' Guide

For Version 5 – 2011

(DRAFT)

Prepared for

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Preface

This document provides guidance for the end users of the Triangle Regional Model (TRM), TransCAD version 5 (TC-v5), on how to install the model, create model scenarios, execute the model, and find, interpret, and use the model outputs.

For technical details or theoretical background of the TRM model, please refer to **Triangle Regional Model Version 5 Model Development Documentation**.

Computer Requirements

The ideal computer will be equipped with Intel Dual-Core or Core-2-Duo processors or similar and a minimum of 2.0 GB RAM.

A full run of the 2010 TRM base-year model (with 2 feedback iterations to converge) takes about 11 hours to execute on a quad-core Intel i7 2.93 GHz processor and 16 GB of RAM equipped 64-bit desktop computer. Required hard drive disk spaces are approximately as follows:

Hard drive space needed (GB)	w/ some intermediate files deleted in the process	All files retained
w/o user benefit files generated for Summit	26	36
w/ user benefit files generated for Summit	36	46

If the "Delete temporary files after model run" box is checked on the main TRM graphic user interface (GUI) before model execution, the total size of all the input and output files of a model will be about 10 gigabytes less than without the box checked. However, since the temporary files are not deleted immediately after they are created, it would be safer to have a free space of 36 or 46 gigabytes as a minimum as if all files are retained. More free space would be preferred.

Outline of the User's Guide

Chapter 1: Overview of TRM
It describes the TRM application structure and data flow and computer resource requirements.

Chapter 2: Getting Started
This chapter provides instructions on how to prepare model setup files, create and install TRM user-interface, and setup TRM model scenarios.

Chapter 3: Model Execution

This chapter provides step-by-step instructions for execution of TRM base year 2010. Key input and output data files required for execution are listed with each step including a description of the required directory structure.

Chapter 4: Input File Preparation
This chapter instructs the user how to prepare those input files that often vary by model scenario and need manual preparation. It does not cover any other input files, contents of which do not change frequently across different model scenarios. Special consultation with the TRM Service Bureau is recommended if making changes to those files is needed.

Chapter 5: Data Dictionary for Input and Output Files
Detailed information about the key input/output data is provided in this last chapter of this Guide.

Chapter 1 – Overview of TRM

The TRM version-5 model is a major update of the version-4 model. The official software platform used for developing this model is TransCAD version 5.0 build 1880. The model was calibrated to the base year of 2010.

The model is implemented using a combination of TransCAD Transportation Modeling software and stand-alone FORTRAN application programs. TransCAD operates as both an integral component of the application and a shell for the management of scenarios and the calling of FORTRAN programs.

This chapter gives an overview of the TRM with respect to its characteristics, structure, and data flow.

1.1 Model Characteristics

The TRM v5 is implemented on the platform of TransCAD with a dedicated Graphic User Interface (GUI) developed using TransCAD's built-in scripting language GISDK, as shown in Figure 1-1. The GUI manages various model scenarios, automates the execution of the model, and evaluates model results.

The TRM is a traditional four-step model with some enhanced features designed to meet the evolving state of the practice in multi-modal travel demand modeling. Key techniques used in the model include:

- A multinomial logit based trip production model and attraction share model;
- A multinomial logit based destination choice model with logsum fed back from the mode choice model;
- A binary logit based non-motorized trip split model;
- A nested logit based mode choice model, including a special trip type called auto-intercept;
- An iterative feedback mechanism, which loops through the destination choice, non-motorized trip split, mode choice, and assignment modules and ensures that the model uses consistent travel costs between input and output for the peak period.

Major features of the model include:

- The TRM forecasts both passenger trips and commercial vehicle trips.
- Forecasting of passenger trips is categorized into multiple market segments based on household socioeconomic characteristics (for details please see the Model Development Documentation).
- Passenger trips are forecasted for both private and public transportation modes.
- Private transportation modes modeled in the TRM include single occupancy vehicles, 2-person occupancy vehicles, and 3+ person occupancy vehicles.

- Public transportation modes modeled in the TRM include local buses, express buses, and rail (for the future year forecasting while not in the base year). The modes for access to transit include walk access, park and ride, and kiss and ride.
- Non-motorized trips are estimated after destination choice with bicycle trips and walk trips mixed together. In other words, their distributions are estimated, but no further mode split between bicycling and walking is estimated.
- Commercial vehicle trips are forecasted for three vehicle types, including autos, pick-ups, and trucks.
- Tolls are fully modeled. Tolls are reflected in nearly all the steps of the model (except trip generation). Tolls are incorporated with travel times via the value of time to form generalized costs. With the capability of toll modeling, the TRM v5 can be used to investigate HOT and toll road alternatives.
- Passengers' traveling to and from the Raleigh-Durham Airport is explicitly modeled. Airport passenger trips are classified into home-based, work-based, private-residence-based (excluding home-based), and non-home non-work based categories.
- Highway traffic assignment forecasts traffic volumes on each roadway segment by the following vehicle types: single-occupancy vehicles (SOV), high-occupancy vehicles (HOV), and trucks. SOV and HOV traffic produced in this step includes both the passenger vehicle trips and the commercial auto and pick-up vehicle trips, with internal-to-internal (I-I), internal-to-external (I-E), external-to-internal (E-I), and external-to-external (E-E or through) traffic all merged together.
- Three time-of-day periods are modeled in the TRM, which are AM peak (6:00 am to 10:00 am), PM peak (3:30 pm to 7:30 pm), and off-peak (the remaining time of the day).

1.2 Model Structure and Flow

The basic overall structure of the TRM is shown in Figure 1-1. Processes in the flow chart are grouped according to the stages and steps on the TRM TransCAD GUI, as shown in Figure 1-2. The processes grouped into the dotted boxes are stages, and the box labels match the stage names shown on the model GUI.

Note that the feedback only occurs if the number of iterations is set to being greater than 0 on the model GUI. The model will loop back one more time after convergence is met to allow the distribution and mode choice models to run one final time with the converged travel times.

Without executing the Feedback Model, a full TRM run starts from the first step, Create Walk Access, and ends at the last step, Transit Assignment. Compared with the feedback model, it takes less time but the price is that the results are not as robust. Feedback is always recommended for serious analyses.

There are also three utilities provided on the model GUI, namely Base Model Validation / Scenario Evaluation, Air Quality Analysis, and Summit User Benefit Analysis. The names are fairly self-explanatory. Details will be provided in Chapter 3.

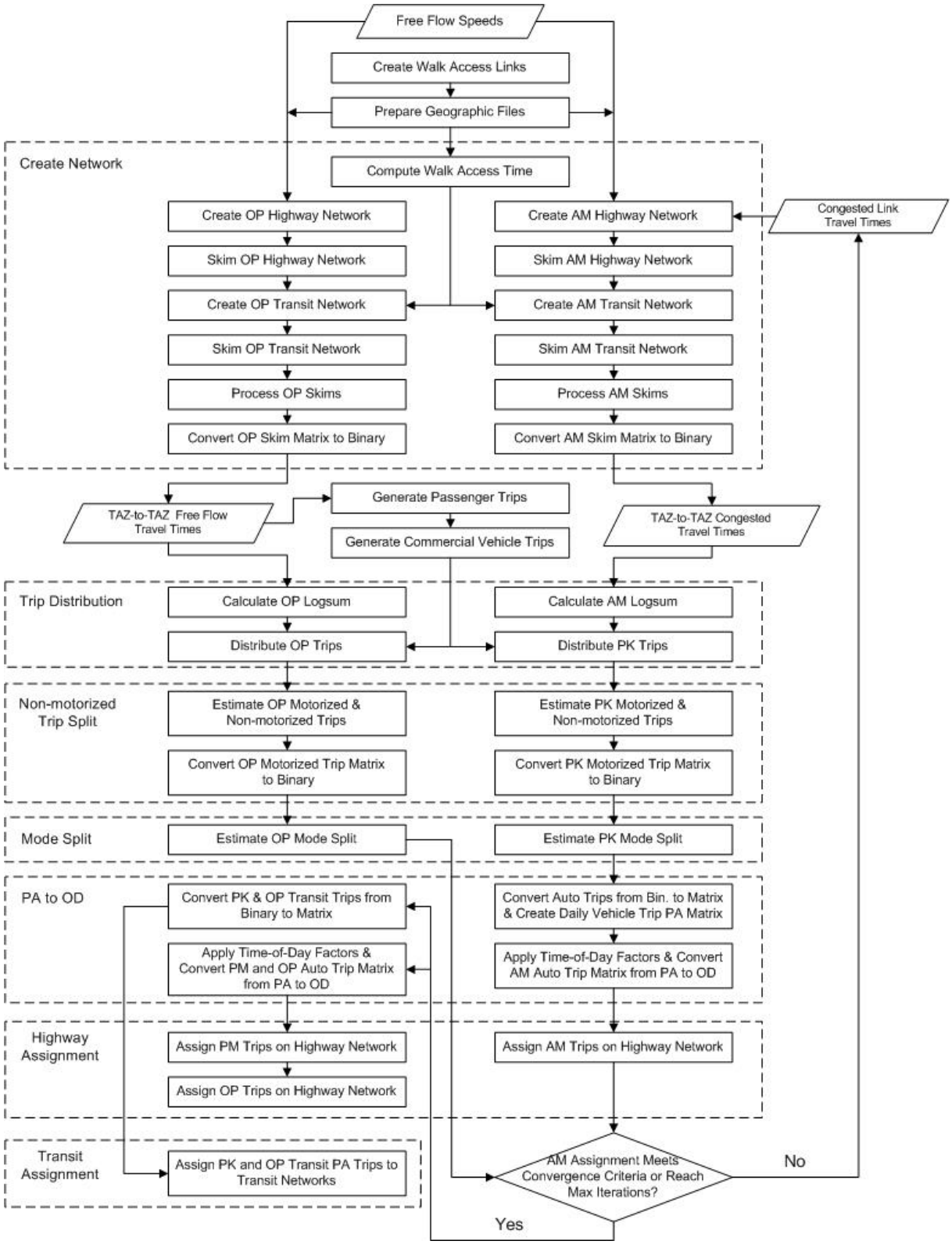


Figure 1-1 TRM v5 Flow Chart

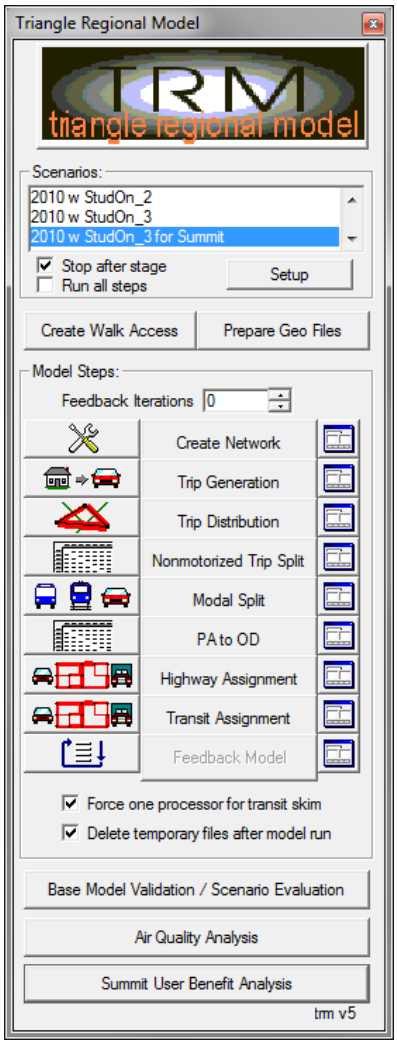


Figure 1-2 TRM v5 Graphic User Interface

1.3 File Directories and Management

The TRM file storage structure is pretty simple and straightforward, as shown in the example in Figure 1-3. There are four file directories that need to be prepared manually, namely **Input**, **Interim**, **Output**, and **EvalModule**. The first three are required for any full model runs and the last one is required for model output evaluation (i.e. when the Base Model Validation / Scenario Evaluation button is clicked on the model GUI). In addition to the four manually prepared directories, there is an optional one called **Air Conformity**, which is created automatically when Air Quality Analysis is executed (i.e. when the Air Quality Analysis button is clicked on the model GUI).

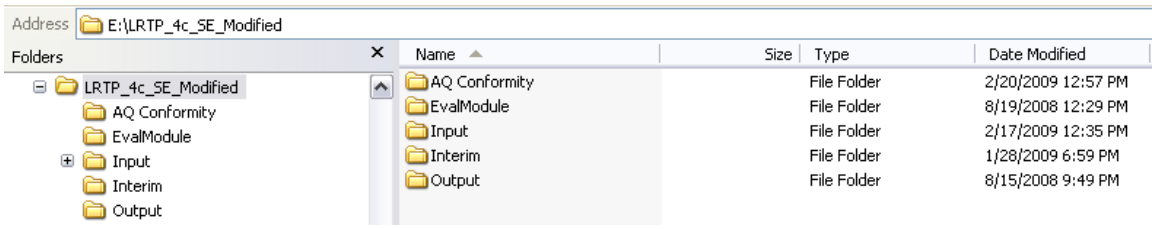


Figure 1-3 TRM File Directories

All the input files required for a model run are grouped into subdirectories, which are then stored in the **Input** directory, as shown in Figure 1-4 below. A summary of the directory contents is provided below; for detailed information, please refer to Chapter 3.

- Master highway network, master transit network, and regional TAZ system geographic files are stored in the **Master Geography** subdirectory.
- Socio-economic data, highway network (created from the master highway network), and time-of-day transit networks (created from the master transit network) are stored in their own distinct subdirectories, namely **SEData**, **Highway**, and **Transit**, respectively.
- Stored in the **Transit** subdirectory are also bus speed equation lookup table, transit mode table, mode-to-mode (operator-to-operator) transfer fare table, time-of-day timed transfer wait time tables, and SE data distribution weights for transit access.
- Through (E-E) trip table and commercial vehicle trip files are stored in their respective subdirectories, i.e., **Extp** and **CommVeh**.
- The "**Input\Programs"** subdirectory contains FORTRAN executable files and control files with the coefficients, constants, and parameters for implementing trip generation, distribution, and mode choice procedures. Except in rare occasions, these files should not be modified.
- The files in the "**Input\Parameter"** subdirectory constitute the speed-capacity lookup table, time-of-day hourly factor table, etc. to execute the TRM. Like the files in the **Programs** subdirectory, the files here should not be modified without careful model validation.

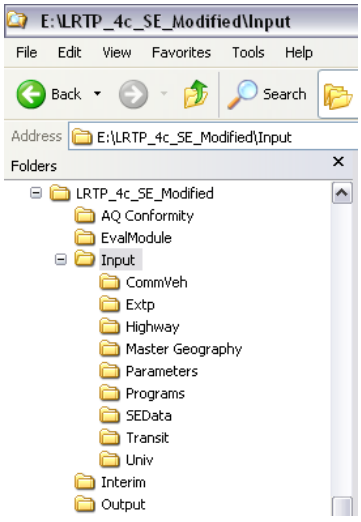


Figure 1-4 TRM Input File Directory and Its Contents

All of the final output files are saved in the **Output** directory. The important ones include highway trip OD matrices, transit trip OD matrices, highway traffic assignment results, and transit assignment results. The results are stratified by time of day and transportation mode (as well as access mode, if transit).

Files that are generated in the application for use in later modules but may not be significant enough (debatable!) to put in the **Output** directory go to the **Interim** directory. During the model execution over 30GB of interim files are created and placed in this directory (over 40 GB, if user benefit input files are generated for Summit application later).

Nearly 1,000 files are involved in a model run, either input of output. For such a large number of files, the TRM includes a Scenario Manager at the top of the model GUI, which can be used to create and manage model scenarios (or called applications). While the Manager has to use a default definition file to initialize all input/output files and parameters, it provides the user with tremendous flexibility with respect to changing the file names and paths and resetting parameters. Use of the Scenario manager is described in greater details in Chapter 2.

Details about the folders and files will be provided in Chapter 3.

Chapter 2 – Getting Started

This chapter provides instructions for the steps needed prior to run the TRM. The key steps include: 1) installing TransCAD software; 2) preparing TRM setup files; and 3) installing the TRM graphical user interface (GUI).

Since we have to talk about directories and files throughout this Guide, to facilitate the presentation, we will refer to the file names as indicated in the TRM50_MOD.bin file (this file will be described in Section 2.2.1) and also assume:

- TransCAD version 5.0 build 1880 program is installed under **C:\Program Files\TransCAD 50**
- All your model scenarios are stored under a master folder, **D:\TRM Model**

In case you have a different TransCAD folder name and it is installed at a different location, e.g. D:\TransCAD\, then you need to replace the text "C:\Program Files\TransCAD 50\" anywhere you see in this Guide with "D:\TransCAD\" to get correct directory for your case.

Similar things have to be done with model scenario directories too, if they are different from the one assumed above.

2.1 Install TransCAD version 5.0 build 1880

The official platform on which the TRM v5 runs is **TransCAD version 5.0 build 1880**.

Before setting up model files, you will have to make sure that TransCAD version 5.0 Build 1880 has already been installed properly on your machine, for example, under the directory of "C:\Program Files\TransCAD 50\".

If you already have other versions of TransCAD installed, that is not a problem and you can install multiple versions of TransCAD on your machine. One thing you have to make sure about is each of the versions has to be installed in a different directory and the one that is up running for the TRM is version 5.0 build 1880.

2.2 Preparing Model Folder and Setup Files

2.2.1 Files Needed for Setup

2.2.1.1 Data on the CDROM (Required)

Accompanied by this User's Guide, a CD-ROM with all the files needed to run the TRM is provided for the user. The file storage structure on the CD is illustrated in Table 2-1.

Table 2-1 Data on the CDROM (Required)

Folder Name	File Name	Description / Instructions
\TRM Script and GUI\	TRMv5_TC50_Script.rsc	This is the TRM script written in GISDK. It should be copied to your local computer and can be placed anywhere you like as long as you can find it in case a re-compilation is needed.
	trm_v5_ui.dbd and supporting files (i.e. trm_v5_ui.1 through trm_v5_ui.6)	These are the TRM graphic user interface (GUI) files, which are created by compiling the model script. These files should be copied to the TransCAD program files folder (e.g., C:\Program Files\TransCAD 50\)
\Model Setup Files\	trm_v5.ini	This file tells the model where to load the model GUI, where to find the scenarios set up and stored earlier, where to find the file providing the initial definition for all input and output files as well as parameters, and the place where all the input files stored. This file should go to the TransCAD program files folder (e.g., C:\Program Files\TransCAD 50\)
	TRM_v5_MOD.bin & TRM_v5_MOD.DCB	This is the file that provides the initial definition for all input and output files and parameters for the model. It basically defines the name and path for the files and values for the parameters. It can be placed anywhere you like as long as it is referenced correctly in the trm50_scen_xp.ini file. A better practice would be creating a separate subdirectory under the master folder, e.g. D:\TRM Model\Model Setup Files\.
\2010\	A full copy of all input files for the base year model	Files and folders are structured as illustrated in Figure 1-2. This entire folder (i.e., 2010) should be copied to your local computer. While it can be placed anywhere you like, again, it would be better organized if putting it in the master folder, e.g. D:\TRM Model\2010\. If this folder serves as [Data Directory] in file trm50_scen_xp.ini, its path and name should be referenced correctly in that file.
\Logo File\	triangle.bmp	This is the TRM logo. It is displayed at the top of the TRM GUI when the model is launched. It should be copied to the TransCAD program files folder (e.g., C:\Program Files\TransCAD 50\).

2.2.1.2 Additional Data (Optional)

These additional files are not required for setting up and executing the TRM, but under certain circumstances they can facilitate the modeling work substantially. They are not included in the TRM data CD-ROM, but if needed, the user can contact the TRM Service Bureau.

Table 2-2 Additional Data (Optional)

Folder Name	File Name	Description / Instructions
\TRM AQ Files\	Subdirectories named 2015, 2025, 2035, and Mobile6 Files, and file County Emission Budgets and Compliance Rates.dbf	This folder is **optiona**l and only needed for air quality analysis. It should be copied to the TransCAD program files folder (e.g., C:\Program Files\TransCAD 50\). Details about the files in this folder are provided in Section 3.12 of Chapter 3.
\TRM Summit\	Summit executable file (summit993.exe) and control file template	This folder is **optiona**l and only needed for Summit user benefit analysis. It should be copied to the TransCAD program files folder (e.g., C:\Program Files\TransCAD 50\). Details about the files in this folder are provided in Section 3.13 of Chapter 3.
\True Universe Highway Network\	True Universe Highway Network.dbd	
\All Coded Transit Routes\	All Transit Routes.rts	
\TRM SE Check & Post –processing Tool\	trm_se_check_and_postprocessing.dbd and supporting files (i.e. trm_se_check_and_postprocessing.1 through trm_se_check_and_postprocessing.6)	This tool checks if the relationship between zonal SE attributes is reasonable; updates area type for each TAZ based on SE data; and creates terminal time matrix for auto trips based on new area types.
\Network Manager\	netmanager.dbd and supporting files (i.e. netmanager.1 through netmanager.6)	This tool creates and manages highway and transit network systems for the TRM.

2.2.2 Prepare Model Setup File

Below are the steps for setting up the initial model setup file on your computer:

1) Create the **TRM Model** folder under the D drive, i.e., **D:\TRM Model**, if it does not exist yet.
2) Create a subdirectory called **Model Setup Files** under **D:\TRM Model**, and copy the files **TRM_v5_mod.bin** & **TRM_v5_mod.dcb** from the **TRM Setup Files** folder on CD to **D:\TRM Model\Model Setup Files**.
3) Copy the entire base year model **2010** folder from the CD to **D:\TRM Model**.
4) Copy file **trm_v5.ini** from the **TRM Setup Files** folder on CD and file **trm_v5_ui.dbd** and its supporting files (i.e. trm_v5_ui.1 through trm_v5_ui.6) from the **TRM Script and GUI** folder on CD to **C:\Program Files\TransCAD 50**
5) Modify the **trm_v5.ini** file to reflect correct file locations. An example is shown below. Brackets and texts in the brackets should NOT be modified.

```
[Model Table]
D:\TRM Model\Model Setup Files\TRM_v5_mod.bin
```

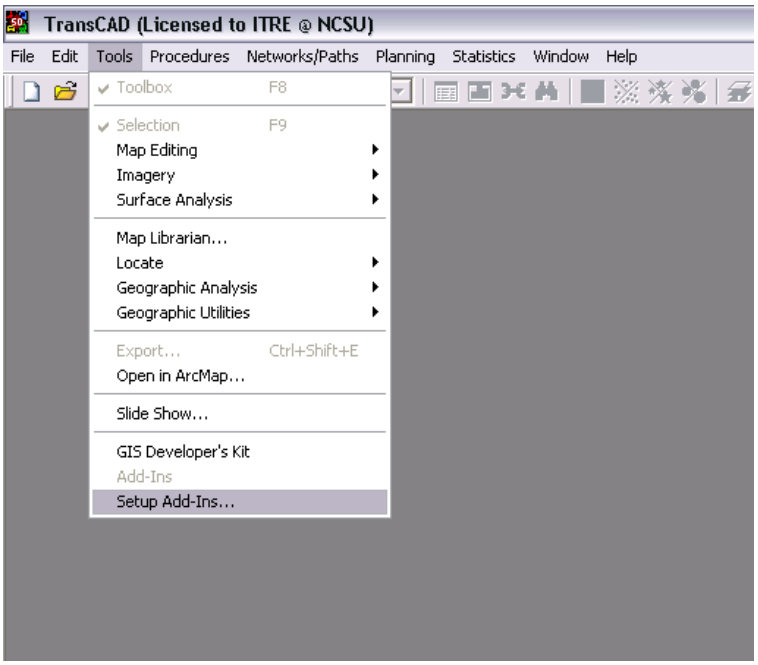
[UI File]
C:\Program Files\TransCAD 50\trm_v5_ui.dbd
[Scenario File]
D:\TRM Model\Model Setup Files\TRM_v5_mod.arr
[Data Directory]
D:\TRM Model\2010\

As a note, the sixth line under [Scenario File] indicates where you are going to save the TRM_v5_MOD.arr file, which is created by the TRM Scenario manager and stores the full information of all the scenarios created using the Scenario manager.

2.3 Create TRM Graphic User Interface

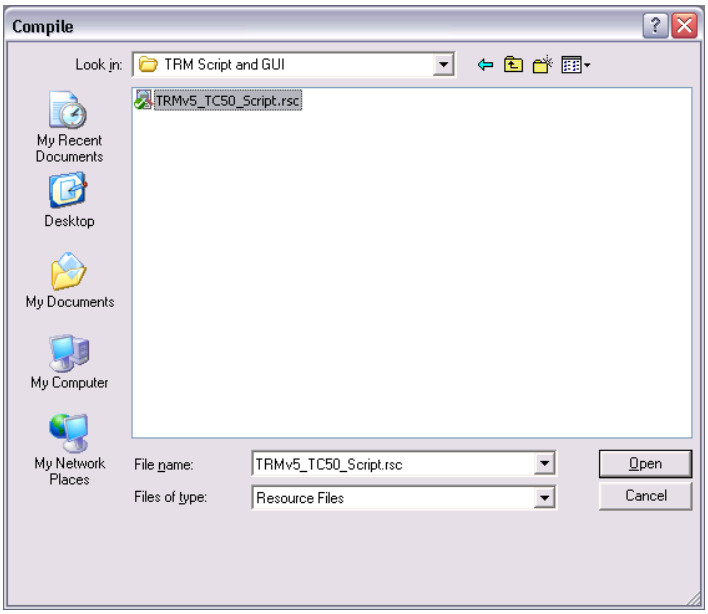
While a GUI has been provided in the CD, in case the user needs to recompile the model script to create a new GUI, the following procedure needs to be followed.

1) From the main menu of TransCAD, choose **Tools → GIS Developer's Kit.**

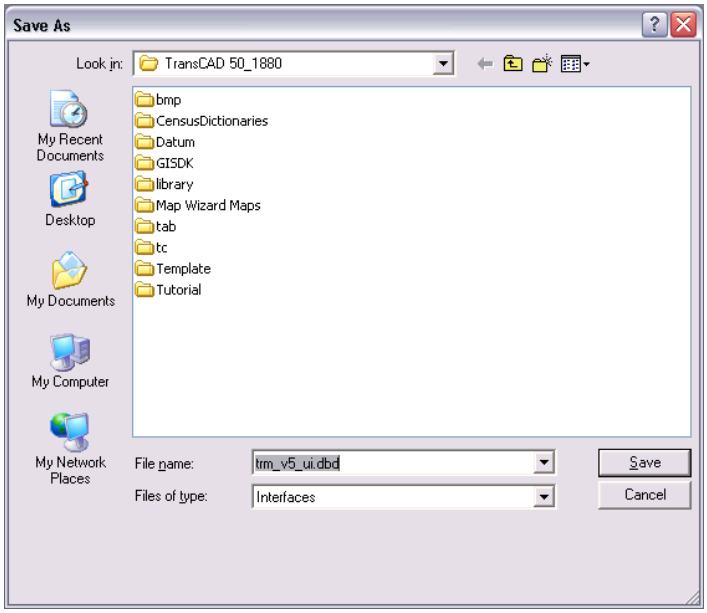


2) A toolbox titled "GISDK Toolbox" pops up. On the toolbox, click the third (middle) button ("**Compile to UI**").

3) In the "Compile" dialog box, browse for the model script file, **TRMv5_TC50_Script.rsc**, and then click "**Open**".



4) In "Save as" window, browse to TransCAD folder **C:\Program Files\TransCAD 50**, and enter "**trm_v5_ui.dbd**" in the "File name" field. Then click "**Save**". If you already have an old file with the same name, simply overwrite it.

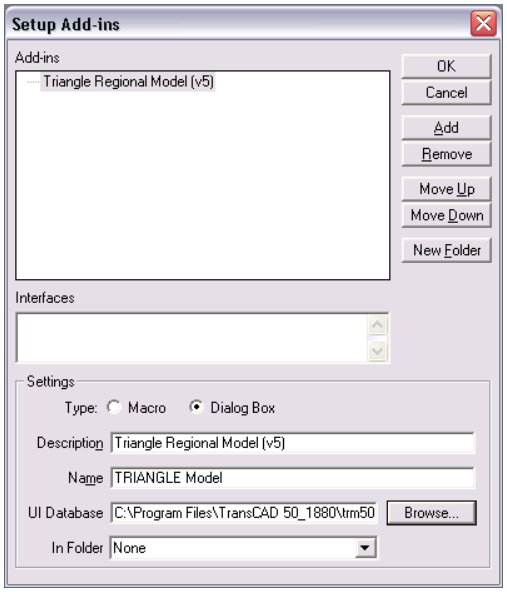


Now you are finished with the recompilation of the model script and the creation of a new GUI.

2.4 Install TRM Graphic User Interface

Next step is to install the TRM GUI. Follow the procedure below:

1) From the TransCAD main menu click "**Tools**" - "**Setup Add-ins**"
2) In the "Setup Add-ins" dialog box, click "**Add**" button.
   Under section "Settings":
   a. In the "Type" row, select the radio button of "**Dialog Box**"
   b. In the "Description" row, you can enter "**Triangle Regional Model (V5)**" or anything else making sense to yourself
   c. In the "Name" row, must enter "**TRIANGLE Model**" (it is case sensitive!).
   d. In the "UI Database" row, click the "Browse" button and then in the "Locate UI Database" dialog box browse for the TRM UI (i.e., "trm_v5_ui.dbd" in C:\Program Files\TransCAD 50\) and click "Open".
   e. Click OK in the "Setup Add-ins" dialog box.



Now you are ready to execute TRM!

2.5 Use TRM Graphic User Interface

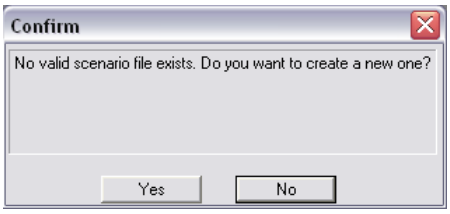
By clicking Triangle Regional Model (V5) from the TransCAD Tools – Add-Ins menu, the TRM GUI will pop up in the TransCAD window, as shown in the screenshot below. Since by now you have not set up any model scenarios in the GUI yet, therefore the Scenarios box does not contain anything and most of the model execution buttons are not enabled at the moment.

2.5.1 Create a New Model Scenario

Assume we are going to setup the base year 2010 model and you have copied the 2010 model files from the CD to the **D:\TRM Model\2010** directory. The steps involved are as follows:

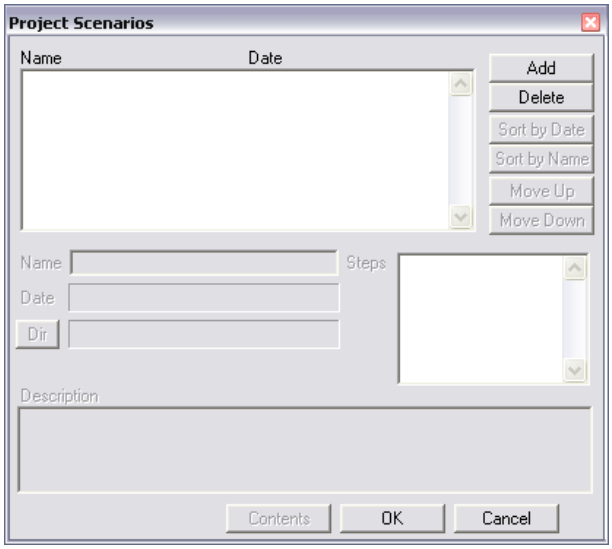
1) Click the "**Setup**" button in the Scenarios frame at the top of the UI.

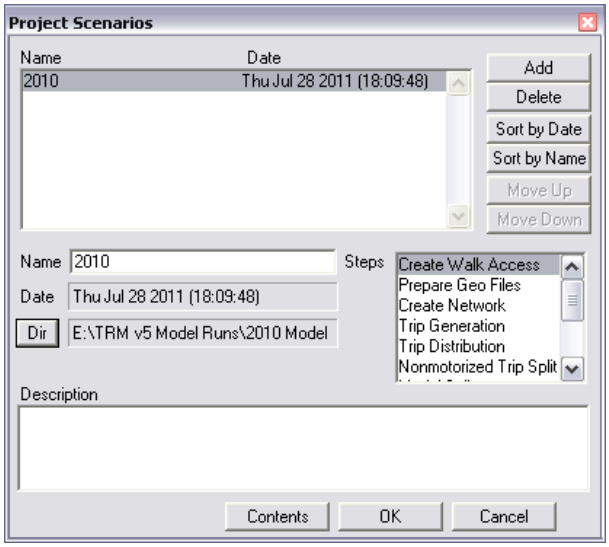
2) If no model scenario exists yet, a message box titled "Confirm" will appear. Click "**Yes**" to start.



3) Now the "Project Scenarios" dialog box appears, as shown below. Then click "**Add**" to add a new scenario.

- In the Name box, enter "**2010**" or any other name you think meaningful.
- If the file directory displayed to the right of the "**Dir**" button is not **D:\TRM Model\2010**, click button "**Dir**" and direct the UI to the **D:\TRM Model\2010** directory where the 2005 model files are stored.





4) The Steps scroll-down box now lists all the TRM modeling steps in it. These steps are the same as those buttons listed on the main model GUI. These steps include:

- Create Walk Access;
- Prepare Geo Files;
- Create Network;

- Trip Generation;
- Trip Distribution;
- Nonmotorized Trip Split;
- Modal Split;
- PA to OD;
- Highway Assignment;
- Transit Assignment; and
- Feedback Model

Now you are ready to specify each and every input and output file as well as parameter to be used in your model run before clicking the "**OK**" button to conclude the setup of this scenario. Detailed information about how to check and specify model input and output files and parameters is provided in Section 2.5.2.

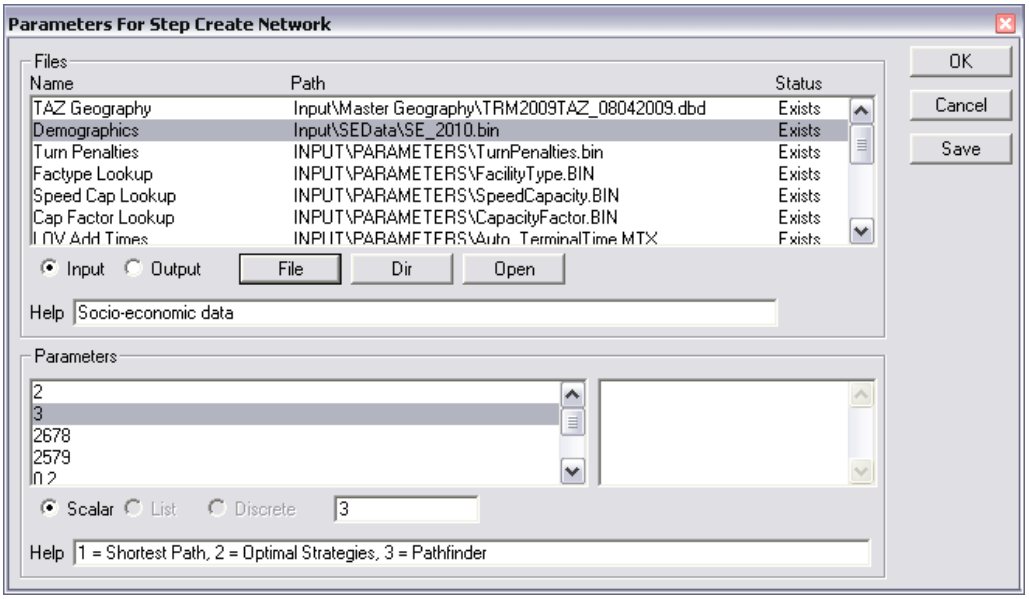
If you add more scenarios, make sure each scenario has its own directory, and the directory and required subdirectories must already exist. Scenarios can be added, deleted, and sorted. All scenarios will be listed in the list box with the date and time of creation. A box is provided for a detailed description of the scenario.

2.5.2 Specify Model Input and Output Files and Parameters

After specifying the name and directory of a new scenario on the Project Scenarios dialog box, the very first thing you need to do is to verify the name, path, and existence of the model input files. If there is any input file missing, the model run will not be successful.

As a note, all the input files, output files, and model parameters get their name, path, and/or values initialized by the model GUI automatically using the values stored in the **TRM_v5_mod.bin** file. But all of them are changeable on this dialog box.

To verify the input files, you can simply double click on each item in the Steps scroll-down box or click an item and then click the "**Contents**" button below. A "Parameters For Step XXXXXX" dialog box will pop up, where XXXXXX represents the step name such as "Create Network". This dialog box contains two blocks of information as described below:



- **Files:** In the Files frame, the names, paths, and status of the input and output files associated with that step are displayed. You can select to view either the input or the output files by selecting the appropriate radio button (i.e., Input or Output). When clicking on each file in the box, a brief description about that file is also displayed in the Help box below.

  As a note, when a new scenario is initially created, the names and paths of all input and output files are defaulted to those preset in the **TRM_v5_mod.bin** file. If an input file you actually use is different from the default one, click the "File" button to choose the right file. If you want an output file to have a different name than the default or be placed in a different folder, also click the "File" button and type the name and/or path you want.

  The "Dir" button allows for changes to file directories with file names unchanged. You can change the directory for one file or multiple files at the same time. To select more than one file, you need to press and hold down the Shift key on your keyboard and then left click the mouse.

  The "Open" button allows the user to open and view the content of the selected file.

  It is recommended that each scenario should have its own directory and subdirectories with all input and output files stored or saved in them. Cross-scenario referencing of files could easily cause confusions and problems and is not recommended.

  Eventually all input files should have a status of Exists. This is a must for a successful model run.

- **Parameters:** In the Parameters frame, you will see the parameters used in the selected step and their data type (scalar, list, or discrete) and a brief description for each parameter.

  If you want to use a different value than the default one for a parameter, you can simply change it in that frame.

Make sure all the parameters are meaningful. If you are not sure, use the default values and you should be fine.

- As a note, any changes you make to the input or output files or the parameters are scenario specific and only apply to the current scenario.

As stated above, all information about default model file names, directory names and parameters are stored in the **TRM_v5_mod.bin** file. This file is used somewhat like a blueprint each time a new scenario is being created. This file can be viewed and edited in TransCAD as with any other binary files. However, making modifications to this file is NOT recommended unless you are very familiar with the model. For an end user of the model, there is no need to change this file at all.

Eventually, all the input, output, and parameter information the user specifies for a scenario using the model GUI will be stored in another file called **TRM_v5_mod.arr** automatically by the model GUI. Later this file is used by the model to load the full scenario information when the GUI is started or the scenario list on the GUI is updated. Any changes to the content of this file should be made through the model GUI. **TRM_v5_mod.arr** is automatically saved to the directory as specified in the [Scenario File] section in file trm_v5.ini.

In case the **TRM_v5_mod.bin** file is modified after a few scenarios have been set up in the model GUI, the modifications will not affect these existing scenarios. Instead they only affect the scenarios to be created on the model GUI. If it is a structural change, such as adding or removing an input or output file or a parameter, it is recommended to re-setup all the existing scenarios if there is any chance that the existing scenarios could be run again later. Or, the model re-run could fail. Again, making changes to **TRM_v5_mod.bin** is NOT recommended by the end user.

If **TRM_v5_mod.arr** is accidentally deleted or renamed, the model GUI will not be able to find it and therefore cannot load any scenario previously created.

If a scenario needs to be archived, it is recommended the entire set of directories with the TRM50_Mod.bin and TRM50_Mod.arr files be archived together. This can help the user identify what settings were used for the archived scenario when reviewed later.

2.5.3 Edit an Existing Model Scenario

After you have setup a scenario, you may want to modify it at a later time, say, use a new terminal travel time matrix file. What you need to do is simply select the scenario you want to modify from the Scenarios box on the model GUI, and then click the Setup button to pop up the Project Scenarios dialog box. Then follow the instructions as described in Section **2.5.2 Specify Model Input and Output Files and Parameters**.

Chapter 3 – Model Execution

This chapter describes a sequential step-by-step process for executing the TRM. .A description of each model step is provided along with some screenshots for illustration. Each step is presented from the following five perspectives: 1) key function(s), 2) input and output data, 3) step-by-step procedure, 4) GISDK macros involved, and 5) special notes (if any).

However, before starting any TRM runs, we first need to specify a few things correctly on the model GUI, which include the spinner titled "Feedback Iterations" and a few checkboxes, namely, 1) Stop after stage; 2) Run all steps; 3) Force one processor for transit skim; and 4) Delete temporary files after model run.

Feedback Iterations: If it is intended to run the model without feedback iterations (i.e. congested travel times output from traffic assignment won't be fed back to trip distribution), specify 0 in the spinner. Otherwise, specify a number greater than 0. More discussions on this Feedback functionality can be found in Section 3.10 Feedback Module.

Stop after stage: With the Feedback Iterations spinner set to 0 on the GUI, by checking this box, only one step of the model will be executed, which is the one you click on the GUI (e.g., Trip Generation). If the number of Feedback Iterations is set to any number greater than 0, all the steps of the model will be executed , no matter if this box is checked or not.

Run all steps: With the Feedback Iterations spinner set to 0 on the UI, by checking this box, model execution will start from the step you click and run through to the last step, transit assignment. If the number of Feedback Iterations is set to any number greater than 0, all the steps of the model will be executed, no matter if this box is checked or not.

Force one processor for transit skim: The official software platform for the TRM, TransCAD 5.0, has some memory management issues with creating kiss-and-ride transit skims of the TRM on quad-core/processor computers. This box needs to be checked on those computers to force the use of only one core/processor, which can eliminate the issue and lead to a successful model run.

Delete temporary files after model run: Many interim temporary files are created during TRM execution. Most of these files are the binary (.bin) version of the matrix (.mtx) files, which is the required file format either input to or output from the FORTRAN programs. They become redundant after a model run finishes. Considering these temporary files together occupy over 10 GB disk space, it is recommended to delete them after model run. To do so, check this box.

Another note is about the peak period definition for transit modeling. In the TRM, transit is modeled only for two time periods, the peak period and the off-peak period. Generally, the peak period includes both the morning peak and the evening peak, but in certain situations it does not. A rule to follow is: **When the word "AM" appears in the name of a transit trip related file or file field, it all means the entire peak period (i.e. morning peak plus evening peak).** However, **when it appears in the name of a transit skim (travel times) related file or file field, it just means the morning peak**, since the morning peak highway travel time is used to estimate the AM peak transit travel time and then

to create AM peak transit skims. Confusions caused by this naming scheme have been realized and will be addressed in the future versions of the TRM model.

3.1 Create Walk Access

3.1.1 Key Functions

KEY FUNCTIONS
This module creates **walk access links** between TAZ centroids and adjacent transit route stops so that transit users can access transit routes from the TAZ and egress transit routes and return to the TAZ. For the rules used to create these walk access links, please see the Model Methodology Documentation.

3.1.2 Input, Output, and Parameters

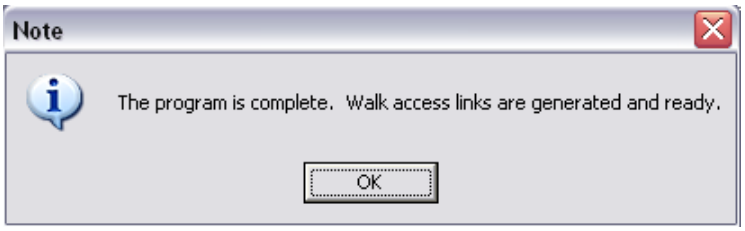
Table 3-1 Input and Output Files and Parameters: Create Walk Access

	File Descriptor	File Name and Location	Notes
Input	Universe Highway Geography	\Input\Master Geography\Highway.dbd	
	Universe Transit System	\Input\Master Geography\Transit.rts	
	SE Distribution Weights	\Input\Transit\SE Distribution Weights for Transit.dbf	This file contains weights with the assumption that in the ten area rings, the closer to the transit stop, the denser the population and/or employment
Output	Walk Access Links	\Interim\walk_access_links.dbd	An intermediate file
	Demographics	\Input\SEData\SE_2010.bin	This file contains zonal socio-economic data as well as zone-related other data. The long walk and short walk percentage fields in the file are updated in this step if existing ones are detected to be outdated. For details about the data fields, please see the Chapter 5.

3.1.3 Execution Procedure

1) On the TRM GUI, click the "**Create Walk Access**" button, and the program will start to run.

2) When the program finishes, a message box will pop up indicating "The program is complete. Walk access links are generated and ready". Click "OK". You are done!



Note: To save model execution time, if this module has been run once and no physical changes have been made to the highway and transit network since, there is no need to re-run this module when you need to rerun the whole model, say, for some what-if policy tests.

3.1.4 GISDK Macros Invoked

- Macro "buildWalkAccess" (Args)
- Macro "walkAccess1"
- Macro "walkAccess2"
- Macro "walkAccess3" (Args)
- Macro "buildWalkAccess" invokes the other three macros in sequence.

3.2 Prepare Geo Files

3.2.1 Key Functions

KEY FUNCTIONS
This module creates 4 files that are going to be used in later steps. They include the highway line geographic file, the peak (AM) and off-peak (OP) transit route system files, and the underlying line layer file on which the transit route systems are based. At the beginning of this step, toll charges of toll roads by vehicle type (SOV, HOV, and truck) and time of day (AM peak, PM peak, and off peak) are calculated and populated to the corresponding data fields in the highway network geographic file.

3.2.2 Input, Output, and Parameters

Table 3-2 Input and Output Files and Parameters: Prepare Geo Files

	File Descriptor	File Name and Location	Notes
Input	Master Line Geography	\Input\Master Geography\ Highway.dbd	
	Transit Route System	\Input\Master Geography\ Transit.rts	
Output	Line Geography	\Input\Highway\Highway_Line.dbd	This file is a subset of the Master Line geographic file, which only includes the links that have a value of 3 or 99 in the MODE field. For details about the data fields, please see the Chapter 5.
	Transit Background	\Input\Transit\Transit_Line.dbd	This file is an exact copy of the Master Line geographic file with all the walk access links created in the Create Walk Access step incorporated.
	AM Transit Route System	\Input\Transit\Transit_AM.rts	This peak period transit network file is a subset of the Transit Route System file in the Master Geography folder. It includes all the routes with a non-null value in the AMPK_HDWY field.
	OP Transit Route System	\Input\Transit\Transit_OP.rts	This off-peak period transit network file is a subset of the Transit Route System file too. It includes all the routes with a non-null value in the OP_HDWY field.

	Parameter Descriptor	Value	Notes
Parameters	AM SOV Toll Rate	0.12	Toll rate ($/mile) for SOVs in AM peak
	AM HOV Toll Rate	0.12	Toll rate ($/mile) for HOVs in AM peak
	AM CV Toll Rate	0.12	Toll rate ($/mile) for trucks in AM peak
	PM SOV Toll Rate	0.12	Toll rate ($/mile) for SOVs in PM peak
	PM HOV Toll Rate	0.12	Toll rate ($/mile) for HOVs in PM peak
	PM CV Toll Rate	0.12	Toll rate ($/mile) for trucks in PM peak
	OP SOV Toll Rate	0.12	Toll rate ($/mile) for SOVs in off peak
	OP HOV Toll Rate	0.12	Toll rate ($/mile) for HOVs in off peak
	OP CV Toll Rate	0.12	Toll rate ($/mile) for trucks in off peak

As can be seen from the output files, transit is modeled for two time periods in the TRM:

1) Peak period, which includes both AM-peak and PM-peak services; and

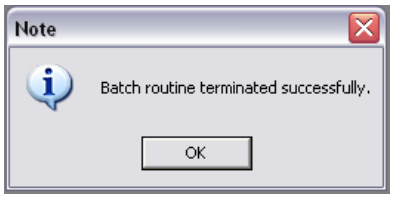
2) Off-peak period.

Transit network files for the peak period have "AM" in their names and descriptors to differentiate from those for the off-peak period, which have "OP" in their names.

3.2.3 Execution Procedure

1) On the TRM GUI, click the "**Prepare Geo Files**" button. The model will start to run.

2) When the program finishes running, a message box will pop up indicating "Batch routine terminated successfully". Click "**OK**".



3) Click "OK" and a batch routine report appears. Close it and you are done with this step.

3.2.4 GISDK Macros Invoked

- Macro "CreateHighwayTransitLayers" (Args)

3.3 Create Network

As indicated in the dialog box below, which pops up from the model GUI, this step calculates walk times on walk access/egress links, creates highway and transit network files, and generates highway and transit skims. As needed by the trip generation, distribution, and mode choice FORTRAN programs, this step also converts TransCAD matrix files into the binary file format for those programs to use later.

All networks and skims are created by time of day, i.e. morning peak and off peak periods. Highway networks and skims are also by vehicle occupancy, namely single-occupancy vehicles (SOV) and high-occupancy vehicles (HOV). Transit networks are also by transit mode (local bus, express bus, and rail)

and access mode (walk, park-and-ride, and kiss-and-ride). TransCAD's Pathfinder approach is used to create transit skims.

3.3.1 Key Functions

KEY FUNCTIONS
Calculates walk access times for walk access/egress links;
Creates highway networks and skim matrices by time of day and vehicle occupancy (SOV and HOV);
Creates commercial vehicle highway skim matrices by time of day;
Creates transit networks and skim matrices by transit mode, access mode, and time of day; and
Converts skim matrix files into the binary file format for FORTRAN programs to use later.

3.3.2 Input, Output, and Parameters

Table 3-3 Input and Output Files and Parameters: Create Network

	File Descriptor	File Name and Location	Notes
Input	TAZ Geography	\Input\Master Geography\ TRM2009TAZ_08042009.dbd	TAZ geographic file
	Demographics	\Input\SEData\SE_2010.bin	Zonal socio-economic data and other zonal descriptive data
	Line Geography	\Input\Highway\Highway_line.dbd	Highway line layer; Output from step "Prepare Geo Files" (3.2)
	Turn Penalties	\Input\Parameters\TurnPenalties.bin	Highway turn penalty file; penalties are in minutes
	Facility Type Lookup	\Input\Parameters\FacilityType.bin	Facility type lookup table
	Speed Cap Lookup	\Input\Parameters\SpeedCapacity.bin	Speed and capacity lookup table
	Cap Factor Lookup	\Input\Parameters\CapacityFactor.bin	Capacity factor lookup table
	LOV Add Times	\Input\Parameters\ Auto_TerminalTime.mtx	Passenger vehicle terminal times in minutes. Values in this file change with zonal area type, which is a function of zonal population/households and employment.
	CV Add Times	\Input\Parameters\ CV_TerminalTime.mtx	Commercial vehicle terminal times in minutes.
	VDF Lookup Table	\Input\Parameters\VDFConical.bin	Volume-delay function parameter lookup based on FCGroup
	Transit Background	\Input\Transit\Transit_Line.dbd	Transit background line layer to serve as the base for transit route systems; output from step "Prepare Geo Files" (3.2)
	AM Transit Route System	\Input\Transit\Transit_AM.rts	AM peak transit route system; output from step "Prepare Geo Files" (3.2)
	OP Transit Route System	\Input\Transit\Transit_OP.rts	Off-peak transit route system; output from step "Prepare Geo Files" (3.2)
	Bus Equations Lookup	\Input\Transit\ BusSpeed_Equations.bin	Bus speed equations lookup table

	Mode Table	\Input\Transit\Modes.dbf	Transit mode table
	Mode Transfer Table	\Input\Transit\Modexfer_2035.dbf	Transit mode transfer table
	AM Transfer Wait Times	\Input\Transit\ TimedTransferWaitTime_AM.bin	Fixed transit transfer wait time in minutes in peak period
	OP Transfer Wait Times	\Input\Transit\ TimedTransferWaitTime_OP.bin	Fixed transit transfer wait time in minutes in off-peak period
Output	Line Geography	\Input\Highway\Highway_line.dbd	Highway line layer; Output from step "Prepare Geo Files" (3.2) and updated in this step with more attribute fields added
	Network	\Output\Highway.net	Highway .net file
	Walk Time File	\Interim\WalkTime.bin	Calculated walk access link times for each TAZ, including short walk, long walk, and their average
	AM LOV Matrix	\Interim\AMLOV.mtx \Interim\AMLOV.BIN	Highway skims for AM-peak single occupancy vehicles with composite travel time and travel distance. The binary file is converted from the matrix file for use in trip generation, distribution, and/or mode choice FORTRAN programs
	AM HOV Matrix	\Interim\AMHOV.mtx \Interim\AMHOV.BIN	Highway skims for AM-peak high occupancy vehicles with composite travel time and travel distance. The binary file is converted from the matrix file for use in trip generation, distribution, and/or mode choice FORTRAN programs
	OP LOV Matrix	\Interim\OPLOV.mtx \Interim\OPLOV.BIN	Highway skims for off-peak single occupancy vehicles with composite travel time and travel distance. The binary file is converted from the matrix file for use in trip generation, distribution, and/or mode choice FORTRAN programs
	OP HOV Matrix	\Interim\OPHOV.mtx \Interim\OPHOV.BIN	Highway skims for off-peak high occupancy vehicles with composite travel time and travel distance. The binary file is converted from the matrix file for use in trip generation, distribution, and/or mode choice FORTRAN programs
	AM LOV2 Matrix	\Interim\AMLOV2.mtx	Highway skims for AM-peak single occupancy vehicles with travel time, distance, and tolls
	AM HOV2 Matrix	\Interim\AMHOV2.mtx	Highway skims for AM-peak high occupancy vehicles with travel time, distance, and tolls
	OP LOV2 Matrix	\Interim\OPLOV2.mtx	Highway skims for off-peak single occupancy vehicles with travel time, distance, and tolls
	OP HOV2 Matrix	\Interim\OPHOV2.mtx	Highway skims for off-peak high occupancy vehicles with travel time, distance, and tolls
	AM Drive Skim	\Interim\AMDRIVE.mtx	Transit skims: AM-Peak Drive-Access Express bus and Rail
	AM Walk Skim	\Interim\AMWALK.mtx	Transit skims: AM-Peak Walk-Access Express bus and Rail
	OP Walk Skim	\Interim\OPWALK.mtx	Transit skims: Off-Peak Walk-Access

		Express bus and Rail
AM CV Matrix	\Output\AMCV.mtx	Highway skims: AM-Peak Commercial Vehicle
OP CV Matrix	\Output\OPCV.mtx	Highway skims: Off-Peak Commercial Vehicle
AM KL Network	\Output\AMKLPATH.tnw	Transit network: AM-Peak Kiss-and-Ride Local bus
AM KP Network	\Output\AMKPPATH.tnw	Transit network: AM-Peak Kiss-and-Ride Express bus
AM KR Network	\Output\AMKRPATH.tnw	Transit network: AM-Peak Kiss-and-Ride Rail
AM DL Network	\Output\AMDLPATH.tnw	Transit network: AM-Peak Park-and-Ride Local bus
AM DP Network	\Output\AMDPPATH.tnw	Transit network: AM-Peak Park-and-Ride Express bus
AM DR Network	\Output\AMDRPATH.tnw	Transit network: AM-Peak Park-and-Ride Rail
AM WL Network	\Output\AMWLPATH.tnw	Transit network: AM-Peak Walk- Access Local bus
AM WP Network	\Output\AMWPPATH.tnw	Transit network: AM-Peak Walk- Access Express bus
AM WR Network	\Output\AMWRPATH.tnw	Transit network: AM-Peak Walk- Access Rail
OP KL Network	\Output\OPKLPATH.tnw	Transit network: Off-Peak Kiss-and-Ride Local bus
OP KP Network	\Output\OPKPPATH.tnw	Transit network: Off-Peak Kiss-and-Ride Express bus
OP KR Network	\Output\OPKRPATH.tnw	Transit network: Off-Peak Kiss-and-Ride Rail
OP DL Network	\Output\OPDLPATH.tnw	Transit network: Off-Peak Park-and-Ride Local bus
OP DP Network	\Output\OPDPPATH.tnw	Transit network: Off-Peak Park-and-Ride Express bus
OP DR Network	\Output\OPDRPATH.tnw	Transit network: Off-Peak Park-and-Ride Rail
OP WL Network	\Output\OPWLPATH.tnw	Transit network: Off-Peak Walk-Access Local bus
OP WP Network	\Output\OPWPPATH.tnw	Transit network: Off-Peak Walk-Access Express bus
OP WR Network	\Output\OPWRPATH.tnw	Transit network: Off-Peak Walk-Access Rail
AM KL Skims	\Output\AMKLSKIM1.mtx	Transit skims: AM-Peak Kiss-and-Ride-Local bus
AM KP Skims	\Output\AMKPSKIM1.mtx	Transit skims: AM-Peak Kiss-and-Ride-Express bus
AM KR Skims	\Output\AMKRSKIM1.mtx	Transit skims: AM-Peak Kiss-and-Ride-Rail
AM DL Skims	\Output\AMDLSKIM1.mtx	Transit skims: AM-Peak Drive-Local bus
AM DP Skims	\Output\AMDPSKIM1.mtx	Transit skims: AM-Peak Drive-Express bus
AM DR Skims	\Output\AMDRSKIM1.mtx	Transit skims: AM-Peak Drive-Rail
AM WL Skims	\Output\AMWLSKIM1.mtx	Transit skims: AM-Peak Walk-Local bus
AM WP Skims	\Output\AMWPSKIM1.mtx	Transit skims: AM-Peak Walk-Express bus

AM WR Skims	\Output\AMWRSKIM1.mtx	Transit skims: AM-Peak Walk-Rail
OP KL Skims	\Output\OPKLSKIM1.mtx	Transit skims: Off-Peak Kiss-and-Ride-Local bus
OP KP Skims	\Output\OPKPSKIM1.mtx	Transit skims: Off-Peak Kiss-and-Ride-Express bus
OP KR Skims	\Output\OPKRSKIM1.mtx	Transit skims: Off-Peak Kiss-and-Ride-Rail
OP DL Skims	\Output\OPDLSKIM1.mtx	Transit skims: Off-Peak Drive-Local bus
OP DP Skims	\Output\OPDPSKIM1.mtx	Transit skims: Off-Peak Drive-Express bus
OP DR Skims	\Output\OPDRSKIM1.mtx	Transit skims: Off-Peak Drive-Rail
OP WL Skims	\Output\OPWLSKIM1.mtx	Transit skims: Off-Peak Walk-Local bus
OP WP Skims	\Output\OPWPSKIM1.mtx	Transit skims: Off-Peak Walk-Express bus
OP WR Skims	\Output\OPWRSKIM1.mtx	Transit skims: Off-Peak Walk-Rail
AM Local Skims	\interim\AML.mtx \interim\AML.BIN	AM-Peak Local Bus Skims: All Access Modes
AM Exp Skims	\interim\AMP.mtx \interim\AMP.BIN	AM-Peak Express Bus Skims: All Access Modes
AM Rail Skims	\interim\AMR.mtx \interim\AMR.BIN	AM-Peak Rail Skims: All Access Modes
OP Local Skims	\interim\OPL.mtx \interim\OPL.BIN	Off-Peak Local Bus Skims: All Access Modes
OP Exp Skims	\interim\OPP.mtx \interim\OPP.BIN	Off-Peak Express Bus Skims: All Access Modes
OP Rail Skims	\interim\OPR.mtx \interim\OPR.BIN	Off-Peak Rail Skims: All Access Modes
AM DL Origin-Parking Drive Times	\Output\origin_parking_AMDL.mtx	Origin TAZ to parking lot drive time matrix: AM-peak park-and-ride local bus
AM DL Parking Nodes	\Output\parking_AMDL.mtx	TAZ-to-TAZ parking lot (node) number matrix: AM-peak park-and-ride local bus
AM DP Origin-Parking Drive Times	\Output\origin_parking_AMDP.mtx	Origin TAZ to parking lot drive time matrix: AM-peak park-and-ride express bus
AM DP Parking Nodes	\Output\parking_AMDP.mtx	TAZ-to-TAZ parking lot (node) number matrix: AM-peak park-and-ride express bus
AM DR Origin-Parking Drive Times	\Output\origin_parking_AMDR.mtx	Origin TAZ to parking lot drive time matrix: AM-peak park-and-ride rail
AM DR Parking Nodes	\Output\parking_AMDR.mtx	TAZ-to-TAZ parking lot (node) number matrix: AM-peak park-and-ride rail
AM KL Origin-Parking Drive Times	\Output\origin_parking_AMKL.mtx	Origin TAZ to parking lot drive time matrix: AM-peak kiss-and-ride local bus
AM KL Parking Nodes	\Output\parking_AMKL.mtx	TAZ-to-TAZ parking lot (node) number matrix: AM-peak kiss-and-ride local bus
AM KP Origin-Parking Drive Times	\Output\origin_parking_AMKP.mtx	Origin TAZ to parking lot drive time matrix: AM-peak kiss-and-ride express bus
AM KP Parking Nodes	\Output\parking_AMKP.mtx	TAZ-to-TAZ parking lot (node) number matrix: AM-peak kiss-and-ride express bus
AM KR Origin-Parking	\Output\origin_parking_AMKR.mtx	Origin TAZ to parking lot drive time

	Drive Times		matrix: AM-peak kiss-and-ride rail
	AM KR Parking Nodes	\Output\parking_AMKR.mtx	TAZ-to-TAZ parking lot (node) number matrix: AM-peak kiss-and-ride rail
	OP DL Origin-Parking Drive Times	\Output\origin_parking_OPDL.mtx	Origin TAZ to parking lot drive time matrix: Off-peak park-and-ride local bus
	OP DL Parking Nodes	\Output\parking_OPDL.mtx	TAZ-to-TAZ parking lot (node) number matrix: Off -peak park-and-ride local bus
	OP DP Origin-Parking Drive Times	\Output\origin_parking_OPDP.mtx	Origin TAZ to parking lot drive time matrix: Off -peak park-and-ride express bus
	OP DP Parking Nodes	\Output\parking_OPDP.mtx	TAZ-to-TAZ parking lot (node) number matrix: Off -peak park-and-ride express bus
	OP DR Origin-Parking Drive Times	\Output\origin_parking_OPDR.mtx	Origin TAZ to parking lot drive time matrix: Off -peak park-and-ride rail
	OP DR Parking Nodes	\Output\parking_OPDR.mtx	TAZ-to-TAZ parking lot (node) number matrix: Off-peak park-and-ride rail
	OP KL Origin-Parking Drive Times	\Output\origin_parking_OPKL.mtx	Origin TAZ to parking lot drive time matrix: Off-peak kiss-and-ride local bus
	OP KL Parking Nodes	\Output\parking_OPKL.mtx	TAZ-to-TAZ parking lot (node) number matrix: Off-peak kiss-and-ride local bus
	OP KP Origin-Parking Drive Times	\Output\origin_parking_OPKP.mtx	Origin TAZ to parking lot drive time matrix: Off-peak kiss-and-ride express bus
	OP KP Parking Nodes	\Output\parking_OPKP.mtx	TAZ-to-TAZ parking lot (node) number matrix: Off-peak kiss-and-ride express bus
	OP KR Origin-Parking Drive Times	\Output\origin_parking_OPKR.mtx	Origin TAZ to parking lot drive time matrix: Off-peak kiss-and-ride rail
	OP KR Parking Nodes	\Output\parking_OPKR.mtx	TAZ-to-TAZ parking lot (node) number matrix: Off-peak kiss-and-ride rail
	Interim file for use by FORTRAN programs	\Interim\amwp.bin	Binary file format of amwalk.mtx in the same folder, which is transit skims for AM-peak walk-access express bus and rail; for use as input to trip generation & distribution FORTRAN programs
	Interim file for use by FORTRAN programs	\Interim\amdr.bin	Binary file format of amdrive.mtx in the same folder, which is transit skims for AM-peak drive-access express bus and rail; for use as input to trip generation FORTRAN program

	Parameter Descriptor	Value	Notes
Parameters	Intrazonal Neighbors	2	Used for calculating intrazonal travel time and distance
	Transit Skim Method	3	pathfinder method
	Number of Zones	2678	Total number of TAZs, including external stations
	Last Internal Zone	2579	Largest ID of the internal TAZs
	SOV Value of Time	0.2	$/minute
	HOV Value of Time	0.3	$/minute
	TRK Value of Time	0.3	$/minute

3.3.3 Execution Procedure

1) On the TRM GUI, click the "**Create Network**" button and the model starts to run.
2) When it completes, a message box appears showing 'Batch routine terminated successfully."
3) Click "OK" and a batch routine report appears. Close it and you are done with this step.

3.3.4 GISDK Macros Invoked

- Macro "Walk Access Time" (Args)
- Macro "Highway Network" (Args)
- Macro "AM Highway Skims"(Args)
- Macro "OP Highway Skims"(Args)
- Macro "Transit Network" (Args)
- Macro "Transit Skims" (Args)
- Macro "AM Transit Skims" (Args)
- Macro "Skim Processing" (Args)
- Macro "AM Skim Processing" (Args)
- Macro "Mtx to Bin" (Args)
- Macro "AM Mtx to Bin" (Args)

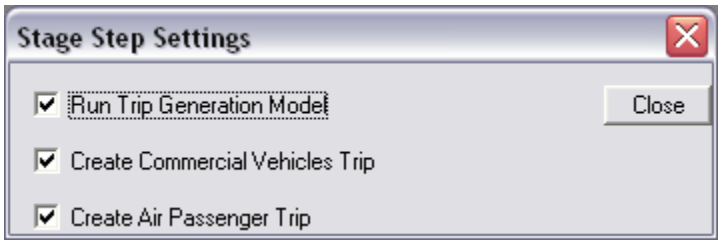
3.4 Trip Generation

In this step, zonal daily passenger trips, including both motorized and non-motorized, are estimated for six trip purposes and five types of households stratified by their socioeconomic characteristics. The trip purposes include home-based work (HBW), home-based shopping (HBShop), home-based K-12 school (HBSchool), home-based other (HBO), work-based non-home (WBNH), and non-home non-work (NHNW), and the household strata include zero car, low income with car(s), medium income with cars less than workers, medium income with cars greater than or equal to workers, and high income with car(s). Home-based university (HBU) student trips are also estimated, and they are all assumed to be low-income and placed in the first and second household strata, i.e. zero-car and low-income-with-car(s), depending on whether the student trip maker has car(s) or not.

In addition, this module also estimates the number of daily zonal commercial vehicle trips for three vehicle types: auto, pickup, and truck. Airport passenger trips are classified into the home-based, work-based, private-residence-based (excluding home-based), and non-home non-work based categories for estimation and then merged into three general trip purposes: HBO, WBNH, and NHNW.

Multinomial logit models are developed and implemented in a FORTRAN program to estimate HBW, HBShop, HBSchool, HBO, and NHNW person trips, with motorized and non-motorized trips mixed together. HBU trips, commercial vehicle trips, and air passenger trips are calculated using the traditional cross-classification trip rate method implemented in GISDK. Due to the need of using

HBW trip generation results as input, WBNH trip estimation is a little special and utilizes a multinomial logit model routine implemented in GISDK.



3.4.1 Key Functions

KEY FUNCTIONS
Stratifies zonal households by household income, household size, auto ownership, workers, and children based on 2000 Census data. Estimates zonal person I-I trip productions by trip purpose and household socioeconomic strata using multinomial logit models and I-E/E-I trip productions and attractions using cross-classification models. Estimates zonal HBU student trips using cross-classification trip rate models. Estimates the probability that a trip attraction to a TAZ would be in each of the five socioeconomic strata using the multinomial logit model. Estimates zonal air passenger trips using cross-classification trip rate models. The number of total regional enplaned passengers is a plain input supplied by the user, which produces total air trip productions based on a few multipliers and factors. Estimates zonal commercial vehicle I-I trips by vehicle type and I-E/E-I CV trips without stratification by vehicle type using cross-classification trip rate models.

3.4.2 Input, Output, and Parameters

Table 3-4 Input and Output Files and Parameters: Trip Generation

	File Descriptor	File Name and Location	Notes
Input	Demographics	\Input\SEData\SE_2010.bin	Zonal socio-economic data and other zonal descriptive data
	Comm Vehicles	\Input\CommVeh\ CV_Vehicle_Base2005.dbf	Zonal number of commercial vehicles in base year 2005 by industrial type
	Other Trip Rates	\Input\CommVeh\ CV_Trip_Rate.dbf	I-I commercial vehicle and I-E/E-I all vehicle trip rates by industrial type
	HBU Trip Rates	\Input\Parameters\HBU Trip Rates.DBF	Home based university student trip rates, including both motorized and non-motorized.
	Air Passenger Rate	\Input\Parameters\	Air passenger trip rates by county and trip

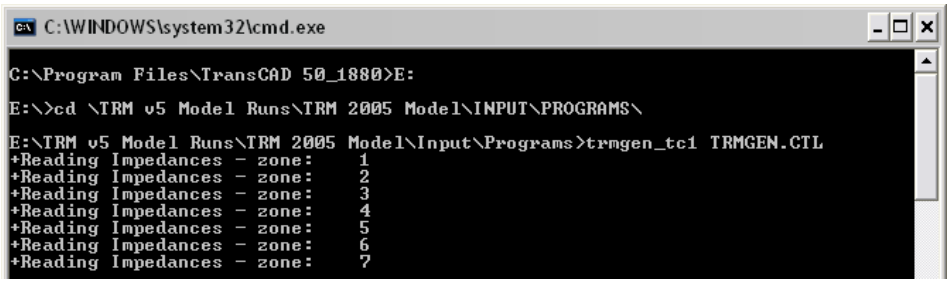
		AirPassenger_Rate.DBF	purpose. Rates by purpose are further refined by household income category and/or employment.
	Interim file for use by FORTRAN program	\Interim\amwp.bin	AM peak walk-access express bus & rail skims in binary file format; Output from step "Create Network" (3.3)
	Interim file for use by FORTRAN program	\Interim\amdr.bin	AM peak drive-access express bus & rail skims in binary file format; Output from step "Create Network" (3.3)
	Interim file for use by FORTRAN program	\Interim\amlov.bin	AM peak SOV highway skims in binary file format; Output from step "Create Network" (3.3)
	Input file used by FORTRAN Program	\Input\Programs\sch_adj.prn	This text file contains adjacent zones and the percent school bus trips for each zone.
	Interim file for use by FORTRAN program	\Interim\dem_tg.bin	This is an interim zonal socio-economic data file prepared specially for working with the trip generation FORTRAN program. The file is created by the model automatically at the very beginning of the Trip Gen step and then fed into the FORTRAN program.
	Interim file for use by FORTRAN program	\Interim\dem_com.bin	This is an interim zonal socio-economic data file prepared specially for working with the commercial vehicle module. The file is created by the model automatically at the very beginning of the Commercial Vehicles substep.
Program Files	Trip Generation FORTRAN Program	\Input\Programs\ TRMGen_tc1.exe	Trip generation FORTRAN program
	Trip Gen FORTRAN Control File	\Input\Programs\TRMGEN.ctl	Trip generation control file with all input and output files and parameters needed by the FORTRAN program. **The path of this file should NOT be changed.**
Output	Output files from FORTRAN Program	\Interim\TGHH.txt	Zonal household stratification by income, size, workers, children, and automobiles
		\Interim\HHStrata.txt	Zonal households in **five SE strata**: 1) zero car, 2) low income with car(s), 3) medium income with cars less than workers, 4) medium income with cars greater than or equal to workers, and 5) high income with car(s)
		\Interim\hhbyinc.txt	Zonal households in income categories 1, 2, 3, and 4
		\Interim\hhby_suff_inc.txt	Zonal households by 4 income categories and 2 car ownership groups (more-or-equal-car and less-car)
		\Interim\WrkEnd.txt	Zonal daily I-I person trip productions and attractions in 5 SE strata for HBW purpose
		\Interim\ShpEnd.txt	Zonal daily I-I person trip productions and attractions in 5 SE strata for HBShop purpose
		\Interim\SchEnd.txt	Zonal daily I-I person trip productions and attractions in 5 SE strata for HBSch [K12] purpose
		\Interim\OthEnd.txt	Zonal daily I-I person trip productions and attractions in 5 SE strata for HBO purpose
		\Interim\WbnhEnd.txt	Zonal daily I-I person trip productions and attractions in 5 SE strata for WBNH purpose
		\Interim\NhnwEnd.txt	Zonal daily I-I person trip productions and

			attractions in 5 SE strata for NHNW purpose
		\Interim\NonMot.txt	Zonal daily I-I person non-motorized trip productions in 5 SE strata by trip purpose; No use any more in TRM v5
		\Interim\racc_str.dat	Accessibility measure for non-motorized model
		\Interim\accstr.txt	Accessibility measure for attraction share model
		\Output\TG.rep	Trip Generation Fortran Program Report
	HBU Trip Gen	\Interim\UnvEnd.txt	Zonal daily I-I person trip productions for HBU purpose. All HBU trips are assumed to be low-income and stratified into either HH stratum 1 or stratum 2 (i.e. zero-car or low-income-with-car households)
	Other Trip Gen	\Output\OthTG1.bin	CV I-I, I-E, & E-I and motorized person I-E & E-I trip productions and attractions
	Air Passenger Trip	\Interim\AirP.bin	An output file with air passenger trip estimation related zonal input and output data. Input data include households by income category and employment, and output data include home-based (HB), work-based (WB), private-residence (PR) based, and non-home non-work (NHNW) based air passenger trips before balanced to daily enplanement. They are converted into HBO, WBNH, and NHNW trips after balanced.

	Parameter Descriptor	Value	Notes
Parameters	IX Factor	0.3	Not used any more in TRM v5
	Flag for future scenario	0	Not used any more in TRM v5
	Daily Enplaned Passenger	12,900	Number of daily enplaned passengers at RDU for the passenger airport model for year 2005. This number should be updated for specific scenarios or at least by year.
	Airport Zone ID	1080	ID of the TAZ where the RDU airport is located

3.4.3 Execution Procedure

1) On the TRM UI click the "**Trip Generation**" button.
2) After the model executes for a few second in TransCAD, the trip generation FORTRAN routine will be called and a DOS window will appear and indicate the program is running.



3) After the FORTRAN routine finishes, the DOS window will close, but the execution continues with commercial vehicle, university student trip, and air passenger models with several progress bars appearing in the TransCAD window one after another.
4) If nothing goes wrong, when the execution completes, a message box appears showing 'Batch routine terminated successfully."
5) Click "OK" and a Batch Routine Report pops up. Close it. And you are done with this step.

3.4.4 GISDK Macros Invoked

- Macro "Trip Generation" (Args)
- Macro "Commercial Veh" (Args)
- Macro "University Trip Estimation" (Args, step)
- Macro "Air Passenger" (Args)
- Macro "Trip Generation" further invokes the trip generation FORTRAN program, trmgen_tc1.exe.

3.5 Trip Distribution

In this step passenger I-I trips are distributed using destination choice models, while I-I and I-E/E-I commercial vehicle trips as well as passenger I-E/E-I trips use traditional gravity models. One exception is the HBU trips, which are distributed using fixed allocation percentages derived from local university student travel surveys and registration records. Another exception is the air passenger trips, which always start from or end at the TAZ where the airport is located. Therefore, no distribution estimation is needed for air passenger tips.

Time-of-day factors are applied by trip purpose to split daily trips into two time periods, peak and off-peak, where the peak period is the combination of the AM peak from 6:00 AM to 10:00 AM and the PM peak from 3:30 PM to 7:30 PM, and the off-peak period covers the rest of the day.

Travel times are used as the primary travel impedance in the destination choice models. Travel distances are added to the destination choice model after model estimation as an adjustment factor for model calibration and application. Only travel times are used in the gravity models. Without feedback iterations, free-flow travel time skims are used in both types of models; with feedback, congested travel times output from the traffic assignment step of last round are used instead, which lead to more consistent results.

At this stage, motorized and non-motorized trips are still mixed together.

3.5.1 Key Functions

KEY FUNCTIONS
Computes zone-to-zone logsum values using mode choice model specifications based on the congested travel times from the traffic assignment step of last iteration. Distributes zonal daily passenger I-I trips using destination choice models implemented in the Fortran program. The distribution is conducted for six trip purpose, HBW, HBShop, HBSchool, HBO, WBNH, and NHNW, and for two time periods, peak (AM and PM peaks combined) and off-peak. Distributes zonal daily HBU trips in two steps, campus allocation based on fixed allocation percentages and then TAZ disaggregation based on zonal employment shares. Distributes commercial vehicle I-I and I-E/E-I trips and passenger I-E/E-I trips using gravity models implemented in TransCAD GISDK.

3.5.2 Input, Output, and Parameters

Table 3-5 Input and Output Files and Parameters: Trip Distribution

	File Name and Location	Notes
Program Files	\Input\Programs\trmmclogsum_tc4.exe	Mode choice logsum calculation FORTRAN Program
	\Input\Programs\trmdis_tc3.exe	Destination choice FORTRAN Program
	\Input\Programs\DCHBW_PK.ctl	Destination choice FORTRAN program control file for HBW-Peak
	\Input\Programs\DCShp_PK.ctl	Destination choice FORTRAN program control file for HBShop-Peak
	\Input\Programs\DCSch_PK.ctl	Destination choice FORTRAN program control file for HBSch-Peak
	\Input\Programs\DCHBO_PK.ctl	Destination choice FORTRAN program control file for HBO-Peak
	\Input\Programs\DCWBNH_PK.ctl	Destination choice FORTRAN program control file for WBNH-Peak
	\Input\Programs\DCNHNW_PK.ctl	Destination choice FORTRAN program control file for NHNW-Peak
	\Input\Programs\DCHBW_OP.ctl	Destination choice FORTRAN program control file for HBW-Off-Peak
	\Input\Programs\DCShp_OP.ctl	Destination choice FORTRAN program control file for HBShop-Off-Peak
	\Input\Programs\DCSch_OP.ctl	Destination choice FORTRAN program control file for HBSch-Off-Peak
	\Input\Programs\DCHBO_OP.ctl	Destination choice FORTRAN program control file for HBO-Off-Peak
	\Input\Programs\DCWBNH_OP.ctl	Destination choice FORTRAN program control file for WBNH-Off-Peak
	\Input\Programs\DCNHNW_OP.ctl	Destination choice FORTRAN program control file for NHNW-Off-Peak
Input	\Interim\WrkEnd.txt	Zonal daily I-I person trip productions and attractions in 5 SE strata for HBW purpose; Output from Trip Generation (3.4)
	\Interim\ShpEnd.txt	Zonal daily I-I person trip productions and attractions in 5 SE strata for HBShop purpose; Output from Trip Generation (3.4)

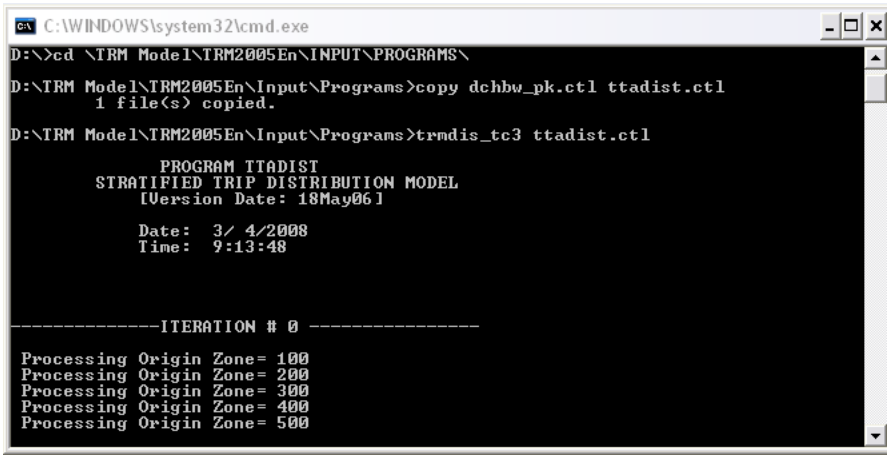
	\Interim\SchEnd.txt	Zonal daily I-I person trip productions and attractions in 5 SE strata for HBSchool purpose; Output from Trip Generation (3.4)
	\Interim\OthEnd.txt	Zonal daily I-I person trip productions and attractions in 5 SE strata for HBO purpose; Output from Trip Generation (3.4)
	\Interim\WbnhEnd.txt	Zonal daily I-I person trip productions and attractions in 5 SE strata for WBNH purpose; Output from Trip Generation (3.4)
	\Interim\NhnwEnd.txt	Zonal daily I-I person trip productions and attractions in 5 SE strata for NHNW purpose; Output from Trip Generation (3.4)
	\Interim\UnvEnd.txt	Zonal daily I-I person trip productions for HBU purpose; Output from Trip Generation (3.4)
	\Interim\DEM_TDHBW.BIN	This is an interim zonal socio-economic data file prepared specially for working with the destination choice FORTRAN program for both HBW & HBSch purposes. The file is created by the model automatically at the very beginning of this step before fed into the FORTRAN program.
	\Interim\DEM_TDSHP.BIN	The same as above, except for the HBShop purpose.
	\Interim\DEM_TDOTH.BIN	The same as above, except for the HBO purpose.
	\Interim\DEM_TDWBNH.BIN	The same as above, except for the WBNH purpose.
	\Interim\DEM_TDNHNW.BIN	The same as above, except for the NHNW purpose.
	\Interim\AMLOV.BIN	AM peak SOV highway skims in binary file format; Output from step "Create Network" (3.3)
	\Interim\AMWP.BIN	AM peak walk-access express-bus & rail skims in binary file format; Output from step "Create Network" (3.3)
	\Interim\OPLOV.BIN	Off-peak SOV highway skims in binary file format; Output from step "Create Network" (3.3)
	\Interim\OPWP.BIN	Off-peak walk-access express-bus & rail skims in binary file format; Output from step "Create Network" (3.3)
	\Input\Parameters\ Gravity_FrictionFactor.dbf	Calibrated trip distribution gravity model friction factors table
	\Input\Parameters\HBU Trip Campus Allocation Percentages.DBF	Percentages for allocating home based university student trips from each production TAZ to the three universities in the region (Duke, NCSU, and UNC)
	\Input\Parameters\HBU Trip TAZ Allocation Index.DBF	An index file that indicates which TAZ belongs to which university for final allocation of HBU trips from the three universities (Duke, NCSU, and UNC) to TAZs
Output	\Interim\WrkPK_Per.bin	I-I person trip PA matrix by 5 household strata for HBW-Peak (in binary file format)
	\Interim\ShpPK_Per.bin	I-I person trip PA matrix by 5 household strata for HBShop-Peak (in binary file format)
	\Interim\SchPK_Per.bin	I-I person trip PA matrix by 5 household strata for HBSch-Peak (in binary file format)
	\Interim\OthPK_Per.bin	I-I person trip PA matrix by 5 household strata for HBO-Peak (in binary file format)
	\Interim\WbnhPK_Per.bin	I-I person trip PA matrix by 5 household strata for WBNH-Peak (in binary file format)
	\Interim\NhnwPK_Per.bin	I-I person trip PA matrix by 5 household strata for NHNW-Peak (in binary file format)
	\Interim\WrkOP_Per.bin	I-I person trip PA matrix by 5 household strata for HBW-Off-Peak (in binary file format)
	\Interim\ShpOP_Per.bin	I-I person trip PA matrix by 5 household strata for HBShop-Off-Peak (in binary file format)
	\Interim\SchOP_Per.bin	I-I person trip PA matrix by 5 household strata for HBSch-Off-Peak (in binary file format)
	\Interim\OthOP_Per.bin	I-I person trip PA matrix by 5 household strata for HBO-Off-Peak

	(in binary file format)
\Interim\WbnhOP_Per.bin	I-I person trip PA matrix by 5 household strata for WBNH-Off-Peak (in binary file format)
\Interim\NhnwOP_Per.bin	I-I person trip PA matrix by 5 household strata for NHNW-Off-Peak (in binary file format)
\Interim\WRKPK_IMP.BIN	Highway-transit composite time matrix by 5 household strata for HBW-Peak (in binary file format)
\Interim\WRKOP_IMP.BIN	Highway-transit composite time matrix by 5 household strata for HBW-Off-Peak (in binary file format)
\Interim\SHPPK_IMP.BIN	Highway-transit composite time matrix by 5 household strata for HBShop-Peak (in binary file format)
\Interim\SHPOP_IMP.BIN	Highway-transit composite time matrix by 5 household strata for HBShop-Off-Peak (in binary file format)
\Interim\SCHPK_IMP.BIN	Highway-transit composite time matrix by 5 household strata for HBSch-Peak (in binary file format)
\Interim\SCHOP_IMP.BIN	Highway-transit composite time matrix by 5 household strata for HBSch-Off-Peak (in binary file format)
\Interim\OTHPK_IMP.BIN	Highway-transit composite time matrix by 5 household strata for HBO-Peak (in binary file format)
\Interim\OTHOP_IMP.BIN	Highway-transit composite time matrix by 5 household strata for HBO-Off-Peak (in binary file format)
\Interim\WBNHPK_IMP.BIN	Highway-transit composite time matrix by 5 household strata for WBNH-Peak (in binary file format)
\Interim\WBNHOP_IMP.BIN	Highway-transit composite time matrix by 5 household strata for WBNH-Off-Peak (in binary file format)
\Interim\NHNWPK_IMP.BIN	Highway-transit composite time matrix by 5 household strata for NHNW-Peak (in binary file format)
\Interim\NHNWOP_IMP.BIN	Highway-transit composite time matrix by 5 household strata for NHNW-Off-Peak (in binary file format)
\Input\Univ\HBU_Per.mtx	Daily I-I person trip PA matrix for HBU purpose
\Interim\UnvEnd.txt	Zonal daily I-I person trip productions and attractions for HBU purpose; this file is only updated at this step with attractions added.
\Output\PACV1.mtx	Vehicle trip PA matrix for I-I and I-E/E-I all commercial vehicle trips as well as I-E/E-I passenger auto trips
\Output\LS_WrkPK.rpt	Logsum calculation Fortran program report for HBW-Peak
\Output\LS_ShpPK.rpt	Logsum calculation Fortran program report for HBShop-Peak
\Output\LS_SchPK.rpt	Logsum calculation Fortran program report for HBSch-Peak
\Output\LS_OthPK.rpt	Logsum calculation Fortran program report for HBO-Peak
\Output\LS_WBNHPK.rpt	Logsum calculation Fortran program report for WBNH-Peak
\Output\LS_NHNWPK.rpt	Logsum calculation Fortran program report for NHNW-Peak
\Output\LS_WrkOP.rpt	Logsum calculation Fortran program report for HBW-Off-Peak
\Output\LS_ShpOP.rpt	Logsum calculation Fortran program report for HBShop-Off-Peak
\Output\LS_SchOP.rpt	Logsum calculation Fortran program report for HBSch-Off-Peak
\Output\LS_OthOP.rpt	Logsum calculation Fortran program report for HBO-Off-Peak
\Output\LS_WBNHOP.rpt	Logsum calculation Fortran program report for WBNH-Off-Peak
\Output\LS_NHNWOP.rpt	Logsum calculation Fortran program report for NHNW-Off-Peak
\Output\DCWrkPK.rpt	Destination choice Fortran program report for HBW-Peak
\Output\DCShpPK.rpt	Destination choice Fortran program report for HBShop-Peak
\Output\DCSchPK.rpt	Destination choice Fortran program report for HBSch-Peak

	\Output\DCOthPK.rpt	Destination choice Fortran program report for HBO-Peak
	\Output\DCWBNHPK.rpt	Destination choice Fortran program report for WBNH-Peak
	\Output\DCNHNWPK.rpt	Destination choice Fortran program report for NHNW-Peak
	\Output\DCWrkOP.rpt	Destination choice Fortran program report for HBW-Off-Peak
	\Output\DCShpOP.rpt	Destination choice Fortran program report for HBShop-Off-Peak
	\Output\DCSchOP.rpt	Destination choice Fortran program report for HBSch-Off-Peak
	\Output\DCOthOP.rpt	Destination choice Fortran program report for HBO-Off-Peak
	\Output\DCWBNHOP.rpt	Destination choice Fortran program report for WBNH-Off-Peak
	\Output\DCNHNWOP.rpt	Destination choice Fortran program report for NHNW-Off-Peak

3.5.3 Execution Procedure

1) On the TRM GUI, click the "**Trip Distribution**" button, and the program starts to run.
2) After the program runs in the TransCAD window for a few seconds, a DOS window pops up indicating the mode choice model logsum calculation is started and in process
3) After logsum calculation finishes, another DOS window pops up indicating the destination choice model is started and in process.



4) If nothing goes wrong, when the execution completes, a message box appears showing 'Batch routine terminated successfully."
5) Click on "OK" to show the Batch Routine Report.
6) Close the report and you are done with trip distribution.

3.5.4 GISDK Macros Invoked

- Macro "Trip Distribution" (Args)
- Macro "PK Trip Distribution" (Args)
- Macro "Logsum Calculation" (Args, tod)
- Macro "University Trip Estimation" (Args, step)

- Both macros, "Trip Distribution" and "PK Trip Distribution", further invoke the mode choice logsum calculation FORTRAN program, trmmclogsum_tc4.exe, and the destination choice FORTRAN program, trmdis_tc3.exe.

3.6 Non-motorized Trip Split

Binary-logit based non-motorized trip split model estimates the probability the trips of each TAZ pair will take motorized modes or non-motorized modes and calculates the number of trips for either category based on the estimated probability. Estimations are made for seven trip purposes (HBW, HBShop, HBSchool, HBO, WBNH, NHNW, and HBU), two time periods of day, and five household strata; HBU trips are treated a little special and all classified into HH strata 1.

3.6.1 Key Functions

KEY FUNCTIONS
Estimates zone-to-zone I-I trip split probability and the number of trips for motorized and non-motorized mode categories by trip purpose, time of day, and HH strata. Converts motorized trip matrices to binary file format for use in the mode choice model. Adds corresponding air passenger trips to HBO, WBNH, and NHNW trip matrices (in binary file format) for peak and off-peak periods

3.6.2 Input, Output, and Parameters

Table 3-6 Input, Output, and Parameters: Non-motorized Trip Split

	File Name and Location	Notes
Input	\Input\Master Geography\ TRM2009TAZ_08042009.dbd	TAZ geographic file
	\Input\SEData\SE_2010.bin	Zonal socio-economic data and other zonal descriptive data
	\Input\Highway\Highway_line.dbd	Highway line layer; Output from step "Prepare Geo Files" (3.2)
	\Interim\AMLOV2.mtx	AM peak SOV highway skim matrix; Output from step "Create Network" (3.3)

\Interim\OPLOV2.mtx	Off-peak SOV highway skim matrix; Output from step "Create Network" (3.3)
\Interim\AML.bin	AM peak all-access-mode local bus skims in binary file format; Output from step "Create Network" (3.3)
\Interim\AMP.bin	AM peak all-access-mode express bus skims in binary file format; Output from step "Create Network" (3.3)
\Interim\OPL.bin	Off-peak all-access-mode local bus skims in binary file format; Output from step "Create Network" (3.3)
\Interim\OPP.bin	Off-peak all-access-mode express bus skims in binary file format; Output from step "Create Network" (3.3)
\Interim\hhbyinc.txt	Zonal households in income categories 1, 2, 3, and 4
\Interim\hhby_suff_inc.txt	Zonal households by 4 income categories and 2 car ownership groups (more-or-equal-car and less-car)
\Input\Programs\Non-Motorized Trip Split Models.dbf	Non-motorized trip split model specifications by trip purpose and time of day
\Input\Programs\Non-Motorized Trip Split Model Constant Factors.dbf	Adjustment factors (multipliers) for non-motorized trip split model constants by trip purpose, time of day, and hh strata
\Input\Parameters\Transit Share in Motorized Modes.dbf	Transit trip shares in motorized modes by trip purpose, time of day, and HH strata
\Input\Parameters\Walk Share in Non-Motorized Modes.dbf	Walk trip shares in non-motorized modes by trip purpose
\Input\Univ\HBU_Per.mtx	Daily I-I person trip PA matrix for HBU; Output from step "Trip Distribution" (3.5)
\Interim\WrkPK_Per.bin	I-I person trip PA matrix by 5 household strata for HBW-Peak (in binary file format); Output from step "Trip Distribution" (3.5)
\Interim\ShpPK_Per.bin	I-I person trip PA matrix by 5 household strata for HBShop-Peak (in binary file format); Output from step "Trip Distribution" (3.5)
\Interim\SchPK_Per.bin	I-I person trip PA matrix by 5 household strata for HBSch-Peak (in binary file format); Output from step "Trip Distribution" (3.5)
\Interim\OthPK_Per.bin	I-I person trip PA matrix by 5 household strata for HBO-Peak (in binary file format); Output from step "Trip Distribution" (3.5)
\Interim\WBNHPK_Per.bin	I-I person trip PA matrix by 5 household strata for WBNH-Peak (in binary file format); Output from step "Trip Distribution" (3.5)
\Interim\NHNWPK_Per.bin	I-I person trip PA matrix by 5 household strata for NHNW-Peak (in binary file format); Output from step "Trip Distribution" (3.5)
\Interim\WrkOP_Per.bin	I-I person trip PA matrix by 5 household strata for HBW-Off-Peak (in binary file format); Output from step "Trip Distribution" (3.5)
\Interim\ShpOP_Per.bin	I-I person trip PA matrix by 5 household strata for HBShop-Off-Peak (in binary file format); Output from step "Trip Distribution" (3.5)
\Interim\SchOP_Per.bin	I-I person trip PA matrix by 5 household strata for HBSch-Off-Peak (in binary file format) ; Output from step "Trip Distribution" (3.5)
\Interim\OthOP_Per.bin	I-I person trip PA matrix by 5 household strata for HBO-Off-Peak (in binary file format); Output from step "Trip Distribution" (3.5)
\Interim\WBNHOP_Per.bin	I-I person trip PA matrix by 5 household strata for WBNH-Off-Peak (in binary file format); Output from step "Trip Distribution" (3.5)
\Interim\NHNWOP_Per.bin	I-I person trip PA matrix by 5 household strata for NHNW-Off-Peak (in binary file format); Output from step "Trip Distribution" (3.5)
\Input\Univ\DUKE_HBU_Factors.mtx	Adjustment factors for Duke HBU trips
\Interim\AirP.bin	An output file with air passenger trip estimation related zonal input and output data. Input data include households by income category and employment, and output data include home-based (HB) and

		work-based (WB), and non-home non-work (NHNW) based air passenger trip attractions before and after being balanced to productions.
Output	\Interim\NMT Shortest Distance.mtx	Zone-to-zone shortest distance for non-motorized modes
	\Interim\Composite Time w Cost.mtx	Auto and transit composite time matrix with monetary cost incorporated via the use of value of time
	\Interim\Composite Time wo Cost.mtx	Auto and transit composite time matrix without monetary cost incorporated
	\Interim\Pre-Utility SE Data.mtx	An intermediate file containing SE data prepared in a format that is ready for utility calculation
	\Interim\WrkPK_Per.mtx	I-I person trip PA matrix by 5 household strata for HBW-Peak, converted from corresponding input binary file
	\Interim\ShpPK_Per.mtx	I-I person trip PA matrix by 5 household strata for HBShop-Peak, converted from corresponding input binary file
	\Interim\SchPK_Per.mtx	I-I person trip PA matrix by 5 household strata for HBSch-Peak, converted from corresponding input binary file
	\Interim\OthPK_Per.mtx	I-I person trip PA matrix by 5 household strata for HBO-Peak, converted from corresponding input binary file
	\Interim\WBNHPK_Per.mtx	I-I person trip PA matrix by 5 household strata for WBNH-Peak, converted from corresponding input binary file
	\Interim\NHNWPK_Per.mtx	I-I person trip PA matrix by 5 household strata for NHNW-Peak, converted from corresponding input binary file
	\Interim\WrkOP_Per.mtx	I-I person trip PA matrix by 5 household strata for HBW-Off-Peak, converted from corresponding input binary file
	\Interim\ShpOP_Per.mtx	I-I person trip PA matrix by 5 household strata for HBShop-Off-Peak, converted from corresponding input binary file
	\Interim\SchOP_Per.mtx	I-I person trip PA matrix by 5 household strata for HBSch-Off-Peak, converted from corresponding input binary file
	\Interim\OthOP_Per.mtx	I-I person trip PA matrix by 5 household strata for HBO-Off-Peak, converted from corresponding input binary file
	\Interim\WBNHOP_Per.mtx	I-I person trip PA matrix by 5 household strata for WBNH-Off-Peak, converted from corresponding input binary file
	\Interim\NHNWOP_Per.mtx	I-I person trip PA matrix by 5 household strata for NHNW-Off-Peak, converted from corresponding input binary file
	\Interim\WrkPK_Per_M.mtx \Interim\WrkPK_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBW-Peak; binary file is converted from the .mtx file for use in mode choice model
	\Interim\ShpPK_Per_M.mtx \Interim\ShpPK_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBShop-Peak; binary file is converted from the .mtx file for use in mode choice model
	\Interim\SchPK_Per_M.mtx \Interim\SchPK_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBSch-Peak; binary file is converted from the .mtx file for use in mode choice model
	\Interim\OthPK_Per_M.mtx \Interim\OthPK_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBO-Peak. The binary file is converted from the .mtx file for use in mode choice model; it is also updated in this step with air passenger trips added.
	\Interim\WBNHPK_Per_M.mtx \Interim\WBNHPK_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for WBNH-Peak. The binary file is converted from the .mtx file for use in mode choice model; it is also updated in this step with air passenger trips added.
	\Interim\NHNWPK_Per_M.mtx \Interim\NHNWPK_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for NHNW-Peak. The binary file is converted from the .mtx file for use in mode choice model; it is also updated in this step with air passenger trips added.

	\Interim\WrkOP_Per_M.mtx \Interim\WrkOP_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBW-Off-Peak; binary file is converted from the .mtx file for use in mode choice model
	\Interim\ShpOP_Per_M.mtx \Interim\ShpOP_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBShop-Off-Peak; binary file is converted from the .mtx file for use in mode choice model
	\Interim\SchOP_Per_M.mtx \Interim\SchOP_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBSch-Off-Peak; binary file is converted from the .mtx file for use in mode choice model
	\Interim\OthOP_Per_M.mtx \Interim\OthOP_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBO-Off-Peak. The binary file is converted from the .mtx file for use in mode choice model; it is also updated in this step with air passenger trips added.
	\Interim\WBNHOP_Per_M.mtx \Interim\WBNHOP_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for WBNH-Off-Peak. The binary file is converted from the .mtx file for use in mode choice model; it is also updated in this step with air passenger trips added.
	\Interim\NHNWOP_Per_M.mtx \Interim\NHNWOP_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for NHNW-Off-Peak. The binary file is converted from the .mtx file for use in mode choice model; it is also updated in this step with air passenger trips added.
	\Interim\WrkPK_Per_NM.mtx	Non-motorized I-I person trip PA matrix by 5 household strata for HBW-Peak
	\Interim\ShpPK_Per_NM.mtx	Non-motorized I-I person trip PA matrix by 5 household strata for HBShop-Peak
	\Interim\SchPK_Per_NM.mtx	Non-motorized I-I person trip PA matrix by 5 household strata for HBSch-Peak
	\Interim\OthPK_Per_NM.mtx	Non-motorized I-I person trip PA matrix by 5 household strata for HBO-Peak
	\Interim\WBNHPK_Per_NM.mtx	Non-motorized I-I person trip PA matrix by 5 household strata for WBNH-Peak
	\Interim\NHNWPK_Per_NM.mtx	Non-motorized I-I person trip PA matrix by 5 household strata for NHNW-Peak
	\Interim\WrkOP_Per_NM.mtx	Non-motorized I-I person trip PA matrix by 5 household strata for HBW-Off-Peak
	\Interim\ShpOP_Per_NM.mtx	Non-motorized I-I person trip PA matrix by 5 household strata for HBShop-Off-Peak
	\Interim\SchOP_Per_NM.mtx	Non-motorized I-I person trip PA matrix by 5 household strata for HBSch-Off-Peak
	\Interim\OthOP_Per_NM.mtx	Non-motorized I-I person trip PA matrix by 5 household strata for HBO-Off-Peak
	\Interim\WBNHOP_Per_NM.mtx	Non-motorized I-I person trip PA matrix by 5 household strata for WBNH-Off-Peak
	\Interim\NHNWOP_Per_NM.mtx	Non-motorized I-I person trip PA matrix by 5 household strata for NHNW-Off-Peak
	\Interim\HBU_Per.mtx	Motorized and non-motorized daily I-I person trip matrices for HBU
	\Interim\HBU_Per_NM.mtx	Non-motorized daily I-I person trip matrices for HBU
	\Interim\UnvPK_Per_M.mtx \Interim\UnvPK_Per_M.bin	Motorized I-I person trip matrices for HBU peak; binary file is converted from the .mtx file for use in mode choice model
	\Interim\UnvOP_Per_M.mtx \Interim\UnvOP_Per_M.bin	Motorized I-I person trip matrices for HBU off-peak; binary file is converted from the .mtx file for use in mode choice model

3.6.3 Execution Procedure

1) On the TRM User Interface, click the "**Nonmotorized Trip Split**" button to start the model run.
2) If nothing goes wrong, when it completes, a message box appears showing 'Batch routine terminated successfully". Click "OK".
3) Close the Batch Routine Report window. Now you are done with the non-motorized trip split step.

3.6.4 GISDK Macros Invoked

- Macro "NonMotorized Split" (Args, tod)
- Macro "Split Motor Trip Mtx to Bin" (Args, tod)
- Macro "Add Air Passenger" (Args, tod)
- Macro "UnivTrip" (Args)

3.7 Modal Split

Modal split, also known as mode choice, is to estimate among a few available travel modes which mode a traveler takes in his/her trip. Using discrete choice models, the probability of taking each of the available modes is estimated.

The TRM mode choice model is composed of twelve nested logit models, one for each of the six trip purposes as aforementioned. For each purpose there are two time periods, peak and off-peak periods.

The mode choice models use the nested logit form. The models apply this structure with a market segmentation strategy that portrays the various travel markets more accurately. Each model is nested into three levels based on travel modes, as shown in Figure 3-1. Each model also has five sub-models, one for each of the five socioeconomic strata as aforementioned.

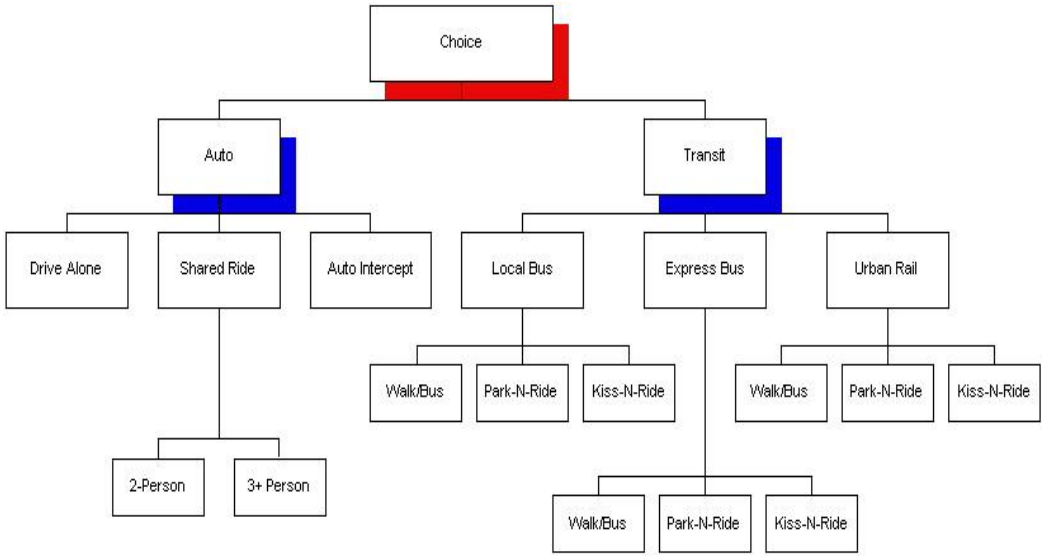


Figure 3-1 TRM Mode Choice Model Structure

3.7.1 Key Functions

KEY FUNCTIONS
Estimates zone-to-zone I-I trip mode choice for seven trip purposes (HBW, HBShop, HBK12, HBO, WBNH, NHNW and HBU) and two time periods (PK and OP). Optionally outputs files by trip purpose and time of day for further FTA user benefit analysis. Overall 13 lowest-level traffic modes are modeled as choices as shown in Figure 3-1, while not all of them are available to all of the travelers. Applies peak time parking space capacity constraint to auto vehicles to selected TAZs (within each of the predefined Parking Analysis Sub-Area via shadow price approach.

3.7.2 Input, Output, and Parameters

Table 3-7 Input, Output, and Parameters: Mode Choice

	File Name and Location	Notes
Program Files	\Input\Programs\TRMMC_tc4.exe	Mode Choice Fortran Program
	\Input\Programs\MCHBW_PK.ctl	Mode choice Fortran program control file for HBW-Peak
	\Input\Programs\MCShp_PK.ctl	Mode choice Fortran program control file for HBShop-Peak
	\Input\Programs\MCSch_PK.ctl	Mode choice Fortran program control file for HBSch-Peak
	\Input\Programs\MCOth_PK.ctl	Mode choice Fortran program control file for HBO-Peak

	\Input\Programs\MCWBNH_PK.ctl	Mode choice Fortran program control file for WBNH-Peak
	\Input\Programs\MCNHNW_PK.ctl	Mode choice Fortran program control file for NHNW-Peak
	\Input\Programs\MCUnv_PK.ctl	Mode choice Fortran program control file for HBU-Peak
	\Input\Programs\MCHBW_OP.ctl	Mode choice Fortran program control file for HBW-Off-Peak
	\Input\Programs\MCShp_OP.ctl	Mode choice Fortran program control file for HBShop-Off-Peak
	\Input\Programs\MCSch_OP.ctl	Mode choice Fortran program control file for HBSch-Off-Peak
	\Input\Programs\MCOth_OP.ctl	Mode choice Fortran program control file for HBO-Off-Peak
	\Input\Programs\MCWBNH_OP.ctl	Mode choice Fortran program control file for WBNH-Off-Peak
	\Input\Programs\MCNHNW_OP.ctl	Mode choice Fortran program control file for NHNW-Off-Peak
	\Input\Programs\MCUnv_OP.ctl	Mode choice Fortran program control file for HBU-Off-Peak
Input	\Interim\WrkPK_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBW-Peak (in binary file format); Output from step "Nonmotorized Trip Split" (3.6)
	\Interim\ShpPK_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBShop-Peak (in binary file format); Output from step "Nonmotorized Trip Split" (3.6)
	\Interim\SchPK_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBSch-Peak (in binary file format); Output from step "Nonmotorized Trip Split" (3.6)
	\Interim\OthPK_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBO-Peak (in binary file format); Output from step "Nonmotorized Trip Split" (3.6)
	\Interim\WBNHPK_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for WBNH-Peak (in binary file format); Output from step "Nonmotorized Trip Split" (3.6)
	\Interim\NHNWPK_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for NHNW-Peak (in binary file format); Output from step "Nonmotorized Trip Split" (3.6)
	\Interim\UnvPK_Per_M.bin	Motorized I-I person trip PA matrix for HBU-Peak; Output from step "Nonmotorized Trip Split" (3.6)
	\Interim\WrkOP_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBW-Off-Peak (in binary file format); Output from step "Nonmotorized Trip Split" (3.6)
	\Interim\ShpOP_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBShop-Off-Peak (in binary file format); Output from step "Nonmotorized Trip Split" (3.6)
	\Interim\SchOP_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBSch-Off-Peak (in binary file format) ; Output from step "Nonmotorized Trip Split" (3.6)
	\Interim\OthOP_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for HBO-Off-Peak (in binary file format); Output from step "Nonmotorized Trip Split" (3.6)
	\Interim\WBNHOP_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for WBNH-Off-Peak (in binary file format); Output from step "Nonmotorized Trip Split" (3.6)
	\Interim\NHNWOP_Per_M.bin	Motorized I-I person trip PA matrix by 5 household strata for NHNW-Off-Peak (in binary file format); Output from step "Nonmotorized Trip Split" (3.6)

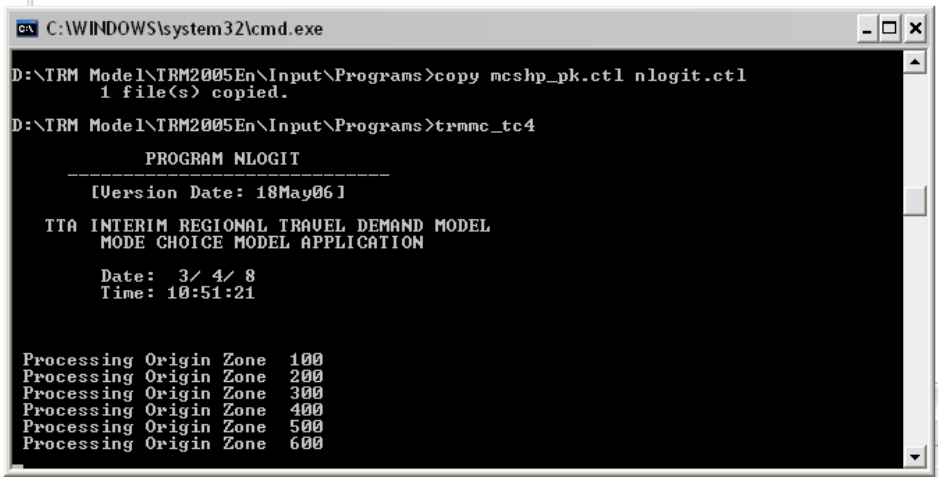
	\Interim\UnvPK_Per_M.bin	Motorized I-I person trip PA matrix for HBU-Peak; Output from step "Nonmotorized Trip Split" (3.6)
	\Interim\AMLOV.bin	AM peak SOV highway skims in binary file format; Output from step "Create Network" (3.3)
	\Interim\AMHOV.bin	AM peak HOV highway skims in binary file format; Output from step "Create Network" (3.3)
	\Interim\OPLOV.bin	Off-peak SOV highway skims in binary file format; Output from step "Create Network" (3.3)
	\Interim\OPHOV.bin	Off-peak HOV highway skims in binary file format; Output from step "Create Network" (3.3)
	\Interim\AML.bin	AM peak all-access-mode local bus skims in binary file format; Output from step "Create Network" (3.3)
	\Interim\AMP.bin	AM peak all-access-mode express bus skims in binary file format; Output from step "Create Network" (3.3)
	\Interim\AMR.bin	AM peak all-access-mode rail skims in binary file format; Output from step "Create Network" (3.3)
	\Interim\OPL.bin	Off-peak all-access-mode local bus skims in binary file format; Output from step "Create Network" (3.3)
	\Interim\OPP.bin	Off-peak all-access-mode express bus skims in binary file format; Output from step "Create Network" (3.3)
	\Interim\OPR.bin	Off-peak all-access-mode rail skims in binary file format; Output from step "Create Network" (3.3)
	\Interim\MCWalk.bin	Zonal short-walk access time and percentage of coverage and long-walk access time and percentage of coverage
	\Interim\ParkCost.bin	Zonal parking cost; created from the SE data file
	\Input\Program\ParkCap.bin	Peak time parking capacity by Parking Analysis Sub-Area and trip purpose
Output	\Input\Program\ShadPrice.bin	Zonal shadow price by trip purpose
	\Interim\PASApurpose_PK.bin	Peak period auto vehicle trip productions and attractions summarized by Parking Analysis Sub-Area
	\Interim\PASApurpose_OP.bin	Off-peak period auto vehicle trip productions and attractions summarized by Parking Analysis Sub-Area
	\Interim\HBW_PK.bin	I-I person trip PA matrix by each traffic mode for HBW-Peak (in binary file format)
	\Interim\SHP_PK.bin	I-I person trip PA matrix by each traffic mode for HBShop-Peak (in binary file format)
	\Interim\SCH_PK.bin	I-I person trip PA matrix by each traffic mode for HBSch-Peak (in binary file format)
	\Interim\OTH_PK.bin	I-I person trip PA matrix by each traffic mode for HBO-Peak (in binary file format)
	\Interim\WBNH_PK.bin	I-I person trip PA matrix by each traffic mode for WBNH-Peak (in binary file format)
	\Interim\NHNW_PK.bin	I-I person trip PA matrix by each traffic mode for NHNW-Peak (in binary file format)
	\Interim\UNV_PK.bin	I-I person trip PA matrix by each traffic mode for HBU-Peak (in binary file format)
	\Interim\HBW_OP.bin	I-I person trip PA matrix by each traffic mode for HBW-Off-peak (in binary file format)
	\Interim\SHP_OP.bin	I-I person trip PA matrix by each traffic mode for HBShop-Off-peak (in binary file format)
	\Interim\SCH_OP.bin	I-I person trip PA matrix by each traffic mode for HBSch-Off-peak (in binary file format)
	\Interim\OTH_OP.bin	I-I person trip PA matrix by each traffic mode for HBO-Off-peak (in binary file format)

\Interim\WBNH_OP.bin	I-I person trip PA matrix by each traffic mode for WBNH-Off-Peak (in binary file format)
\Interim\NHNW_OP.bin	I-I person trip PA matrix by each traffic mode for NHNW-Off-peak (in binary file format)
\Interim\UNV_OP.bin	I-I person trip PA matrix by each traffic mode for HBU-Off-peak (in binary file format)
\Interim\HBW_PK.DRV	I-I auto intercept person trip PA matrix for HBW-Peak (in text file format): drive access part
\Interim\HBW_OP.DRV	I-I auto intercept person trip PA matrix for HBW-Off-peak (in text file format): drive access part
\Interim\UNV_PK.DRV	I-I auto intercept person trip PA matrix for HBU-Peak (in text file format): drive access part
\Interim\UNV_OP.DRV	I-I auto intercept person trip PA matrix for HBU-Off-peak (in text file format): drive access part
\Interim\HBW_PK_TRN.ASC	I-I auto intercept person trip PA matrix for HBW-Peak (in text file format): transit part
\Interim\HBW_OP_TRN.ASC	I-I auto intercept person trip PA matrix for HBW-Off-peak (in text file format): transit part
\Interim\UNV_PK_TRN.ASC	I-I auto intercept person trip PA matrix for HBU-Peak (in text file format): transit part
\Interim\UNV_OP_TRN.ASC	I-I auto intercept person trip PA matrix for HBU-Off-peak (in text file format): transit part
\Interim\UBHBW_PK.bin	Zone-to-zone travel information, such as logsums, in-vehicle travel times, trips by mode, and shares by mode, for HBW peak period user benefit analysis
\Interim\UBSHP_PK.bin	Same as above, except for HBShop peak period user benefit analysis
\Interim\UBSCH_PK.bin	Same as above, except for HBSchool peak period user benefit analysis
\Interim\UBOTH_PK.bin	Same as above, except for HBO peak period user benefit analysis
\Interim\UBWBNH_PK.bin	Same as above, except for WBNH peak period user benefit analysis
\Interim\UBNHNW_PK.bin	Same as above, except for NHNW peak period user benefit analysis
\Interim\UBUNV_PK.bin	Same as above, except for HBU peak period user benefit analysis
\Interim\UBHBW_OP.bin	Same as above, except for HBW off-peak period user benefit analysis
\Interim\UBSHP_OP.bin	Same as above, except for HBShop off-peak period user benefit analysis
\Interim\UBSCH_OP.bin	Same as above, except for HBSchool off-peak period user benefit analysis
\Interim\UBOTH_OP.bin	Same as above, except for HBO off-peak period user benefit analysis
\Interim\UBWBNH_OP.bin	Same as above, except for WBNH off-peak period user benefit analysis
\Interim\UBNHNW_OP.bin	Same as above, except for NHNW off-peak period user benefit analysis
\Interim\UBUNV_OP.bin	Same as above, except for HBU off-peak period user benefit analysis
\Output\MC_HBW_PK.rpt	Mode choice Fortran program report: HBW-Peak
\Output\MC_Shp_PK.rpt	Mode choice Fortran program report: HBShop-Peak
\Output\MC_Sch_PK.rpt	Mode choice Fortran program report: HBSch-Peak
\Output\MC_Oth_PK.rpt	Mode choice Fortran program report: HBO-Peak

	\Output\MC_WBNH_PK.rpt	Mode choice Fortran program report: WBNH-Peak
	\Output\MC_NHNW_PK.rpt	Mode choice Fortran program report: NHNW-Peak
	\Output\MC_UNV_PK.rpt	Mode choice Fortran program report: HBU-Peak
	\Output\MC_HBW_OP.rpt	Mode choice Fortran program report: HBW-Off-Peak
	\Output\MC_Shp_OP.rpt	Mode choice Fortran program report: HBShop-Off-Peak
	\Output\MC_Sch_OP.rpt	Mode choice Fortran program report: HBSch-Off-Peak
	\Output\MC_Oth_OP.rpt	Mode choice Fortran program report: HBO-Off-Peak
	\Output\MC_WBNH_OP.rpt	Mode choice Fortran program report: WBNH-Off-Peak
	\Output\MC_NHNW_OP.rpt	Mode choice Fortran program report: NHNW-Off-Peak
	\Output\MC_UNV_OP.rpt	Mode choice Fortran program report: HBU-Off-Peak

3.7.3 Execution Procedure

1) On the TRM User Interface, click the "**Mode Split**" button.
2) The model first runs in TransCAD window for a couple of seconds.
3) Then a DOS window appears showing the start and process of the mode choice model.



4) If nothing goes wrong, when it completes, a message box appears showing 'Batch routine terminated successfully". Click "OK".
5) Now the Batch Routine Report is opened up. Close it. Now you are done with the mode choice step.

3.7.4 GISDK Macros Invoked

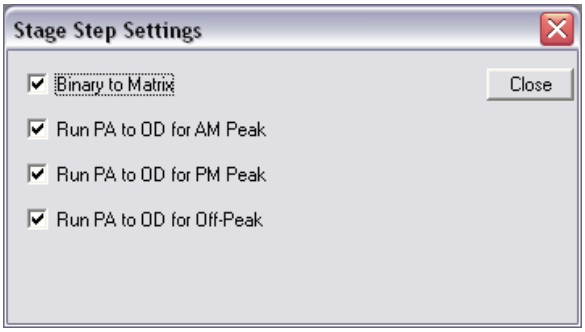
- Macro "Mode Split" (Args)

- Macro "PK Mode Split" (Args)
- Both "Mode Split" and "PK Mode Split" macros further invoke the mode choice FORTRAN program, trmmc_tc4.exe.

3.8 PA to OD

In all the steps described previously, trips and trip exchanges are estimated in the Production-Attraction format. To assign the trips onto the highway network, they have to be in the origin-destination (OD) format. This step converts those PA-formatted highway trip tables into OD-formatted trip tables, which will be used in highway assignment later. Since the transit assignment procedure uses PA-formatted transit trip tables, no conversion is conducted for those tables.

There is also another conversion task that has to be accomplished before the PA-to-OD conversion can even take place: Converting the binary file format of trip exchanges to the TransCAD matrix file format. As we can see, all trip exchanges are manipulated in the binary file format in the Trip Distribution and Mode Choice steps by the FORTRAN programs.



3.8.1 Key Functions

KEY FUNCTIONS
1. For motorized person trips (both highway and transit): Adds E-I transit trip table to mode choice output I-I transit trip tables by trip purpose and time of day. Splits and converts peak-period person trip PA matrices into AM-peak and PM-peak SOV and HOV vehicle trip OD matrices by applying directional time-of-day factors and vehicle occupancy rates. This conversion applies to all the six trip purposes modeled. Converts off-peak-period person trip PA matrices into SOV and HOV vehicle trip OD matrices by applying directional time-of-day factors and vehicle occupancy rates too. This conversion applies to all the six trip purposes too.

Adds the drive part of the auto-intercept trips to the highway OD trip matrices and the transit part to the transit trip matrices.

Slices and converts daily passenger E-E and I-E/E-I vehicle trip matrices into three time-of-day SOV and HOV matrices (AM peak, PM peak, and Off-peak) by applying directional time-of-day factors and SOV and HOV percentages.

Collapses the seven trip purposes into one while maintaining the SOV and HOV grouping and the times of day, and then merges the collapsed SOV and HOV matrices with the E-E, I-E, and E-I SOV and HOV matrices to create complete passenger SOV and HOV OD matrices for the AM-peak, PM-peak, and off-peak periods.

For transit trips, no PA to OD conversion is needed since trip matrices in the PA format are loaded onto the transit routes directly. The only conversion conducted is converting the trip matrices from the binary file format as output from the mode choice FORTRAN program to the TransCAD matrix format.

2. For commercial vehicle trips:

Splits and converts daily commercial vehicle (CV) trip PA matrices into AM-peak, PM-peak, and off-peak OD matrices by applying directional time-of-day factors.

Creates CV SOV and HOV OD matrices by re-grouping the auto and pickup CV trips based on some assumptions for the vehicle occupancy rates.

3. Putting passenger trip matrices and CV trip matrices together:

Separates out the auto and pickup SOV and HOV matrices from the CV OD trip matrix file and merges them into the passenger SOV and HOV OD matrices correspondingly. Then combine the truck trip matrix with the merged passenger SOV and HOV OD matrices to get the final OD matrices for highway traffic assignment. This final OD matrix file includes three matrices in it: SOV, HOV, and Truck (still named as CV in the file).

3.8.2 Input, Output, and Parameters

Table 3-8 Input, Output, and Parameters: PA to OD

	File Name and Location	Notes
Input	\Input\ExtP\EETrips_2010.mtx	Through (E-E) vehicle traffic OD matrix
	\Input\Transit\ Transit_External_PK.mtx	Peak period External-Internal transit PA matrix
	\Input\Transit\ Transit_External_OP.mtx	Off-peak period External-Internal transit PA matrix
	\Interim\HBW_PK.bin	I-I person trip PA matrix by each traffic mode for HBW-Peak (in binary file format); Output from step "Mode Split" (3.7)
	\Interim\SHP_PK.bin	I-I person trip PA matrix by each traffic mode for HBShop-Peak (in binary file format); Output from step "Mode Split" (3.7)
	\Interim\SCH_PK.bin	I-I person trip PA matrix by each traffic mode for HBSch-Peak (in binary file format); Output from step "Mode Split" (3.7)

\Interim\OTH_PK.bin	I-I person trip PA matrix by each traffic mode for HBO-Peak (in binary file format); Output from step "Mode Split" (3.7)
\Interim\WBNH_PK.bin	I-I person trip PA matrix by each traffic mode for WBNH-Peak (in binary file format); Output from step "Mode Split" (3.7)
\Interim\NHNW_PK.bin	I-I person trip PA matrix by each traffic mode for NHNW-Peak (in binary file format); Output from step "Mode Split" (3.7)
\Interim\UNV_PK.bin	I-I person trip PA matrix by each traffic mode for HBU-Peak (in binary file format); Output from step "Mode Split" (3.7)
\Interim\HBW_OP.bin	I-I person trip PA matrix by each traffic mode for HBW-Off-peak (in binary file format); Output from step "Mode Split" (3.7)
\Interim\SHP_OP.bin	I-I person trip PA matrix by each traffic mode for HBShop-Off-peak (in binary file format); Output from step "Mode Split" (3.7)
\Interim\SCH_OP.bin	I-I person trip PA matrix by each traffic mode for HBSch-Off-peak (in binary file format); Output from step "Mode Split" (3.7)
\Interim\OTH_OP.bin	I-I person trip PA matrix by each traffic mode for HBO-Off-peak (in binary file format); Output from step "Mode Split" (3.7)
\Interim\WBNH_OP.bin	I-I person trip PA matrix by each traffic mode for WBNH-Off-peak (in binary file format); Output from step "Mode Split" (3.7)
\Interim\NHNW_OP.bin	I-I person trip PA matrix by each traffic mode for NHNW-Off-peak (in binary file format); Output from step "Mode Split" (3.7)
\Interim\UNV_OP.bin	I-I person trip PA matrix by each traffic mode for HBU-Off-peak (in binary file format); Output from step "Mode Split" (3.7)
\Interim\HBW_PK.DRV	I-I auto intercept person trip PA matrix for HBW-Peak (in text file format): drive access part. Output from step "Mode Split" (3.7)
\Interim\HBW_OP.DRV	I-I auto intercept person trip PA matrix for HBW-Off-peak (in text file format): drive access part. Output from step "Mode Split" (3.7)
\Interim\UNV_PK.DRV	I-I auto intercept person trip PA matrix for HBU-Peak (in text file format): drive access part. Output from step "Mode Split" (3.7)
\Interim\UNV_OP.DRV	I-I auto intercept person trip PA matrix for HBU-Off-peak (in text file format): drive access part. Output from step "Mode Split" (3.7)
\Interim\HBW_PK_TRN.ASC	I-I auto intercept person trip PA matrix for HBW-Peak (in text file format): transit part. Output from step "Mode Split" (3.7)
\Interim\HBW_OP_TRN.ASC	I-I auto intercept person trip PA matrix for HBW-Off-peak (in text file format): transit part. Output from step "Mode Split" (3.7)
\Interim\UNV_PK_TRN.ASC	I-I auto intercept person trip PA matrix for HBU-Peak (in text file format): transit part. Output from step "Mode Split" (3.7)
\Interim\UNV_OP_TRN.ASC	I-I auto intercept person trip PA matrix for HBU-Off-peak (in text file format): transit part. Output from step "Mode Split" (3.7)
\Input\Parameters\HourlyFactor.bin	Directional time-of-day factors for AM peak, PM peak, and off peak
\Interim\WRKPK_PER.bin	All mode I-I person trip PA matrix by 5 hh strata for HBW-Peak (in binary file format)
\Interim\SHPPK_PER.bin	All mode I-I person trip PA matrix by 5 hh strata for HBShop-Peak (in binary file format)
\Interim\SCHPK_PER.bin	All mode I-I person trip PA matrix by 5 hh strata for HBSch-Peak (in binary file format)
\Interim\OTHPK_PER.bin	All mode I-I person trip PA matrix by 5 hh strata for HBO-Peak (in binary file format)
\Interim\WBNHPK_PER.bin	All mode I-I person trip PA matrix by 5 hh strata for WBNH-Peak (in binary file format)
\Interim\NHNWPK_PER.bin	All mode I-I person trip PA matrix by 5 hh strata for NHNW-Peak (in binary file format)
\Interim\WRKOP_PER.bin	All mode I-I person trip PA matrix by 5 hh strata for HBW-Off-Peak (in binary file format)
\Interim\SHPOP_PER.bin	All mode I-I person trip PA matrix by 5 hh strata for HBShop-Off-Peak (in binary file format)

	\Interim\SCHOP_PER.bin	All mode I-I person trip PA matrix by 5 hh strata for HBSch-Off-Peak (in binary file format)
	\Interim\OTHOP_PER.bin	All mode I-I person trip PA matrix by 5 hh strata for HBO-Off-Peak (in binary file format)
	\Interim\WBNHOP_PER.bin	All mode I-I person trip PA matrix by 5 hh strata for WBNH-Off-Peak (in binary file format)
	\Interim\NHNWOP_PER.bin	All mode I-I person trip PA matrix by 5 hh strata for NHNW-Off-Peak (in binary file format)
Output	\Interim\WRKPK_PER.mtx	All mode I-I person trip PA matrix by 5 hh strata for HBW-Peak
	\Interim\SHPPK_PER.mtx	All mode I-I person trip PA matrix by 5 hh strata for HBShop-Peak
	\Interim\SCHPK_PER.mtx	All mode I-I person trip PA matrix by 5 hh strata for HBSch-Peak
	\Interim\OTHPK_PER.mtx	All mode I-I person trip PA matrix by 5 hh strata for HBO-Peak
	\Interim\WBNHPK_PER.mtx	All mode I-I person trip PA matrix by 5 hh strata for WBNH-Peak
	\Interim\NHNWPK_PER.mtx	All mode I-I person trip PA matrix by 5 hh strata for NHNW-Peak
	\Interim\WRKOP_PER.mtx	All mode I-I person trip PA matrix by 5 hh strata for HBW-Off-Peak
	\Interim\SHPOP_PER.mtx	All mode I-I person trip PA matrix by 5 hh strata for HBShop-Off-Peak
	\Interim\SCHOP_PER.mtx	All mode I-I person trip PA matrix by 5 hh strata for HBSch-Off-Peak
	\Interim\OTHOP_PER.mtx	All mode I-I person trip PA matrix by 5 hh strata for HBO-Off-Peak
	\Interim\WBNHOP_PER.mtx	All mode I-I person trip PA matrix by 5 hh strata for WBNH-Off-Peak
	\Interim\NHNWOP_PER.mtx	All mode I-I person trip PA matrix by 5 hh strata for NHNW-Off-Peak
	\Interim\HBW_tmp.mtx	Daily I-I HBW person trip PA matrix by auto modes (drive-alone, 2-person carpool, and 3+ person carpool)
	\Interim\SCH_tmp.mtx	Daily I-I HBSch person trip PA matrix by auto modes (drive-alone, 2-person carpool, and 3+ person carpool)
	\Interim\SHP_tmp.mtx	Daily I-I HBShop person trip PA matrix by auto modes (drive-alone, 2-person carpool, and 3+ person carpool)
	\Interim\OTH_tmp.mtx	Daily I-I HBO person trip PA matrix by auto modes (drive-alone, 2-person carpool, and 3+ person carpool)
	\Interim\WBNH_tmp.mtx	Daily I-I WBNH person trip PA matrix by auto modes (drive-alone, 2-person carpool, and 3+ person carpool)
	\Interim\NHNW_tmp.mtx	Daily I-I NHNW person trip PA matrix by auto modes (drive-alone, 2-person carpool, and 3+ person carpool)
	\Interim\UNV_tmp.mtx	Daily I-I HBU person trip PA matrix by auto modes (drive-alone, 2-person carpool, and 3+ person carpool)
	\Interim\HBW_pa.mtx	Daily I-I HBW vehicle trip PA matrix by vehicle occupancy (SOV and HOV)
	\Interim\SCH_pa.mtx	Daily I-I HBSch vehicle trip PA matrix by vehicle occupancy (SOV and HOV)
	\Interim\SHP_pa.mtx	Daily I-I HBShop vehicle trip PA matrix by vehicle occupancy (SOV and HOV)
	\Interim\OTH_pa.mtx	Daily I-I HBO vehicle trip PA matrix by vehicle occupancy (SOV and HOV)
	\Interim\WBNH_pa.mtx	Daily I-I WBNH vehicle trip PA matrix by vehicle occupancy (SOV and HOV)
	\Interim\NHNW_pa.mtx	Daily I-I NHNW vehicle trip PA matrix by vehicle occupancy (SOV and HOV)

	\Interim\UNV_pa.mtx	Daily I-I HBU vehicle trip PA matrix by vehicle occupancy (SOV and HOV)
	\Interim\intercept_PK.mtx	Peak period I-I auto intercept trips: transit part. This file is the sum of HBW_PK_TRN.ASC and UNV_PK_TRN.ASC
	\Interim\intercept_OP.mtx	Off-peak period I-I auto intercept trips: transit part. This file is the sum of HBW_OP_TRN.ASC and UNV_OP_TRN.ASC
	\Interim\XXXYY_OD.mtx	Time-of-day passenger vehicle I-I trip OD matrices by vehicle occupancy (SOV and HOV). One file for each combination of a trip purpose, XXX ∈ [HBW, SHP, SCH, OTH, WBNH, NHNW, UNV], and a time of day, YY ∈ [AM, PM, OP], where AM = AM peak period, PM = PM peak period, and OP = Off-peak period.
	\Interim\CVEAM_OD.mtx, CVEPM_OD.mtx, and CVEOP_OD.mtx	Commercial vehicle I-I trip matrices by vehicle type (auto, pickup, and truck), CV I-E/E-I matrix, CV E-E matrix, and passenger vehicle I-E/E-I and E-E trip matrices. One file for each time of day (AM peak, PM peak, and off peak)
	\Output\TOTAM_OD.mtx	Final overall SOV, HOV, and truck vehicle trip OD matrices for AM peak period; this matrix goes to traffic assignment
	\Output\TOTPM_OD.mtx	Final overall SOV, HOV, and truck vehicle trip OD matrices for PM peak period; this matrix goes to traffic assignment
	\Output\TOTOP_OD.mtx	Final overall SOV, HOV, and truck vehicle trip OD matrices for off peak period; this matrix goes to traffic assignment
	\Output\PK_TRN.mtx	Final person trip PA matrices by transit mode for peak period; this matrix goes to transit assignment
	\Output\OP_TRN.mtx	Final person trip PA matrices by transit mode for off-peak period; this matrix goes to transit assignment

	Parameter Descriptor	Value	Notes
Parameters	AM Auto Thru Ratio	0.092	These values are used to slice the input daily EE auto trip matrix into three times of day. They should add up to 1 and should not be changed without survey data support.
	PM Auto Thru Ratio	0.276	
	OP Auto Thru Ratio	0.633	
	AM CV Thru Ratio	0.133	These values are used to slice the input daily EE commercial vehicle trip matrix into three times of day. They should add up to 1 and should not be changed without survey data support.
	PM CV Thru Ratio	0.208	
	OP CV Thru Ratio	0.659	
	PA to OD Cache Size	10,000,000	Cache size used for PA-to-OD module computation; this value should not be changed.

3.8.3 Execution Procedure

1) On the TRM GUI, click "**PA to OD**" to start the model run.
2) If nothing goes wrong, when it completes, a message box appears showing 'Batch routine terminated successfully". Click "OK", and a Batch Routine Report pops up.
3) Close the report file. You are done with this PA to OD step.

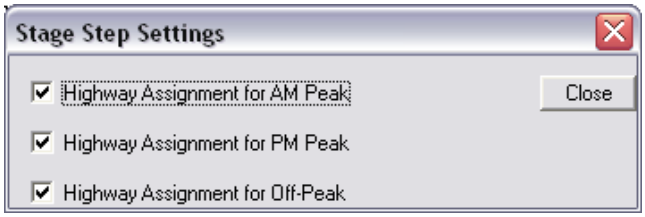
3.8.4 GISDK Macros Invoked

- Macro "Hwy Bin to Mtx"(Args)
- Macro "Bin to Mtx"(Args)
- Macro "AM PA to OD" (Args)

- Macro "PM PA to OD" (Args)
- Macro "OP PA to OD" (Args)

3.9 Highway Assignment

This step loads vehicle trip OD matrices onto the highway network using the multi-modal multi-class user equilibrium method for the three times of day, AM, PM, and off-peak periods, and three classes of vehicles, SOV, HOV, and truck. The volume-delay function used in the assignment procedure is the conical function with a varying parameter, alpha, for different highway functional classes.



3.9.1 Key Functions

KEY FUNCTIONS
Assigns highway SOV, HOV, and truck vehicle trips for AM-peak, PM-peak, and off-peak periods. For AM-peak and PM-peak traffic assignment, each period is further divided into 3 sequential time segments with the peak hour of the peak in the middle and two 1.5-hour shoulder times on either side of the peak hour. Assignment is conducted for each time segment separately and results are then aggregated to the entire AM or PM peak period.

3.9.2 Input, Output, and Parameters

Table 3-9 Input, Output, and Parameters: Highway Assignment

	File Name and Location	Notes
Input	\Input\Highway\Highway_line.dbd	Highway line layer; Output from step "Prepare Geo Files" (3.2) and updated in step "Create Network" (3.3)
	\Output\Highway.net	Highway .net file; Output from step "Create Network" (3.3)
	\Output\TOTAM_OD.mtx	Final SOV, HOV, and truck vehicle trip OD matrices for AM Peak; Output from step "PA to OD" (3.8)
	\Output\TOTPM_OD.mtx	Final SOV, HOV, and truck vehicle trip OD matrices for PM Peak; Output from step "PA to OD" (3.8)
	\Output\TOTOP_OD.mtx	Final SOV, HOV, and truck vehicle trip OD matrices for Off Peak; Output from step "PA to OD" (3.8)
	\Output\AMP1.bin	Highway assignment results for the 1.5-hour shoulder period before the peak hour in the AM peak period: flows, travel times, VMT, VHT, v/c

Output		ratios
	\Output\AMP2.bin	Highway assignment results for the peak hour in the AM peak period: flows, travel times, VMT, VHT, v/c ratios
	\Output\AMP3.bin	Highway assignment results for the 1.5-hour shoulder period after the peak hour in the AM peak period: flows, travel times, VMT, VHT, v/c ratios
	\Output\AMAssn1.bin	Aggregated (or averaged) highway assignment results for the entire AM peak period: flows, travel times, VMT, VHT, v/c ratios. Results in this file are derived from AMP1.bin, AMP2.bin, and AMP3.bin.
	\Output\PMP1.bin	Highway assignment results for the 1.5-hour shoulder period before the peak hour in the PM peak period: flows, travel times, VMT, VHT, v/c ratios
	\Output\PMP2.bin	Highway assignment results for the peak hour in the PM peak period: flows, travel times, VMT, VHT, v/c ratios
	\Output\PMP3.bin	Highway assignment results for the 1.5-hour shoulder period after the peak hour in the PM peak period: flows, travel times, VMT, VHT, v/c ratios
	\Output\PMAssn1.bin	Aggregated (or averaged) highway assignment results for the entire PM peak period: flows, travel times, VMT, VHT, v/c ratios. Results in this file are derived from PMP1.bin, PMP2.bin, and PMP3.bin.
	\Output\OPAssn1.bin	Off peak highway assignment results: flows, travel times, VMT, VHT, v/c ratios
	\Output\TMV_AM1.bin	Highway turning movements at ALL intersections in the network for the 1.5-hour shoulder period before the peak hour in the AM peak period
	\Output\TMV_AM2.bin	Highway turning movements at ALL intersections in the network for the peak hour in the AM peak period
	\Output\TMV_AM3.bin	Highway turning movements at ALL intersections in the network for the 1.5-hour shoulder period after the peak hour in the AM peak period
	\Output\TMV_PM1.bin	Highway turning movements at ALL intersections in the network for the 1.5-hour shoulder period before the peak hour in the PM peak period
	\Output\TMV_PM2.bin	Highway turning movements at ALL intersections in the network for the peak hour in the PM peak period
	\Output\TMV_PM3.bin	Highway turning movements at ALL intersections in the network for the 1.5-hour shoulder period after the peak hour in the PM peak period
	\Output\Intersection Turning Movements_OP.bin	Off peak highway turning movements at ALL intersections in the network

	Parameter Descriptor	Value	Notes
Parameters	Maximum Assignment Iterations	99 or any positive value	Number of iterations specified for assignment model convergence
	Assignment method	1	1 = User Equilibrium (UE) Assignment 2 = Stochastic User Equilibrium (SUE) Assignment (Note: This parameter is no longer used by the model. UE is the only one that can be used.)

3.9.3 Execution Procedure

1) On the TRM GUI, click the "**Highway Assignment**" button to start the model run.
2) When it completes, a message box appears showing 'Batch routine terminated successfully". Click "OK" and a Batch Routine Report pops up.
3) Close the report. You are now done with Highway Assignment.

3.9.4 GISDK Macros Invoked

- Macro "AM Highway Assignment" (Args)
- Macro "PM Highway Assignment" (Args)
- Macro "OP Highway Assignment" (Args)

3.10 Transit Assignment

This step loads the peak and off-peak transit trip PA matrices onto the peak transit route system and the off-peak transit route systems, respectively, using TransCAD pathfinder transit assignment procedure. The loading is carried out separately for nine modes (i.e., three transit modes: local bus, express bus, and rail, and three access modes: walk-access, park-and-ride, and kiss-and-ride).

3.10.1 Key Functions

KEY FUNCTIONS
This step loads the transit trip PA matrices onto the peak transit route system and the off-peak transit route systems for nine modes (i.e., three transit modes: local bus, express bus, and rail, and three access modes: walk-access, park-and-ride, and kiss-and-ride). The output from this step includes: 1) Boarding and alighting at each stop of each transit route; 2) Transit flows (onboard passengers) by segment of each route; 3) Aggregated transit flows (across all routes) on highway links; 4) Transfers between transit routes and stops; 5) Walk (or drive) flows related to transit; and 6) Stop-to-stop transit flows. The output stop-to-stop flow matrices are indexed intensively using the route names, operator names, and company/mode names in the transit route system, which provides convenient ways for the planner to analyze transit stop-to-stop flows from different angles.

3.10.2 Input, Output, and Parameters

Table 3-10 Input, Output, and Parameters: Transit Assignment

	File Name and Location	Notes

Input	\Input\Transit\Transit_AM.rts	Peak Period Transit Route System; Output from step "Prepare Geo Files" (3.2)
	\Input\Transit\Transit_OP.rts	Off-peak Period Transit Route System; Output from step "Prepare Geo Files" (3.2)
	\Input\Transit\Transit_Line.dbd	Transit Line Geography; Output from step "Prepare Geo Files" (3.2)
	\Input\Transit\Mode.dbf	Transit mode table
	\Input\Transit\ModeXfer.dbf	Transit mode transfer table
	\Input\Transit\Transit Operator and Company Dictionary.dbf	A dictionary file which explains what the numbers used in the Operator and Company fields in the transit route system (.rts) file mean.
	\Output\PK_Trn.mtx	Final person trip PA matrices by transit mode for Peak Period; Output from step "PA to OD" (3.8)
	\Output\OP_Trn.mtx	Final person trip PA matrices by transit mode for Off-peak Period; Output from step "PA to OD" (3.8)
	\Output\AMKLPATH.tnw	Transit network: AM-Peak Kiss-and-Ride Local bus; Output from step "Create Network" (3.3)
	\Output\AMKPPATH.tnw	Transit network: AM-Peak Kiss-and-Ride Express bus; Output from step "Create Network" (3.3)
	\Output\AMKRPATH.tnw	Transit network: AM-Peak Kiss-and-Ride Rail; Output from step "Create Network" (3.3)
	\Output\AMDLPATH.tnw	Transit network: AM-Peak Park-and-Ride Local bus; Output from step "Create Network" (3.3)
	\Output\AMDPPATH.tnw	Transit network: AM-Peak Park-and-Ride Express bus; Output from step "Create Network" (3.3)
	\Output\AMDRPATH.tnw	Transit network: AM-Peak Park-and-Ride Rail; Output from step "Create Network" (3.3)
	\Output\AMWLPATH.tnw	Transit network: AM-Peak Walk- Access Local bus; Output from step "Create Network" (3.3)
	\Output\AMWPPATH.tnw	Transit network: AM-Peak Walk- Access Express bus; Output from step "Create Network" (3.3)
	\Output\AMWRPATH.tnw	Transit network: AM-Peak Walk- Access Rail; Output from step "Create Network" (3.3)
	\Output\OPKLPATH.tnw	Transit network: Off-Peak Kiss-and-Ride Local bus; Output from step "Create Network" (3.3)
	\Output\OPKPPATH.tnw	Transit network: Off-Peak Kiss-and-Ride Express bus; Output from step "Create Network" (3.3)
	\Output\OPKRPATH.tnw	Transit network: Off-Peak Kiss-and-Ride Rail; Output from step "Create Network" (3.3)
	\Output\OPDLPATH.tnw	Transit network: Off-Peak Park-and-Ride Local bus; Output from step "Create Network" (3.3)
	\Output\OPDPPATH.tnw	Transit network: Off-Peak Park-and-Ride Express bus; Output from step "Create Network" (3.3)
	\Output\OPDRPATH.tnw	Transit network: Off-Peak Park-and-Ride Rail; Output from step "Create Network" (3.3)
	\Output\OPWLPATH.tnw	Transit network: Off-Peak Walk-Access Local bus; Output from step "Create Network" (3.3)
	\Output\OPWPPATH.tnw	Transit network: Off-Peak Walk-Access Express bus; Output from step "Create Network" (3.3)
	\Output\OPWRPATH.tnw	Transit network: Off-Peak Walk-Access Rail; Output from step "Create Network" (3.3)
Output	\Output\ Transit_Transfer_AM.bin	Transit transfer movements for the peak period
	\Output\ Transit_Transfer_OP.bin	Transit transfer movements for the off-peak period

	\Output\XXYYYZZZ_flw.bin	Where, XX ∈ [PK, OP] YYY ∈ [Loc, Exp, Ral] ZZZ ∈ [Wlk, PnR, KnR] & PK = Peak Period OP = Off-peak Period Loc = Local Bus Exp = Express Bus Ral = Rail Wlk = Walk-Access PnR = Park-and-Ride KnR = Kiss-and-Ride	Stop-to-stop (milepost-to-milepost) transit flow by route for the specific time of day, transit mode, and access mode. Additional results include BaseIVTT and Cost.
	\Output\XXYYYZZZ_agg.bin		Aggregated directional transit and non-transit (access/egress/transfer) flows on each highway link by access/egress/transfer mode for the specific time of day and transit mode.
	\Output\XXYYYZZZ_ono.bin		Modeled boarding and alighting at each every stop in the regional transit route system for the specific time of day, transit mode, and access mode
	\Output\XXYYYZZZ_mov.bin		Transfers from stops of one route to stops of all other routes where possible for the specific time of day, transit mode, and access mode
	\Output\XXYYYZZZ_wfl.bin		Transit related directional walk flow (access, transfer, and egress) on all walkable highway links for the specific time of day, transit mode, and access mode. If it is a drive access mode, the file also includes directional drive-access flow on highway links.
	\Output\XXYYYZZZ_**s2s.mtx**		Stop-to-stop transit flows. The matrix explains how many passengers board at a stop AND alight at another stop, which is basically a PA trip matrix between stops. This matrix is also intensively indexed so that stop-to-stop flows can be easily viewed and summarized by route, operator, and company.
	\Output\ origin_parking_XXYZ.mtx	Where, XX ∈ [AM, OP] Y ∈ [D, K] Z ∈ [L, P, R] & AM = Peak Peiod OP = Off-peak Period D = Park-and-Ride K = Kiss-and-Ride L = Local Bus P= Express Bus R = Rail	Drive-access Origin TAZ to Parking Lot drive time (in minutes)
	\Output\parking_XXYZ.mtx		Drive-access Origin TAZ to Destination TAZ parking lot choice

3.10.3 Execution Procedure

7) On the TRM GUI, click the "**Transit Assignment**" button to start the model run.
8) If nothing goes wrong, when it completes, a message box appears showing 'Batch routine terminated successfully". Click "OK" and a Batch Routine Report pops up.
9) Close the report. You are now done with Transit Assignment.

3.10.4 GISDK Macros Invoked

- Macro "Transit Assignment" (Args)

3.11 Feedback Module

The feedback module, shown as the Feedback Model button on the GUI, allows the user to run the model with congested travel times output from the traffic assignment step being fed back to the trip distribution step. The advantage of using feedback is that congested travel times rather than free-flow travel times are used to estimate destination and/or mode choices, which is more realistic. The disadvantage is that the model takes longer time to run.

In the current TRM, feedback is only applied to the AM peak period. Its PM peak and off-peak sub-models run without feedback.

The GUI allows you to specify as many iterations as you want. This may lead the user to ask "how many iterations are enough for a model to converge?" It really depends. The TRM scenarios evaluated for the 2035 LRTP were able to converge within 3 - 4 iterations with the system-wide %RMSE of travel times between two successive iterations being set to 10%. The user should expect more iterations with smaller %RMSE.

For technical details of the feedback model, please refer to the TRM Model Development Documentation.

3.11.1 Input, Output, and Parameters

Besides all the input and output files and parameters that have been described in the previous sections of this chapter, there are only two more parameters used in this step and no more files involved. As has been mentioned above, these two parameters are the number of feedback iterations and the converging / closing criteria.

Table 3-11 Input, Output, and Parameters: Feedback Model

	Parameter Descriptor	Value	Notes
Parameters	Feedback Iterations	0 or larger integers	Number of iterations specified for feedback model convergence. It can take any non-negative value. But if 0, there will be no feedback.
	Closing Criterion	Any real number larger than 0	System-wide %RMSE of travel times between two successive iterations is used as the sole closing criterion. It can be any real number greater than 0. For the base year model calibration, a default value of 10% was used. For scenario comparison, smaller values are recommended, such as 5% or lower.

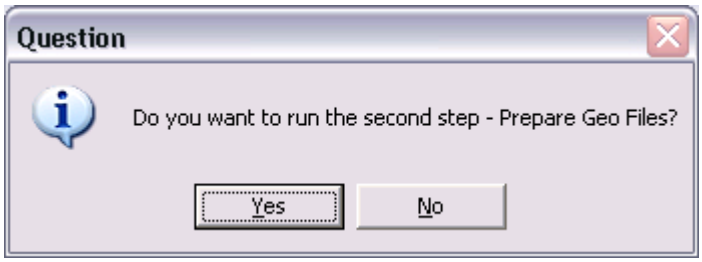
3.11.2 Execution Procedure

1) On the TRM GUI, from the Scenarios box choose the model scenario to be executed, e.g., 2010.
2) If a %RMSE value different from the default 10% is preferred as the converging criterion, click the "Setup" button on the GUI and follow the instructions as described in Section 2.5 of Chapter 2 to make the change.
3) In the "Feedback Iterations" spinner box, enter the number of iterations desired.

   Note, when the feedback iteration is set greater than 0, it does not matter if the boxes "Stop after stage" and "Run all steps" are checked or not. All steps will be executed in sequence.

4) Now click the "**Feedback Model**" button on the GUI to start the model run.
5) A message box as shown below pops up immediately. If this model scenario has never been executed since it was setup OR there have been physical changes made to the master highway or transit network since the last execution of the model, regardless of with or without feedback iterations, you need to choose Yes; otherwise, you can choose No to avoid repetition and save some time.

6) If you choose Yes in step 5), the full model run will start immediately, beginning with the "Create Walk Access" step.
7) If you choose No in step 5), a second message box will pop up asking if you want to run the second step, Prepare Geo Files. If you have changed any attribute values in the master highway network or the master transit network, you will then need to choose Yes; otherwise, you can choose No.



8) The model will run all the steps with the feedback mechanism applied. The feedback loop will stop when either the converging criterion is met or the maximum number of iterations is reached.
9) When the execution completes, a Note box appears showing 'Batch routine terminated successfully."
10) Click on "OK" to show the Batch Routine Report. Close it and you are now finished.

Note: To find out how many iterations it took for the model to converge and at what %RMSE level the model converged, you need to look at the Report file created by TransCAD automatically. To find

and open the Report file, please choose **Edit – Preferences** from the TransCAD main menu, and then choose the **Logging** tab from the **User Preferences** dialog box. Click the **Display** button under the Report text box. Search for the text "Percent RMSE for AM Feedback iteration" will lead you to the right place.

3.11.3 GISDK Macros Invoked

- Macro "Feedback Model" (Args)

  – In the execution of this macro, it further invokes all the macros and the FORTRAN programs as described in the previous sections of this chapter.

3.12 Model Validation and Scenario Evaluation

This module is developed to evaluate the performance of the base year model and summarize the forecasts made by the future year model scenarios. The base year model is evaluated by comparing model estimates with observed values and the difference between the two is usually what we are interested in. However, since the program has not be customized for the future year models, besides summarizing the future year forecasts, the program still compares the model estimated values with the observed ones (of the base year). This extra comparison does not make much sense and you should just focus on the summarized statistics.

Summarized statistics include average trip lengths in both miles and minutes by trip purpose and time of day, VMT total and by federal functional class (FFC), traffic forecasts on pre-defined screen lines and cut lines, transit ridership by transit agency and time of day, and transportation mode share by trip purpose and time of day.

Measures of Effectiveness (MOE) include percent deviation of average trip lengths by trip purpose and time of day, percent deviation of VMT total and by FFC, percent deviation of traffic forecasts on screen lines and cut lines, percent deviation of model estimated daily traffic volumes by FFC and by volume group, coefficient of determination (R-squared) of region-wide traffic estimation, %RMSE of model estimated daily traffic volumes by FFC and by volume group, and transit ridership comparison by transit agency and time of day.

3.12.1 Input, Output, and Parameters

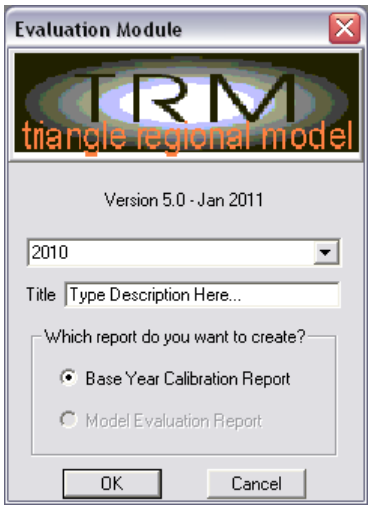
Table 3-12 Input, Output, and Parameters: Model Validation

	File Name and Location	Notes
Input	\Input\SEData\SE_2010.bin	Zonal socio-economic data
	\Input\Highway\Highway_line.dbd	Highway line layer; Output from step "Prepare Geo Files" (3.2)

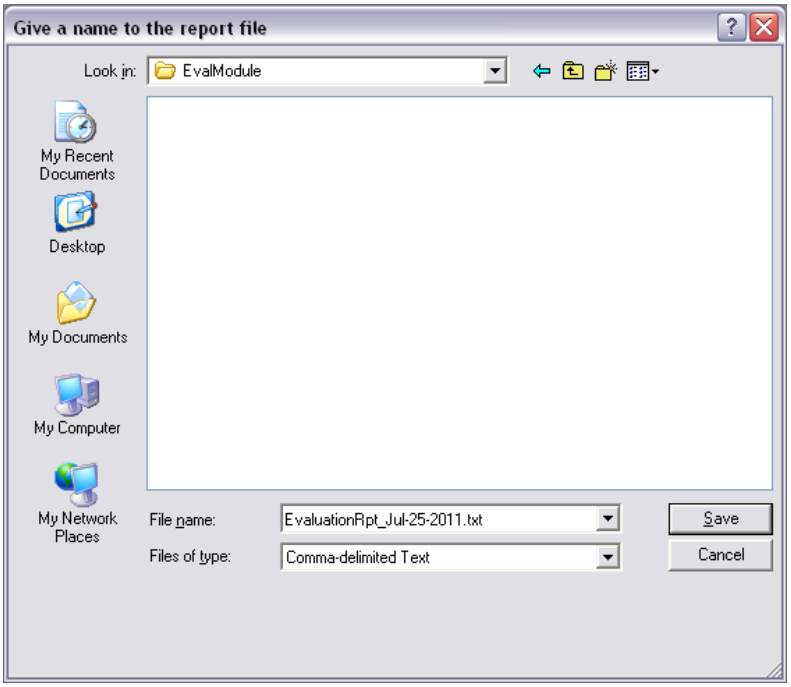
	\Input\Transit\Transit_AM.rts	AM peak transit route system; output from step "Prepare Geo Files" (3.2)
	\Input\Transit\Transit_OP.rts	Off-peak transit route system; output from step "Prepare Geo Files" (3.2)
	\Output\AMAssn1.bin	AM peak highway assignment results; Output from step "Highway Assignment" (3.9)
	\Output\PMAssn1.bin	PM peak highway assignment results; Output from step "Highway Assignment" (3.9)
	\Output\OPAssn1.bin	Off peak highway assignment results; Output from step "Highway Assignment" (3.9)
	\Interim\AMLOV2.mtx	Highway skims for AM-Peak SOVs; Output from step "Create Network" (3.3)
	\Interim\OPLOV2.mtx	Highway skims for off-Peak HOVs; Output from step "Create Network" (3.3)
	\EvalModule\ ObservedPersonTrips_PA_2010.mtx	Observed highway passenger trip PA matrix by trip purpose and time of day for year 2010
	\EvalModule\Non-Motorized Trip Split Observations_2010.dbf	Observed motorized and non-motorized trips by trip purpose and time of day for year 2010
	\EvalModule\ TrafficCount_Observed_2010.bin	Observed daily traffic counts data for year 2010
	\EvalModule\ Transit_Ridership_Observed_2010.dbf	Observed transit ridership data by agency and time of day for year 2010
	\EvalModule\Screenline & Cutline Dictionary.dbf	Screenline & cutline dictionary file
	\Interim\WRKPK_PER.mtx	I-I person trip PA matrix by 5 household strata for HBW-Peak; output from step "PA to OD" (3.8)
	\Interim\SHPPK_PER.mtx	I-I person trip PA matrix by 5 household strata for HBShop-Peak; output from step "PA to OD" (3.8)
	\Interim\SCHPK_PER.mtx	I-I person trip PA matrix by 5 household strata for HBSch-Peak; output from step "PA to OD" (3.8)
	\Interim\OTHPK_PER.mtx	I-I person trip PA matrix by 5 household strata for HBO-Peak; output from step "PA to OD" (3.8)
	\Interim\WBNHOP_PER.mtx	I-I person trip PA matrix by 5 household strata for WBNH-Peak; output from step "PA to OD" (3.8)
	\Interim\NHNWPK_PER.mtx	I-I person trip PA matrix by 5 household strata for NHNW-Peak; output from step "PA to OD" (3.8)
	\Interim\WRKOP_PER.mtx	I-I person trip PA matrix by 5 household strata for HBW-Off-Peak; output from step "PA to OD" (3.8)
	\Interim\SHPOP_PER.mtx	I-I person trip PA matrix by 5 household strata for HBShop-Off-Peak; output from step "PA to OD" (3.8)
	\Interim\SCHOP_PER.mtx	I-I person trip PA matrix by 5 household strata for HBSch-Off-Peak; output from step "PA to OD" (3.8)
	\Interim\OTHOP_PER.mtx	I-I person trip PA matrix by 5 household strata for HBO-Off-Peak; output from step "PA to OD" (3.8)
	\Interim\WBNHOP_PER.mtx	I-I person trip PA matrix by 5 household strata for WBNH-Off-Peak; output from step "PA to OD" (3.8)
	\Interim\NHNWOP_PER.mtx	I-I person trip PA matrix by 5 household strata for NHNW-Off-Peak; output from step "PA to OD" (3.8)
	\Output\XXYYYZZZ_ono.bin	XX ∈ [PK, OP], YYY ∈ [Loc, Exp, Ral], and ZZZ ∈ [Wlk, PnR, KnR]. Modeled boarding and alighting at each every stop in the regional transit route system by time of day, transit mode, and access mode; Output from step "Transit Assignment" (3.9)
Output	\EvalModule\EvaluationRpt.txt	This formatted text report contains all the statistical summaries and MOEs as described in the beginning of this section.

3.12.2 Execution Procedure

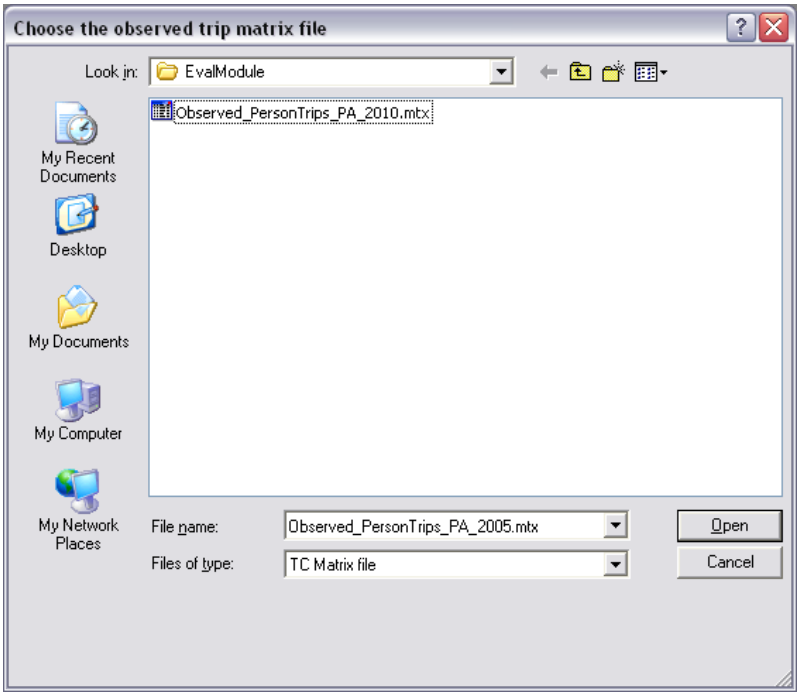
1) On the TRM GUI, click the button titled "Base Model Calibration / Scenario Evaluation" to bring up the Evaluation Module dialog box as shown below.



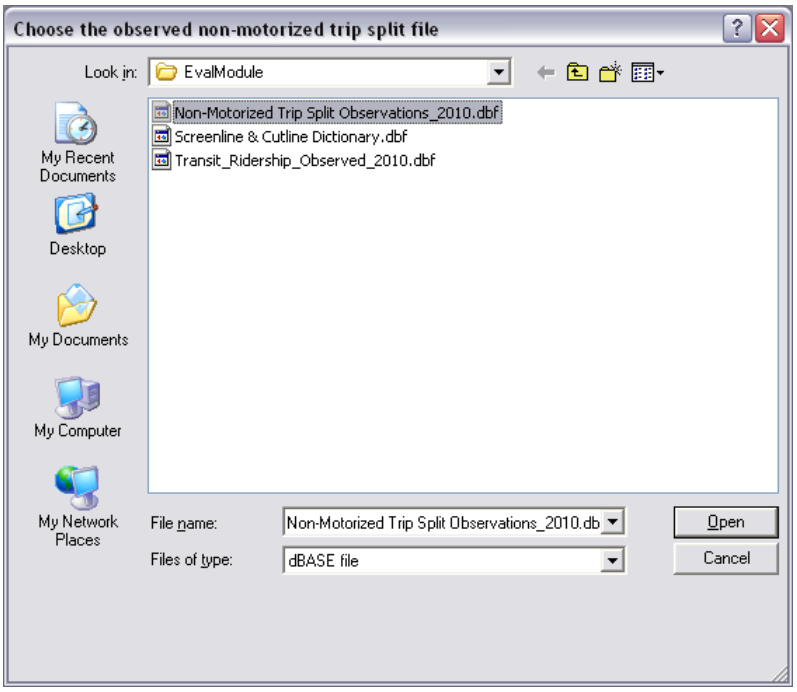
2) From the scenario dropdown list choose the model scenario to be evaluated
3) As an option, you can type some descriptions about the scenario to be evaluated in the Title text box.
4) Click OK to execute.
5) A dialog box titled "Give a name to the report file" pops up immediately. Browse to the **EvalModule**\ folder of the current model scenario, accept the default file name or type in a new name for the report to be created, and click Save. The report will be a plain text file.



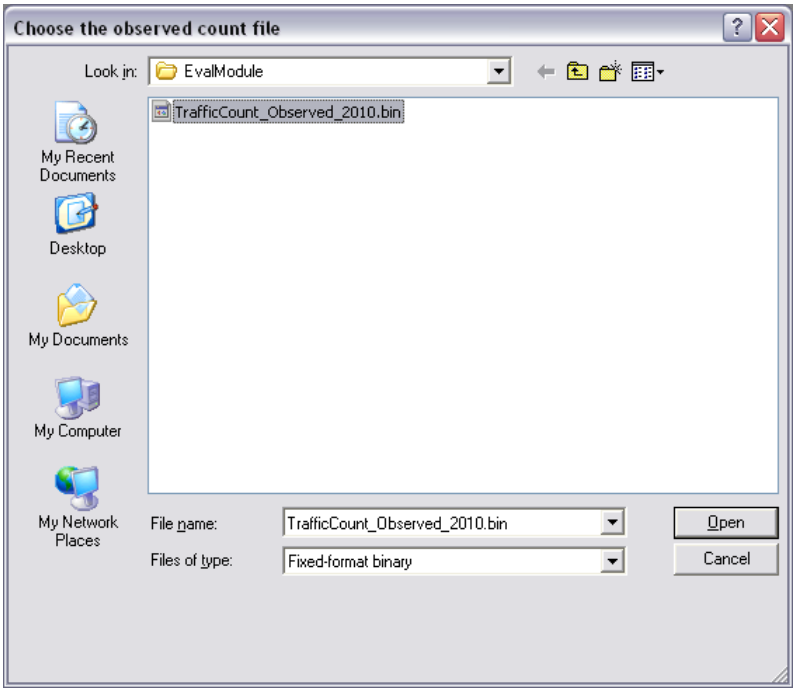
6) Now the dialog box "Chose the observed trip matrix file" opens. Browse to \EvalModule\, highlight the file "Observed_PersonTrips_PA_2010.mtx", and click Open.



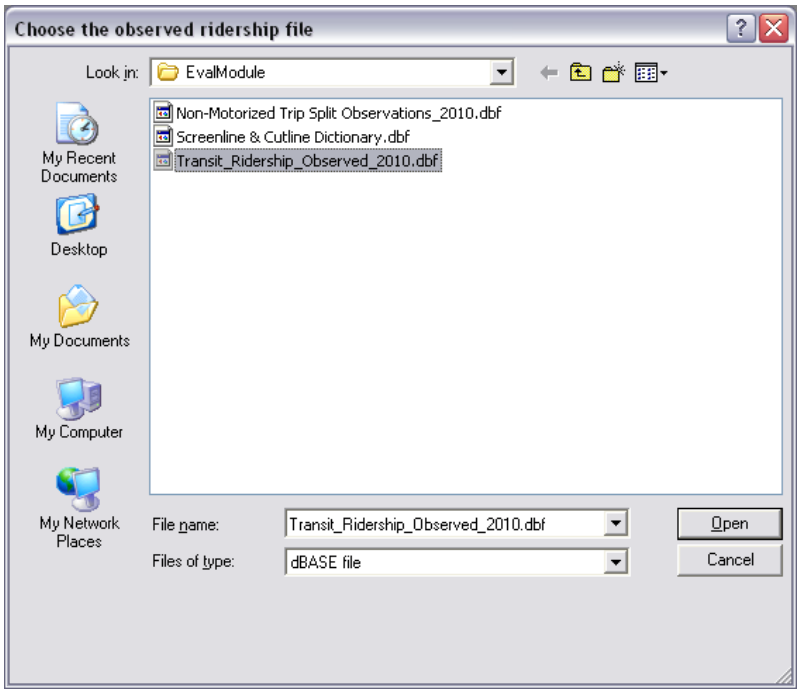
7) Then next dialog box titled "Choose the observed non-motorized trip split file" appears, asking for observed motorized/non-motorized trips file. Browse to the \EvalModule\ folder, highlight the file "Non-Motorized Trip Split Observations_2010.dbf", and click Open.



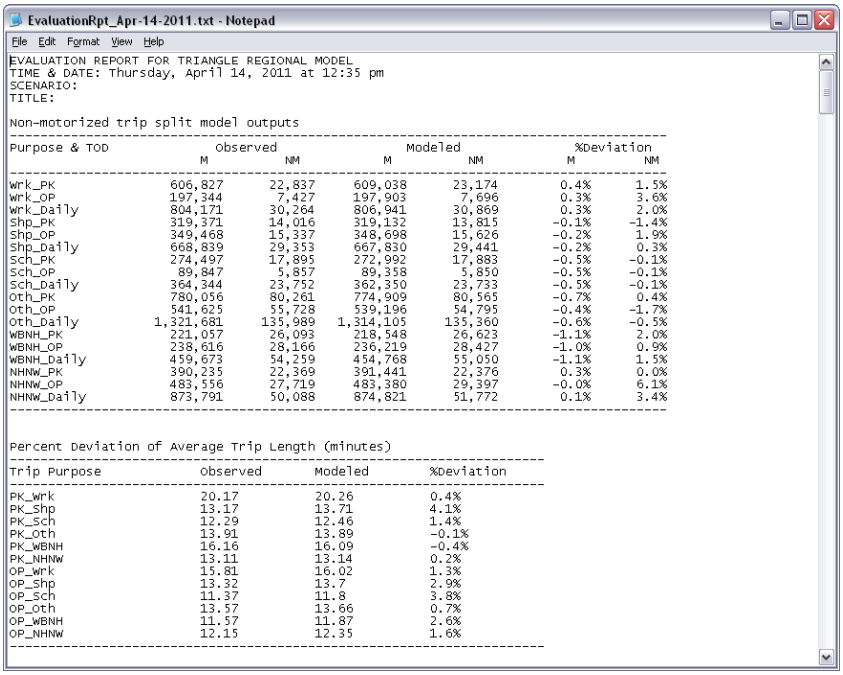
8) A fourth dialog box titled "Choose the observed count file" appears, asking for highway traffic count data file. Browse to the \EvalModule\ folder, highlight the file "TrafficCount_Observed_2010.bin", and click Open.



9) The last dialog box "Chose the observed ridership file" now opens. Again, browse to \EvalModule\, highlight the file "Transit_Ridership_Observed_2010.dbf", and click Open again.



10) No more dialog box appears, and the program really starts to run this time!
11) When it completes, a message box will appear indicating "Congratulations!! You have completed the Model Validation Report. Do you want to open the report?" You can choose either Yes or No. The report file looks like the following one.



EvaluationRpt_Apr-14-2011.txt - Notepad

File Edit Format View Help

EVALUATION REPORT FOR TRIANGLE REGIONAL MODEL
TIME & DATE: Thursday, April 14, 2011 at 12:35 pm
SCENARIO:
TITLE:

Non-motorized trip split model outputs

Purpose & TOD	Observed		Modeled		%Deviation	
	M	NM	M	NM	M	NM
Wrk_PK	606,827	22,837	609,038	23,174	0.4%	1.5%
Wrk_OP	197,344	7,427	197,903	7,696	0.3%	3.6%
Wrk_Daily	804,171	30,264	806,941	30,869	0.3%	2.0%
Shp_PK	319,371	14,016	319,132	13,815	-0.1%	-1.4%
Shp_OP	349,468	15,337	348,698	15,626	-0.2%	1.9%
Shp_Daily	668,839	29,353	667,830	29,441	-0.2%	0.3%
Sch_PK	274,497	17,895	272,992	17,883	-0.5%	-0.1%
Sch_OP	89,847	5,857	89,358	5,850	-0.5%	-0.1%
Sch_Daily	364,344	23,752	362,350	23,733	-0.5%	-0.1%
Oth_PK	780,056	80,261	774,909	80,565	-0.7%	0.4%
Oth_OP	541,625	55,728	539,196	54,795	-0.4%	-1.7%
Oth_Daily	1,321,681	135,989	1,314,105	135,360	-0.6%	-0.5%
WBNH_PK	221,057	26,093	218,548	26,623	-1.1%	2.0%
WBNH_OP	238,616	28,166	236,219	28,427	-1.0%	0.9%
WBNH_Daily	459,673	54,259	454,768	55,050	-1.1%	1.5%
NHNW_PK	390,235	22,369	391,441	22,376	0.3%	0.0%
NHNW_OP	483,556	27,719	483,380	29,397	-0.0%	6.1%
NHNW_Daily	873,791	50,088	874,821	51,772	0.1%	3.4%

Percent Deviation of Average Trip Length (minutes)

Trip Purpose	Observed	Modeled	%Deviation
PK_Wrk	20.17	20.26	0.4%
PK_Shp	13.17	13.71	4.1%
PK_Sch	12.29	12.46	1.4%
PK_Oth	13.91	13.89	-0.1%
PK_WBNH	16.16	16.09	-0.4%
PK_NHNW	13.11	13.14	0.2%
OP_Wrk	15.81	16.02	1.3%
OP_Shp	13.32	13.7	2.9%
OP_Sch	11.37	11.8	3.8%
OP_Oth	13.57	13.66	0.7%
OP_WBNH	11.57	11.87	2.6%
OP_NHNW	12.15	12.35	1.6%

3.12.3 GISDK Macros Invoked

- DBox "EVALUATION"
- Macro "Calibration Routine" (Pars)
- DBox "EVALUATION" invokes Macro "Calibration Routine"

3.13 Air Quality Analysis

This section provides instructions on how to use the AQ Analysis Module, an integral part of the TRM model, to obtain the estimates of emission pollutants (i.e., NOx and CO) based on the TRM model run results for a particular scenario. The AQ Analysis Module fully automates all the steps required for AQ analysis, including the execution of Mobile6.

However, to run this module, you need several extra input files that are specifically prepared for air quality analysis. These files include:

1) Mobile6 files, including Mobile6 executable (*.exe) file as well as all supporting files.
2) County emission budget and compliance rate file, which contains emission budgets by county by year (2015, 2025, and 2035) and county compliance rates; and
3) Grouped by year (2015, 2025, and 2035), initial input files to Mobile6, one for each county and for either pollutant (i.e., NOx or CO).

All of the input files are grouped into one folder named "TRM AQ Files". Considering only a very limited number of users need to do air quality analysis, this folder along with the files in it is not included in the CDROM provided. A copy of these files can be obtained from the Triangle Regional Model Service Bureau by a separate request.

Once you get the folder and files, it must be placed in your working TransCAD program files folder, i.e. C:\Programs\TransCAD 48\ in our case. And you **should not** alter any files in this folder.

3.13.1 Input, Output, and Parameters

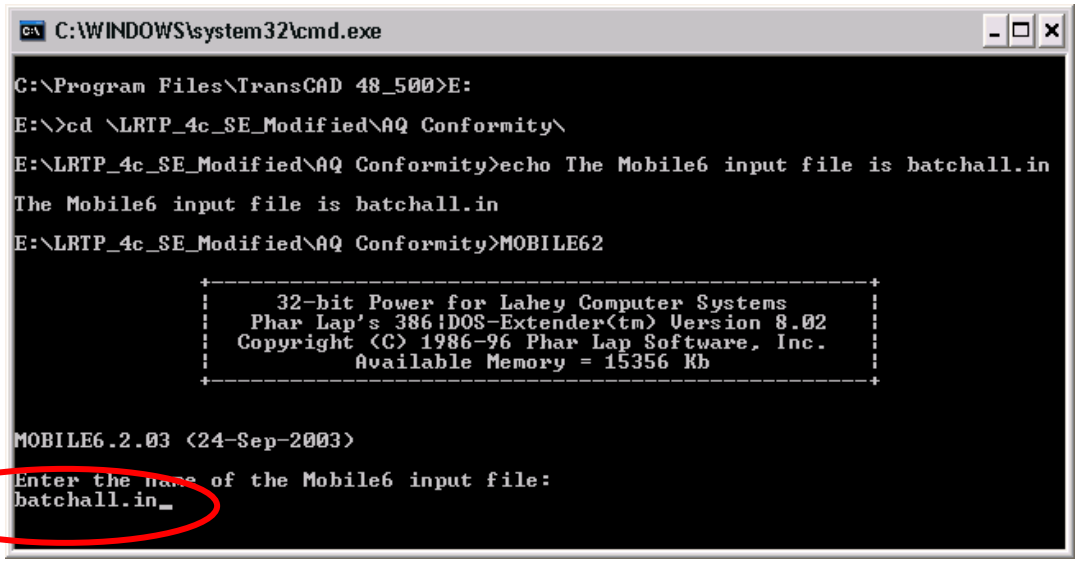
Table 3-13 Input, Output, and Parameters: Air Quality Analysis

	File Name and Location	Notes
Input	\Input\Highway\Highway_line.dbd	Highway line layer; Output from step "Prepare Geo Files" (3.2). **Note: Make sure values in the fields "County" and "FCLASS" are correct** (see Universe Highway Geographic File in Chapter 5). This is critical for the AQ program to compute pollutants accurately.

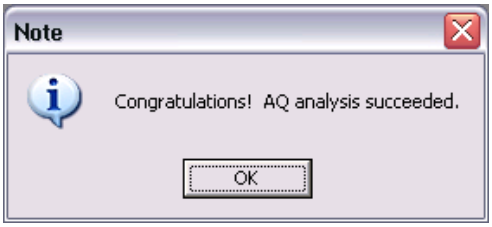
	\Output\AMAssn1.bin	AM peak highway assignment results; Output from step "Highway Assignment" (3.7)
	\Output\PMAssn1.bin	PM peak highway assignment results; Output from step "Highway Assignment" (3.7)
	\Output\OPAssn1.bin	Off peak highway assignment results; Output from step "Highway Assignment" (3.7)
	C:\Programs\TransCAD 48\TRM AQ Files\Mobile6 Files\MOBILE62.exe & all supporting files in the same directory	Mobile 6 executable file
	C:\Programs\TransCAD 48\TRM AQ Files\County Emission Budgets and Compliance Rates.dbf	This file contains emission budgets by county by year (2015, 2025, and 2035) and county compliance rates.
	C:\Programs\TransCAD 48\TRM AQ Files\YYYY*.in	YYYY = 2015, 2025, or 2035. This folder contains all the *.in files by county and pollutant type (NOx or CO)
Output	\Air Conformity\Modeled Emission Report for YYYY.dbf	YYYY is the year you chose on the "Air Quality Analysis" dialog box for analysis. This file contains estimated amount of pollutant emissions for all the counties and for both pollutants (NOx and CO).
	\Air Conformity*.TAB \Air Conformity*.TXT	One for each county and either pollutant
	\Air Conformity\VMT & VHT Results for AQ Analysis.bin	This file contains VMT, VHT, and average speed data by county, highway federal functional class, and time of day.

3.13.2 Execution Procedure

1) Click the "Air Quality Analysis" button on the TRM GUI;
2) Choose an appropriate year from the pop-up dialog box, which is also titled "Air Quality Analysis";
3) Click the Run button from the dialog box;
4) After the module runs for a couple of seconds, a DOS window will appear on your screen with Mobile6 launched. Type "batchall.in" (do not include the quotation marks) in the blank line under the line "Enter the name of the Mobile6 input file:", and hit the Enter key on your keyboard;



5) Now the program starts to execute and it takes several minutes to finish. If all things have been set up correctly, you should have a message box pop up at the end of the execution indicating the completion, as shown in the picture below.



3.13.3 GISDK Macros Invoked

- Dbox "AQ Conformity", which invokes Mobile 6.

3.14 Summit User Benefit Analysis

This section provides instructions on how to run the FTA Summit application from the TRM v5 model Graphic User Interface (GUI) to obtain user benefit estimates using TRM model run results from any two specific scenarios. The integrated Summit Module in the TRM script fully automates all the steps required for user benefit analysis, which include input data specification, error checking, and processing, control file creation, Summit execution, and input and output data organization.

However, to run this module, you need several extra input files that are specifically prepared for air quality analysis. These files include:

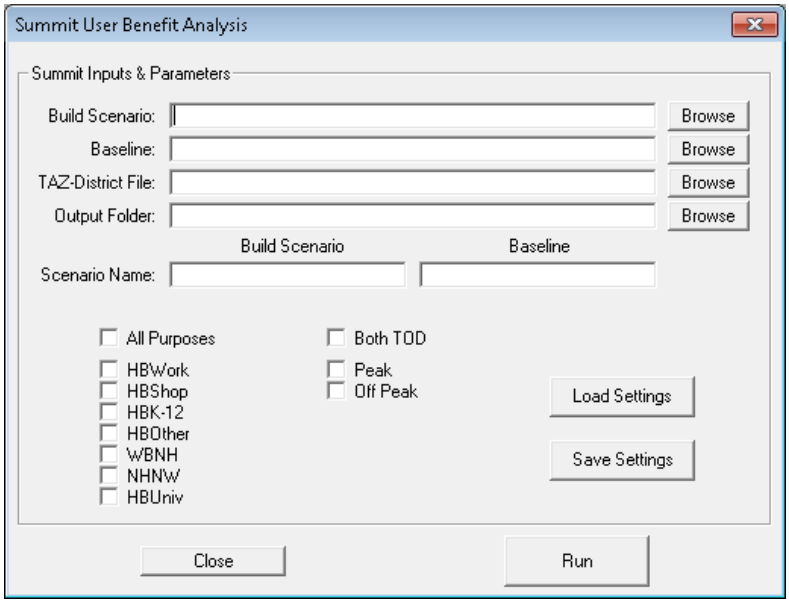
1) Summit executable file (e.g. summit993.exe);
2) Template control file named "trm summit control file template.ctl";
3) User benefit analysis input files from mode choice FORTRAN program:
   - UBHBW_PK.BIN & UBHBW_OP.BIN
   - UBSHP_PK.BIN & UBSHP_OP.BIN
   - UBSCH_PK.BIN & UBSCH_OP.BIN
   - UBOTH_PK.BIN & UBOTH_OP.BIN
   - UBWBNH_PK.BIN & UBWBNH_OP.BIN
   - UBNHNW_PK.BIN & UBNHNW_OP.BIN
   - UBUNV_PK.BIN & UBUNV_OP.BIN
4) One additional TRM scenario. Unlike most of the TRM model applications, Summit works on and needs inputs from two scenarios rather than a single one. It basically compares the two

scenarios and calculates user benefits based on trip pattern changes between them. Files listed in item 3) above must exist for this scenario.

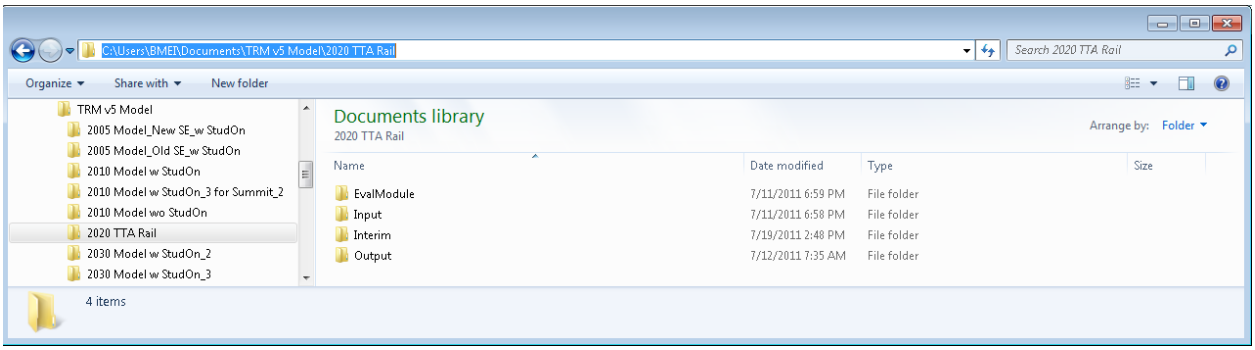
5) TAZ-district equivalency file. For user benefit analysis, TAZs should be aggregated into much larger districts to produce more meaningful information and more usable results. The TAZ-district equivalency file serves this purpose.

3.14.1 User Interface

Locate the button titled "Summit User Benefit Analysis" on the TRM v5 GUI. By clicking the button, dialog box "Summit User Benefit Analysis" pops up, as shown below.



Scenarios: On this dialog box, you can specify a Build Scenario for which the user benefit analysis is conducted against the Baseline. You can either type a path into the editable text box or click the Browse button to choose the directory from the Windows Browse for Folder dialog box. Given the TRM model folder structure, a scenario (including the baseline) here refers to the top-level directory of a model run setup. For example, in the figure below each of the folders immediately under the TRM v5 Model directory can be specified as a scenario. If "2020 TTA Rail" is chosen as a scenario, the path "C:\Users\BMEI\Documents\TRM v5 Model\2020 TTA Rail" should be specified in the scenario text box on the dialog box window above.



Scenario Names: Now you need to give a short, meaningful, and easy-to-call name to either of the scenarios in the Scenario Name text box. These names will be used in Summit control files as well as output files and help you readily distinguish one scenario from the other.

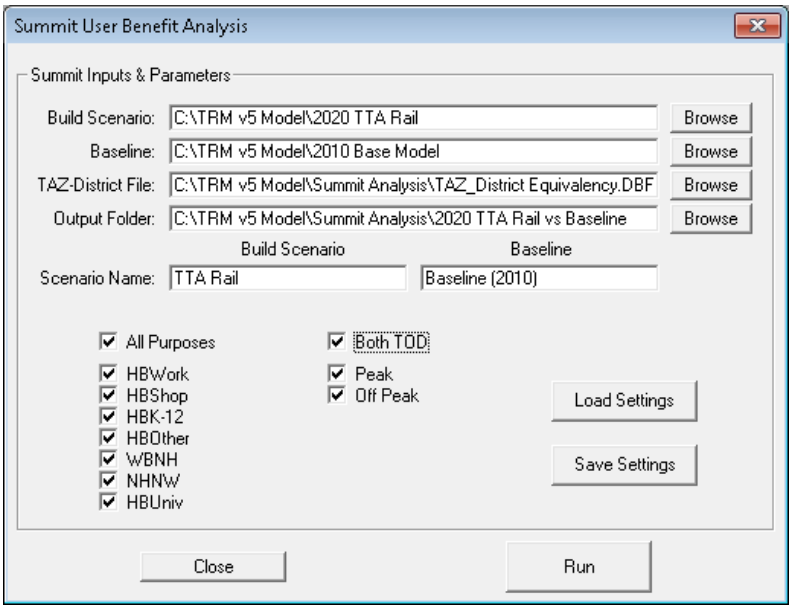
TAZ-District File: After scenarios are chosen and name is provided, you need to specify a TAZ-district equivalency file. For user benefit analysis, TAZs should be aggregated into much larger districts to produce more meaningful information and more usable results. The TAZ-district equivalency file serves this purpose and its contents and structure will be described in detail in the Input Files section. As a note, this file is not in a format that can be used by the Summit program directly, but it is much easier for the user to produce. The TRM Summit module will convert this user-supplied file (in DBASE format) into Summit-readable file (in text format). Again, you can either type in or browse for the file.

Output Folder: The Output Folder is where all the output files from Summit execution are stored, along with a few other files including Summit program control files, a batch file, and the converted TAZ-district equivalency file which are all created by the TRM Summit module.

Trip Purpose and Time of Day Checkboxes: The next section on the dialog box is a group of checkboxes where you choose for what trip purpose(s) and what time(s) of day to run the Summit program. Check the one(s) you would like to run.

Save and Load Settings: After all the above information is specified on the dialog box, you can save the settings to a text file (with a .set extension), which can be used for reference later. Saved settings can also be loaded to the dialog box from a previously saved file, which can save you a few seconds to re-specify the information manually.

An example fully specified dialog box is shown below:



3.14.2 Input Files

Input files required by the TRM Summit module include:

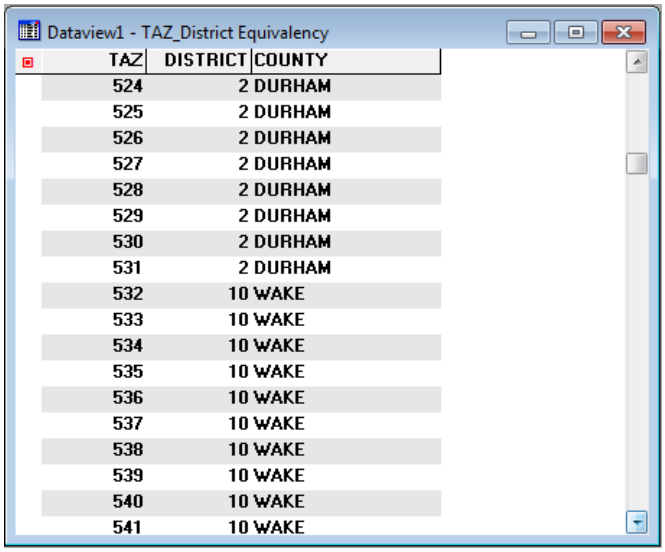
1) TAZ-to-TAZ travel information
Unlike most of the TRM model applications, Summit works on and needs inputs from two scenarios rather than a single one. It basically compares the two scenarios and calculates user benefits based on trip pattern changes between them. Therefore, for both scenarios to be compared, the following input files need to exist before Summit can be started:

- UBHBW_PK.BIN & UBHBW_OP.BIN
- UBSHP_PK.BIN & UBSHP_OP.BIN
- UBSCH_PK.BIN & UBSCH_OP.BIN
- UBOTH_PK.BIN & UBOTH_OP.BIN
- UBWBNH_PK.BIN & UBWBNH_OP.BIN
- UBNHNW_PK.BIN & UBNHNW_OP.BIN
- UBUNV_PK.BIN & UBUNV_OP.BIN

These files contain zone-to-zone travel information, such as logsums, in-vehicle travel times, trips by mode, and shares by mode. These files should be produced by the mode choice FORTRAN program automatically with the USERBEN variable set to true (T) in the mode choice control files (e.g., mchbw.ctl). These files are stored in the **Interim** folder automatically by the FORTRAN program; that is the place where they have to be in order for the TRM Summit module to run successfully.

2) TAZ-district equivalency file

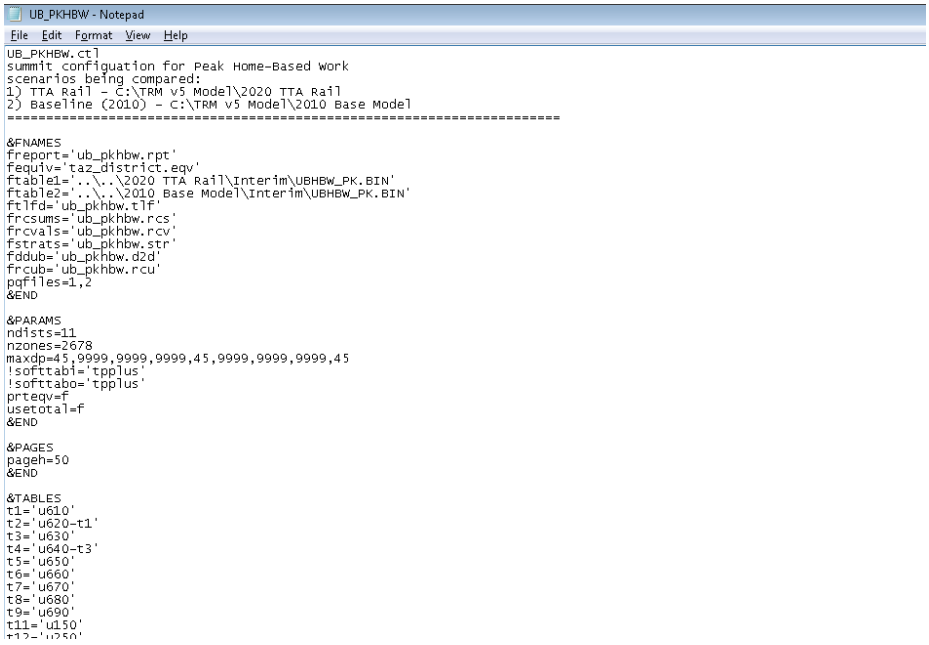
This is the user-supplied TAZ-district equivalency file. It contains at a minimum two columns of data, one with TAZ numbers and the other with corresponding district numbers. One district can have multiple TAZs, but one TAZ can only belong to one district. The number of districts must not exceed 17 as required by the Summit program. The file has to be in the **DBASE** (**.dbf**) file format, and the heading of the column for TAZs must be "**TAZ**" and the heading for districts must be "**District**". Both columns must be the **integer** data type. An example is shown below. As a note, presence of additional columns in the table is fine as long as the required two are there. This file can be stored anywhere on your computer, though a meaningful place is always preferred.



TAZ	DISTRICT	COUNTY
524	2	DURHAM
525	2	DURHAM
526	2	DURHAM
527	2	DURHAM
528	2	DURHAM
529	2	DURHAM
530	2	DURHAM
531	2	DURHAM
532	10	WAKE
533	10	WAKE
534	10	WAKE
535	10	WAKE
536	10	WAKE
537	10	WAKE
538	10	WAKE
539	10	WAKE
540	10	WAKE
541	10	WAKE

3) Control files and template control file

Summit program control files are the places where input and output file names, parameter values, and tables contained in output files are specified. A screenshot of an example control file is shown below. For each combination of trip purpose and time of day, there has to be a control file. This means there should be 14 control files for 7 trip purposes and two times of day for the TRM model. Fortunately, the user does not have to create the control files manually, since all the control files are taken care of by the TRM Summit module automatically based on a template control file. Created control files are automatically saved to the output folder as specified on the Summit User Benefit Analysis dialog box.

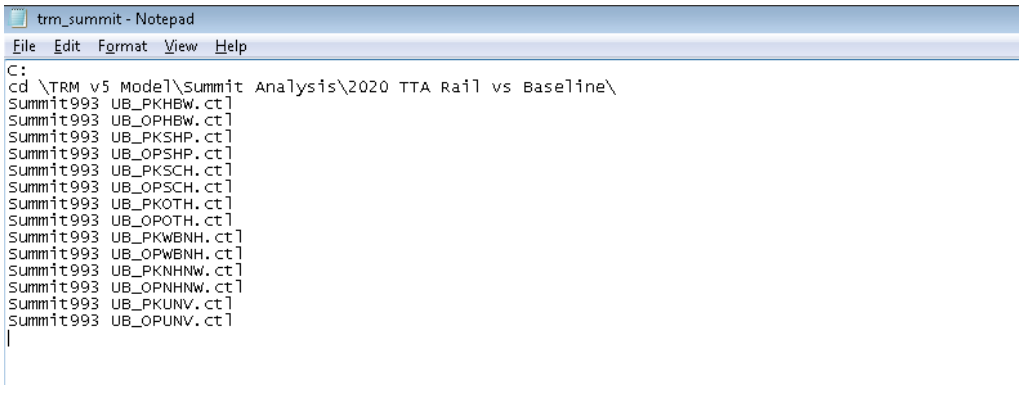


The template control file, always named "trm summit control file template.ctl", is used as a blueprint by the TRM Summit module to produce real control files for use with Summit. These real control files when created incorporate the information from the template as well as that specified on the Summit User Benefit Analysis dialog box. As an input, the template control file must be stored in the **TRM Summit** sub-directory under the TransCAD program files folder. If the sub-directory does not exist, create it. An example path is C:\Program Files\TransCAD\TRM Summit\trm summit control file template.ctl.

For details of the Summit control file, please refer to the User's Guide to Summit published by the FTA.

4) Batch file

The batch file, always named "trm_summit.bat", is also created automatically by the TRM Summit module and stored in the output folder. An example of the contents of the file is shown below.



5) Summit executable file
Like the template control file, the Summit executable file (e.g. summit993.exe or newer version) must be stored in the **TRM Summit** sub-directory under the TransCAD program files folder too.

3.14.3 Output Files

The FTA Summit program produces standard outputs, and all the output files are stored in the output folder as specified on the Summit User Benefit Analysis dialog box. For each combination of trip purpose and time of day, there are a set of output files named in the format of "UB_XXYYY.ZZZ", where UB stands for user benefit, XX is the time of day – PK or OP, and YYY is the trip purpose (which is four-letter for the WBNH and NHNW purposes). ZZZ is the file extension, as described below.

1) Report on control playback and district-to-district summaries
    a. control file specification: freport
    b. output file extension: .rpt
2) Trip length frequency distribution reports
    a. control file specification: ftlfd
    b. output file extension: .tlf
3) Row sums and column sums of TAZ-level user benefit tables
    a. control file specification: frcub
    b. output file extension: .rcu
4) District-to-district aggregations of standard user benefit tables
    a. control file specification: fddub
    b. output file extension: .d2d
5) Stratified TAZ-to-TAZ trip tables
    a. control file specification is fstrats
    b. output file extension: .str
6) Row and column sums from selected tables
    a. control file specification is frcsums
    b. output file extension: .rcs
7) Cell values from selected rows/columns of selected tables
    a. control file specification is frcvals
    b. output file extension: .rcv

For details of these output files, please refer to the User's Guide to Summit published by the FTA.

3.14.4 Execution Procedure

1) Make sure there is a sub-folder called "TRM Summit" immediately under the TransCAD program files folder (where your TransCAD is launched from).
2) Make sure the following two files exist in the TRM Summit sub-folder as mentioned above; one is the Summit executable file (e.g. summit993.exe or new version) and the other is the template control file named "trm summit control file template.ctl".
3) Now click the Summit User Benefit Analysis button on the TRM GUI to pop up the Summit User Benefit Analysis dialog box.
4) Specify all the information needed on the dialog box.
5) Click the Run button on the dialog box to start the program.
6) If the run is successful, a message box indicating "Summit done!" will pop up at the end; otherwise, a "Summit failed!" box will appear. If everything is set up correctly (as described above), you should always have successful runs.

3.14.5 GISDK Macros Invoked

- Dbox "FTASummit"

3.15 When the Delete-Temporary-Files Box Checked

If the "Delete temporary files after model run" box is checked on the model GUI, the following files will be deleted automatically by the program at the end of the model execution. These files are intermediate files containing either zone-to-zone trip interchanges or travel times/skims with one record for each OD pair, stored in the TransCAD binary file format. Since the TRM has over 7 million OD pairs (2678 x 2678), the size of each of these files is really huge. When a model run finishes, the mission of these intermediate files finishes too and therefore they can be safely deleted.

Details about these files can be found in Section 3.5 and Chapter 5.

- Interim\AMLOV.bin and AMLOV.dcb
- Interim\AMHOV.bin and AMHOV.dcb
- Interim\AML.bin and AML.dcb
- Interim\AMP.bin and AMP.dcb
- Interim\AMR.bin and AMR.dcb
- Interim\AMDR.bin and AMDR.dcb
- Interim\AMWP.bin and AMWP.dcb
- Interim\OPL.bin and OPL.dcb
- Interim\OPP.bin and OPP.dcb

- Interim\OPR.bin and OPR.dcb
- Interim\OPDR.bin and OPDR.dcb
- Interim\OPWP.bin and OPWP.dcb
- Interim\WRKPK_PER.bin and WRKPK_PER.dcb
- Interim\WRKPK_IMP.bin and WRKPK_IMP.dcb
- Interim\SHPPK_PER.bin and SHPPK_PER.dcb
- Interim\SHPPK_IMP.bin and SHPPK_IMP.dcb
- Interim\SCHPK_PER.bin and SCHPK_PER.dcb
- Interim\SCHPK_IMP.bin and SCHPK_IMP.dcb
- Interim\OTHPK_PER.bin and OTHPK_PER.dcb
- Interim\OTHPK_IMP.bin and OTHPK_IMP.dcb
- Interim\WBNHPK_PER.bin and WBNHPK_PER.dcb
- Interim\WBNHPK_IMP.bin and WBNHPK_IMP.dcb
- Interim\NHNWPK_PER.bin and NHNWPK_PER.dcb
- Interim\NHNWPK_IMP.bin and NHNWPK_IMP.dcb
- Interim\UNVPK_PER.bin and UNVPK_PER.dcb
- Interim\WRKOP_PER.bin and WRKOP_PER.dcb
- Interim\WRKOP_IMP.bin and WRKOP_IMP.dcb
- Interim\SHPOP_PER.bin and SHPOP_PER.dcb
- Interim\SHPOP_IMP.bin and SHPOP_IMP.dcb
- Interim\SCHOP_PER.bin and SCHOP_PER.dcb
- Interim\SCHOP_IMP.bin and SCHOP_IMP.dcb
- Interim\OTHOP_PER.bin and OTHOP_PER.dcb
- Interim\OTHOP_IMP.bin and OTHOP_IMP.dcb
- Interim\WBNHOP_PER.bin and WBNHOP_PER.dcb
- Interim\WBNHOP_IMP.bin and WBNHOP_IMP.dcb
- Interim\NHNWOP_PER.bin and NHNWOP_PER.dcb
- Interim\NHNWOP_IMP.bin and NHNWOP_IMP.dcb
- Interim\UNVOP_PER.bin and UNVOP_PER.dcb

Chapter 4 – Input File Preparation

This chapter instructs the user how to prepare those input files that often vary by planning model scenario and need manual preparation. It does not cover any other input files, contents of which do not change frequently across different model scenarios. Special consultation with the TRM Service Bureau is recommended if making changes to those files is needed.

A list of the input files that often need to be prepared by the model user is provided below.

1) Universe highway geographic file (Highway.dbd) and transit route system file (transit.rts) in the Input\Master Geography\ directory;
2) Socioeconomic data file (SE_2010.bin) in Input\SEData\;
3) Auto terminal time matrix (Auto_TerminalTime.mtx) in Input\Parameters\;
4) E-E trip matrix (EETrips_2010.mtx) in Input\Extp\;
5) Timed transfer wait time tables for both am peak and off peak (TimedTransferWaitTime_AM.bin & TimedTransferWaitTime_OP.bin) in Input\Transit\;
6) Mode choice FORTRAN program control files (mchbw_op.ctl, mchbw_pk.ctl, etc.) in Input\Programs\.
7) External transit trip matrix files (Transit_External_PK.mtx and Transit_External_OP.mtx) in Input\Transit\.

4.1 Universe Highway Network Geographic File and Transit Route System File

Users have two options on the preparation of highway and transit networks. The first is to use the Map Editing toolbox and Route System toolbox provided by TransCAD. These two toolboxes provide all kinds of functions that will be needed in the creation or revision of a highway or transit network. However in some cases the second option can save users a lot of time. The second option is to use Network Manager, a network editing and management tool developed by the TRM Service Bureau (TRMSB). Users need to use Network Manager to create a true universe line layer first, which includes all base year links and all future year projects. Once the true universe line layer is established, users can create a network by simply selecting which future year projects should be included. That is to say, all the future year projects only need to be coded once and they can be included in any networks to avoid time-consuming repetitive coding efforts. Network Manager is a powerful tool and it can be used in the preparation of both highway network and transit network.

It is suggested that TransCAD toolboxes should be used when users want to revise the network with minor changes; and Network Manager should be used when users want to create a totally new network or revise the network with major changes. It is regarded as a major change if users will need more than 1 day to complete the network preparation using TransCAD toolboxes.

4.1.1 Preparation of Networks Using TransCAD Toolboxes

TRMSB created networks for year 2005, 2015, 2025, and 2035. Sometimes users need to make some minor changes to such networks to get the network they want to test on, such as editing the highway link attributes, adding/removing several highway links, or changing the attributes or routing of transit services. In such cases, it is suggested to use TransCAD toolboxes to prepare the networks. This section describes how to make such changes and lists some useful notes. Even if users are very familiar with the Map Editing toolbox and Route System toolbox provided by TransCAD, the notes will be very helpful.

Any network revisions should be made on the geographic files under the directory of \Input\Master Geography\. If users make any geographic changes to the highway network (adding/removing links, revising the shape of the links), users need to make sure that the transit network is still working on the revised highway network. For detail, please refer to Section 4.1.1.3.

4.1.1.1 How to Edit Highway Link Attributes

1) Open highway.dbd from "Model Folder\Input\Master Geography\".
2) It's suggested to show the node layer so that the start and end points are clear (Hint: click the  button on the menu). Make sure to make the line layer as the active layer after show the node layer.
3) Zoom to the link that will be edited using  or  tools on the toolbox, usually located on the right side of the screen.
4) Click the  button on the toolbox, and then click the link. A dataview window will pop up. In this window, the link attributes can be modified by double click on the attributes that need to be modified. Only the second column (the one with grey and white background) is editable. To see how these attributes are coded, please refer to the table in Section 5.1.

Note:

If users are sure that the combination of link attributes has a corresponding facility type, , users can skip the following steps. Otherwise, users need to open the facility type lookup table to check if the new combination of attributes can find its facility type; because if not, TRM model run could stop and give an error message in the "Create Network" step. The facility type lookup table, usually named as FacilityType.bin, is located at "Model Folder\Input\Parameters\". In the facility type lookup table, a facility type is determined based on the first 5 columns, that is, "LANES", "POSTSPD", "MED_LT", "SIGNLDNS" and "SPECIAL".

If the new combination of attributes cannot find it facility type, users can try to modify "SIGNLDNS" or "MED_LT" to match a record in the facility type lookup table. If no such modifications are reasonable, a new combination of attributes has to be added into the facility type lookup table following the instructions below.

1) Open the facility type lookup table
2) Click "Edit"→ "Add Records" on the menu
3) Type in the number of records that user want to add in the "Add Records" window
4) Type in the new combination of attributes in the first 5 columns

5) Users have to give the new combination of attributes an existing facility type number, because otherwise, users need to expand the speed and capacity lookup table. For example, users want to add a facility with the following attributes:

LANES=1, POSTSPD=55, MED_LT=1, SIGNLDNS=2 and SPECIAL=99

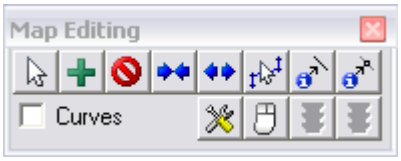
Suppose this combination is not currently in the facility lookup table, but there is a very close combination of

LANES=1, POSTSPD=55, MED_LT=1, SIGNLDNS=1 and SPECIAL=99

If the users think "2-3 signals per mile" and "less than 2 signals per mile" do not make too much difference as to the facility speed and capacity, user can use the R_FACTYPE and R_BUS_SPEED_CAT numbers from the second combination for the first combination.

4.1.1.2 How to Add/Delete Highway Links

1) Open highway.dbd from "\Input\Master Geography\";
2) It's suggested to show the node layer so that the start and end points are clear (Hint: click the  button on the menu). Make sure to make the line layer as the active layer after show the node layer;
3) Open Map Editing Toolbox by clicking "Tools"→ "Map Editing"→ "Toolbox" (or by clicking  button). If "Toolbox" menu item is grey, make the link layer as the active layer. The Map Editing Toolbox is as follows.



4) The functions of each tool are briefly described below. For more detail, please refer to TransCAD User's Guide.

Tool	Name	How to use it
	Modify	Click on a line to show the editing handles; drag handles to edit.
	Add	Click on the map to add a new line.
	Delete	Click on a line to delete it.
	Join	Click on an endpoint where exactly two lines meet to join the lines.
	Split	Click on a shape point to split the line in two, or click on an endpoint to separate lines from each other.
	Configure Settings	Click to change settings
	Green Light	Click to save your edits
	Red Light	Click to cancel your edits

Note:

- Please make sure the combination of link attributes can find a match in the facility type look up table as described in Section 4.1.1.1.
- The following attributes are required for model run and must be filled, "Dir", "FCLASS", "FCGroup", "Direction", "LanesAB", "LanesBA", "Med_Lt", "PostSpd", "SignlDns", "Special", "Mode" and "AreaType". It is also suggested to fill "County" for AQ analysis.
- Before any join/split action (such as using "Join", "Split" and "Add" Tool), make sure configuring geographic editing settings first. "Add" could be a join/split action because if the starting or ending point of the new line is close enough to any other line in the layer, TransCAD automatically split the existing line to make sure the existing line and the new line meet. The geographic editing settings will tell TransCAD how to deal with the link attributes for join/split actions. For example, when a link is split into two links, you might want to assign the same road name to the two new links but assign proportionally the link length.

  To configure geographic editing settings, click  then click the "update" button in the "Configure Geographic Editing Settings" window.

- After a new link has been added, please make sure it has been connected to other links as expected.
- Which way is AB and which way is BA?

  Each link has a topology direction, pointing from the starting point to the ending point when the link is created. Along the topology direction is AB and against the topology direction is BA.

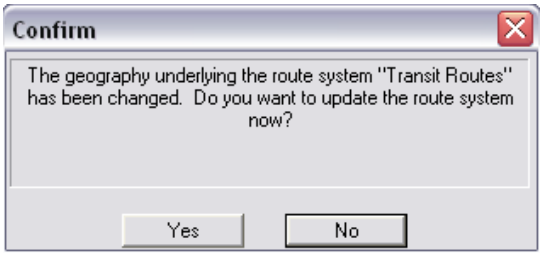
  - Dir=0 means this link is a 2-way link, so LanesAB>0 and LanesBA>0.
  - Dir=1 means this link is a 1-way link and the flow direction is the same as the topology direction, so LanesAB>0 and LanesBA=0.
  - Dir=-1 means this link is a 1-way link and the flow direction is against the topology direction, so LanesAB=0 and LanesBA>0.

  It is important to make sure that the combination of Dir, LanesAB and LanesBA makes sense. In a TRM model run, whenever the user sees the error message of "referenced memory illegally", the first thing to check is whether Dir, LanesAB and LanesBA are consistent.

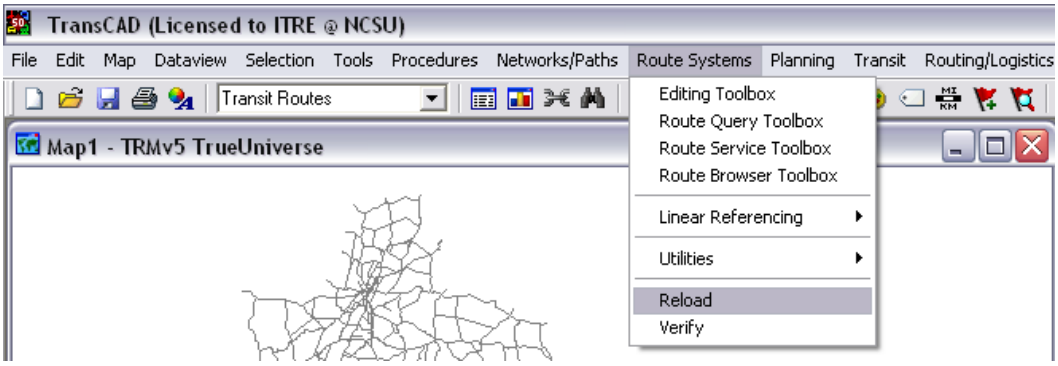
  To show the topology or flow direction, click the  button on TransCAD main menu, choose the line layer and click "Style" button, then choose the "Arrowheads" in the "Style" window.

4.1.1.3 How to Check if Transit Network Messed Up by Highway Network Editing

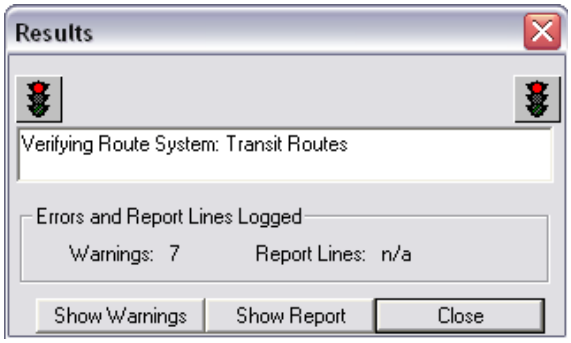
1) Keep a copy of transit network before any geographic editing (such as add/delete links). Copy the whole folder "\Input\Master Geography\" to another address.
2) Open transit.rts from "\Input\Master Geography\". (Note: Open the file as file type of "Route System (*.rts)" instead of "Geographic File (*.cdf;*.dbd)". Don't open *.rts files from "\Input\Transit\".
3) If any geographic editing has been made, a popup window will show up when you open the transit.rts file as follows. Click "Yes" button to update the route system.



4) Choose "Route Systems" → "Reload" to reload the route systems.



5) Choose "Route Systems" → "Verify" to verify the connectivity, link direction and route stops.
6) If there are any problems in the transit route system, TransCAD will give a warning window.



7) To check the error messages, click "Show Warnings". Internet Explorer will be opened. Scroll down to the end to see the error messages. An example of the error message is listed below.

```
TransCAD 4.8 session started by cwang on TRM159 at Thu Jan 03 14:46:33 2008
          Thu Jan 03 14:57:02 2008
               Route 187 is not connected near link 21818
               Route 188 is not connected near link 10786
               Route 189 is not connected near link 10786
               Route 190 is not connected near link 21818
          Verifying Route System: Transit Routes
               Route 190 is not connected near link 21818 .  Click OK to continue.

Reference info: tcroute, 1482, 0.
```

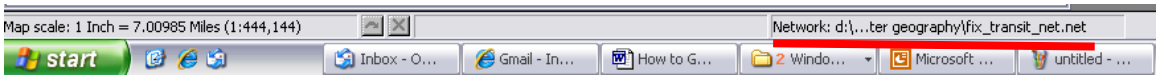
In this example, four routes are not connected near link 10786 and 21818. Users have to use the Route System Editing Toolbox to fix these problems. For more detail, please refer to Section 4.1.1.5.

4.1.1.4 How to Edit Transit Route Attributes

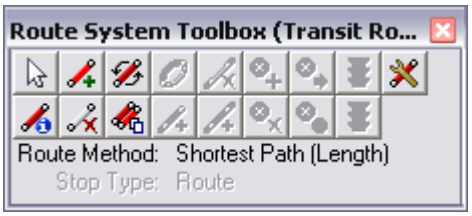
1) Open transit.rts from "Model Folder\Input\Master Geography\".
2) Make sure the transit route layer is the active layer. Open the dataview of the transit route layer by clicking on  in the menu.
3) Users can edit any cell in the dataview by clicking a cell and entering the new value. To see how these attributes are coded, please refer to the table in Section 5.1.

4.1.1.5 How to Make Geographic Changes to Transit Route System

1) Open transit.rts from "Model Folder\Input\Master Geography\".
2) Choose "Procedures"→ "Networks/Paths" to activate "Networks/Paths" menu (if there is a check sign before "Networks/Paths" already, skip this step).
3) Create a network file by choosing "Networks/Paths"→ "Create".
4) In the "Create Network" window, don't change anything, just click "OK" button to save the network file. After creating the network file, the network file will be opened automatically although users cannot see any changes but a line at the bottom of the window.



5) Choose "Route Systems" → "Editing Toolbox" to open Route System Toolbox.



6) The functions of most frequently used tools are briefly described below. For more detail, please refer to TransCAD User's Guide.

Tool	Name	How to use it
	Select	Selects one or more routes or physical stops
	Delete Section	Deletes a section of a route
	Add Section	Inserts a new section into a route
	Add a Stop	Adds a stop to a route
	Move a Stop	Moves a stop on a route
	Set Options	Sets route system edit options
	Green Light	Saves changes you make to a route
	Red Light	Discards changes you make to a route

7) Choose "Route Systems" → "Reload" and "Route Systems" → "Verify" to check if the transit network is working properly.

Note:

Before adding a section to connect the disconnected route with "Add Section" tool, it's suggested to change the edit options using "Set Options" tool. It's suggested to use "Click Segments" method and uncheck "Editing uses route direction" so that users can just click the links one by one to define the route section without considering if it's along or against the route direction (TransCAD will determine the direction based on the rest of the route).

4.1.2 Preparation of Networks using Network Manager

Network Manager is developed for creating and managing different scenarios of highway and transit networks for the Triangle Regional Model.

The tool consists of two major components, one for highway network management and the other for transit network management. The highway tool works on the true universe line layer, while the transit tool works on the scenario highway network, which can be created using the highway tool.

The highway tool consists of two components, one for creating and managing highway projects, and the other for creating and managing scenario highway networks. The former is called "Create Project" and the latter is called "Create Scenario". Examples of highway projects are adding new highway links, closing highway links, changing the link attributes (such as adding a lane), adding centroid connectors, or adding transit only links (including the light rail lines). Each highway project can be regarded as a group of changes to the true universe line layer, and it is the basic unit that can be used to build up a scenario highway network. A scenario highway network includes not only highway links, but also some links serving as underlying lines for transit routes (such as light rail lines). It will be used as the "highway.dbd" under the folder of "Master Geography" in the TRM model. It can be created by selecting and putting the highway projects onto the base year highway network.

The transit tool also consists of two components. The first one is called "Create Transit Route System". It creates and manages transit routes one by one. It should be used when the underlying scenario highway network is not significantly changed. Otherwise, the second component, "Re-create Transit Route System", should be used.

TRMSB created "User's Guide for the TRM Network Manager", which describes the functions and procedures of Network Manager in great detail. So this section only focuses on the concept, basic ideas, and how it is used to develop transit networks for the TRM model. Users need to refer to "User's Guide for the TRM Network Manager" for specific functions and procedures.

4.1.2.1 Highway Tool

The highway tool works on the true universe line layer. A true universe line layer for TRM v5 is maintained by TRMSB. It includes the base year network (year 2010), all 2035 LRTP projects, and some of the CTP projects. It also includes some highway projects for transit purposes, which serve as underlying lines for future transit routes.

Network Manger is a very powerful tool and users can use it to complete the network preparation in any ways they want. Figure 4-1 shows a typical flow chart for using Network Manger to create a scenario highway network. In Figure 4-1, the words in quotation marks are all functions provided in Network Manager. Users need to refer to "User's guide for the TRM Network Manager" for specific functions and procedures.

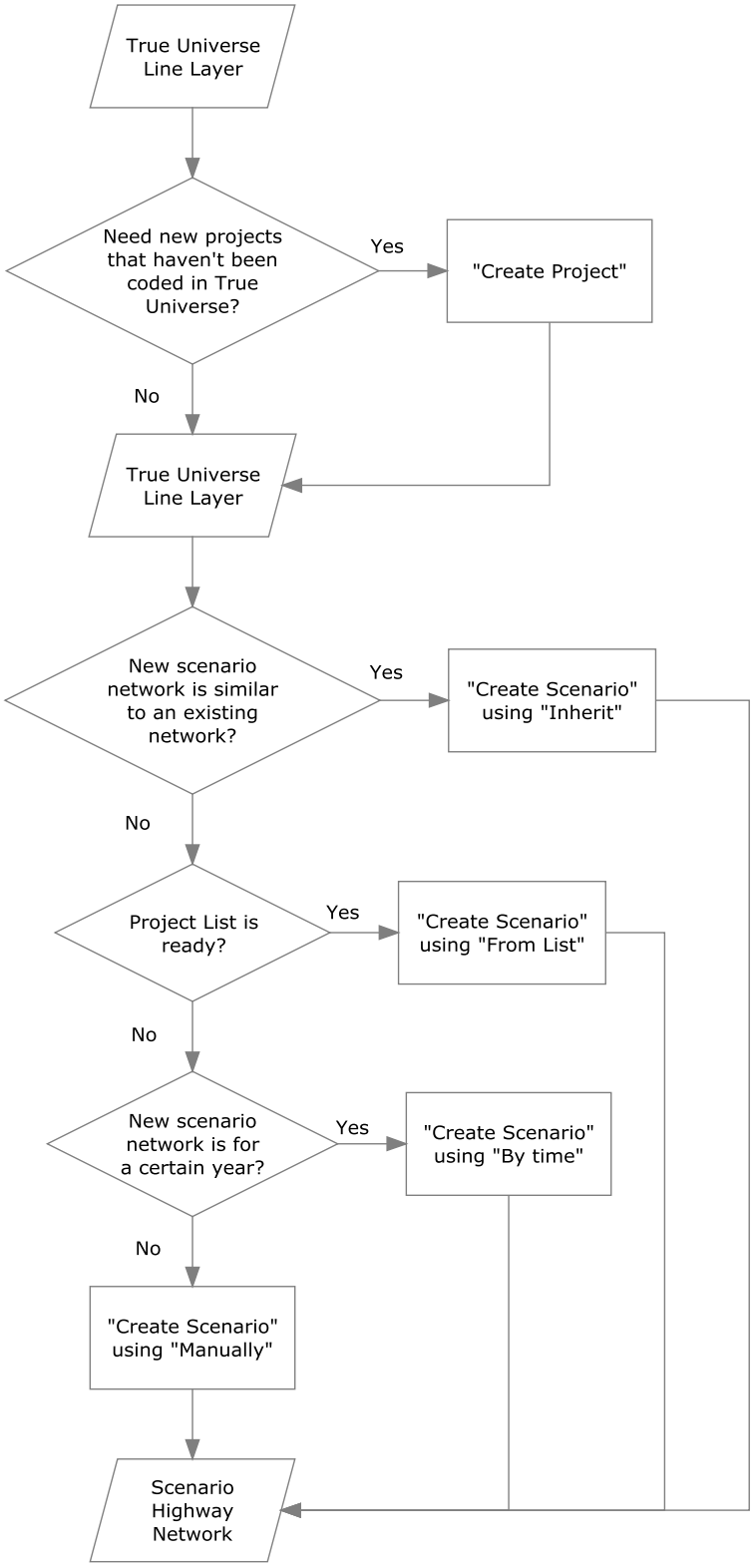
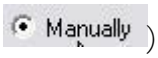
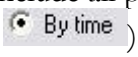
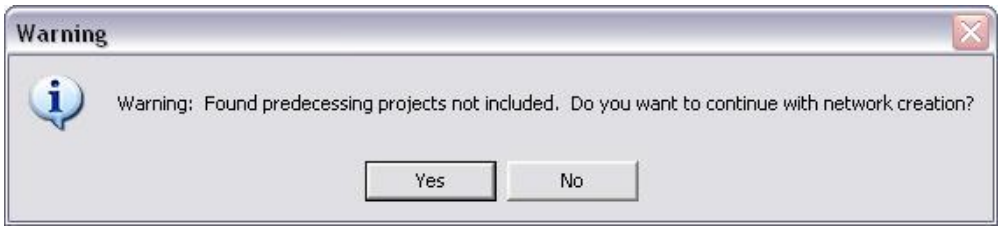


Figure 4-1 Flow Chart for Using Network Manger to Create a Scenario Highway Network

Figure 4-1 shows that if the true universe line layer does not include the projects users want to test, users need to code the projects in the true universe line layer first by using the "Create Project" function (the icon is ) in Network Manager. Users have several choices with regard to creating scenario highway network (the icon is ). If the new scenario network is similar to an existing network whose "Project List.bin" file exists, users can "inherit" (the icon is ) the list of projects from the existing network and make necessary changes by "manually" (the icon is ) selecting which projects should be included or removed. If users can create an ID list of projects that users want to include in the scenario highway network, users can use the "From List" (the icon is ) function. If users want to include all projects before a certain year (such as year 2017), users can use the "By time" (the icon is ) function. Users can always modify the list of projects using the "manually" function. After clicking the "Create" button, a scenario highway network (named "highway.dbd") is created, as well as "Project List.bin" that is a list of projects included in this scenario highway network.

A common warning message in the creation of scenario highway network is shown below.



This warning message is related to predecessors. A project could have predecessors, which are the projects without which building the current project is impossible or makes no sense. A typical situation is that a project has multiple phases and phase II cannot be built until phase I is completed. After clicking the "No" button on the warning message, Network Manager will show the project ID of the predecessors.

When selecting the projects to be included in the scenario highway network, users need to pay special attention to the transit-related projects. They could be transit only links (such as community roads that are too small to be included in the highway network but used by local buses), rail lines, or park and ride links. Although autos will not run on those links, they are important underlying lines to build the transit network. These transit-related projects are normally not LRTP projects, and users need to make sure they are included in the scenario highway network.

In the current true universe line layer, some general coding rules have been followed to assign project IDs. Although these rules are not followed for all projects due to some historical reasons, these rules can help users get some information from the project IDs. The major coding rules are listed in Table 4-1.

Table 4-1 General Project ID Coding Rules

Project ID coding rule	Example	Notes
Numbers only	76, 77.1	DCHC LRTP projects
"A"+numbers(+letters)	A10, A135a	CAMPO LRTP projects (excluding freeway projects) in Wake County
"F"+numbers(+letters)	F3, F44a	CAMPO freeway LRTP projects in Wake County
"Frnk"+number	Frnk1	CAMPO LRTP projects in Franklin County
"Grnv"+number(+letters)	Grnv105, Grnv84c	CAMPO LRTP projects in Granville County
"Hrnt"+number	Hrnt3	CAMPO LRTP projects in Harnett County
"Jhns"+number(+letters)	Jhns1a, Jhns7	CAMPO LRTP projects in Johnston County
"CAMPO"+number	CAMPO01	CAMPO projects that are not in the LRTP project list
"DCHC"+number	DCHC02	DCHC projects that are not in the LRTP project list
SnDns05		Changes of signal density based on 2005 field data collection
Speed05		Changes of posted speed based on 2005 field data collection
Lanes05		Changes of the number of lanes based on 2005 field data collection
MedLT05		Changes of median/left turn information based on 2005 field data collection
SpeedAdj		Speed adjustment due to lane use (reduce the speed limit considering the urbanization in year 2020)
"FLY"+number	FLY1	Flyover project on I-40 for transit purpose (coded by MAB)
"STAC"+number(+letters)	STAC4, STAC17C	Underlying lines for transit services planned in STAC (coded by MAB)
Transit agent+number(+letters)	CAT8C, CHT-CL	Underlying lines for transit services in this transit agent

4.1.2.2 Transit Tool

The transit tool works on the scenario highway network, which can be created from the highway tool. A highway network from other sources or methods can also serve as a scenario highway network. For example, users can follow the instructions in Section 4.1.1 to modify a highway network using TransCAD toolboxes. The modified network can also be used as the scenario highway network.

Network Manger is a very powerful tool and users can use it to complete the network preparation in any ways they want. Figure 4-2 shows a typical flow chart for using Network Manger to create a transit network. In Figure 4-2, the words in quotation marks are all functions provided in Network Manager.

Users need to refer to "User's Guide for the TRM Network Manager" for specific functions and procedures.

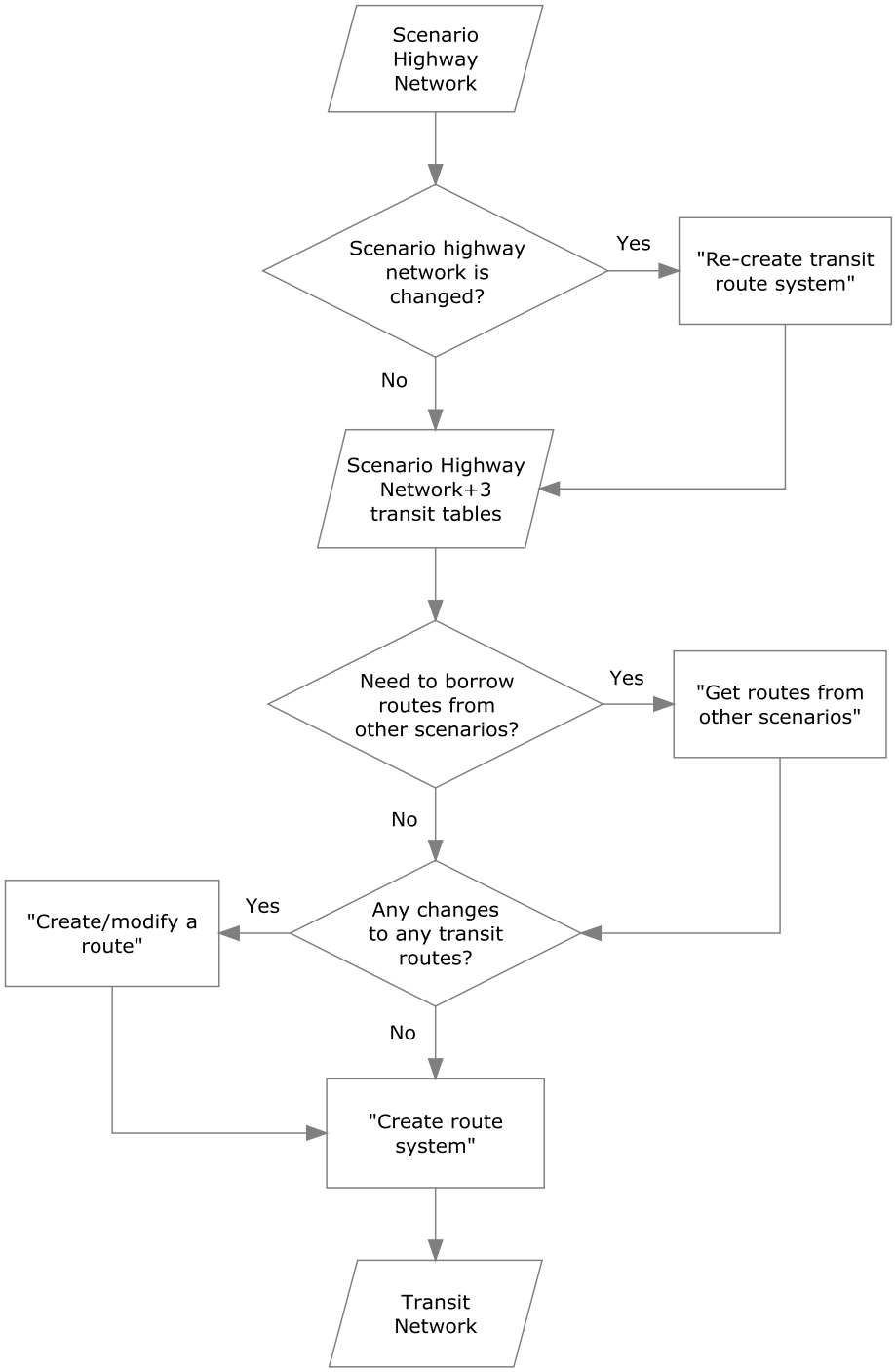
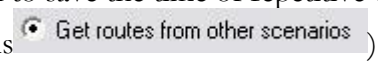
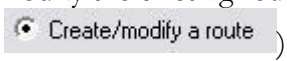


Figure 4-2 Flow Chart for Using Network Manger to Create a Transit Network

Figure 4-2 shows that if the scenario highway network has not been modified, users can go directly to the step of borrow routes. TRMSB has coded about 750 transit routes. These routes can be borrowed to any scenario highway network to save the time of repetitive coding work by using the "Get routes from other scenarios" (the icon is 

) function. Users can code new routes, remove or modify the existing routes, or change route attributes by using the "Create/modify a route" (the icon is 

) function. Whenever the routes are changed, three transit-related tables are modified to record the changes. The tables are "Route_Table.bin", "Link_Table.bin" and "Stop_Table.bin". In the final step, "create route system" (the icon is 
) , Network Manager creates a transit network based on the three transit-related tables and the scenario highway network.

Figure 4-2 shows that if the scenario highway network has been modified, users can use the "re-create transit route system" (the icon is 
) function. To use this function, users need an existing scenario highway network and the three corresponding transit-related tables. The "re-create transit route system" function modifies the three transit-related tables to fit the new scenario highway network. "Create route system" can then be used to create a transit network.

It is possible that TRM detects errors in the highway or transit network in the "Create Network" step and the model stops. In this case, users need to follow the error message to modify the route system in Network Manager and re-create the transit network. This process could be time-consuming since it usually takes about 2 hours for TRM to run from the first step ("Create Walk Access") to the point where it fails. Users should try to fix all the errors at one time.

4.2 Socioeconomic Data File

Socioeconomic data (in \Input\SEData\) normally are provided by local planners. To understand what type of SE data are needed in the TRM, please refer to Section 5.1.

If no enough information is available or the schedule is very tight, SE data can also be created by interpolation if users think such SE data can meet the modeling need. Users need SE data for two model years (e.g. 2015 and 2025) to interpolate the SE data for a certain model year (e.g. 2017). Please refer to item 3) of Section 4.4 for the interpolation method.

TRMSB developed a GISDK script, "TRM SE Check and Post-processing Tool", to help the preparation of socioeconomic data. Users can apply this tool to

1) Check if the relationship of the fields in the new SE data is reasonable
2) Update area type for each Traffic Analysis Zone (TAZ) based on the new SE data
3) Create terminal time matrix for auto trips based on new area type

The first and second functions are related to the preparation of SE data and are introduced here. The third function is introduced in Section 4.3. For more details, users can refer to the "User's Guide for TRM SE Check and Post-processing Tool".

The tool checks the SE data based on the following criteria. If any errors are found, an error message pops out with the type of error. Users need to go into the SE data file to fix the problems.

- No data fields should be negative
- Household, population and mean income for a TAZ should all be 0, or none of them is 0
- Each off-campus student is counted as one person in population; therefore the number of off-campus student should always be less than or equal to population
- The average household size for a TAZ should either be 0 or greater than 1
- The average household size for a TAZ should not be greater than 5 if that TAZ has at least 6 households
- If a TAZ has any kinds of special generators, the sum of industry percentage, retail percentage, highway percentage, office percentage and service percentage should be 100
- The percentage of commercial vehicle trips in ADT (PCTAV) should not be greater than 100
- The percentage of EE trips in auto trips (PCTAUTOEE) should not be greater than 100
- The percentage of EE trips in commercial vehicle trips (PCTCVEE) should not be greater than 100

The area type field "ATYPE" in SE data file is updated automatically after running "TRM SE Check and Post-processing Tool". It is calculated based on the following equation.

$$LUD_i = \frac{DWELLUNIT_i + UBEDS_i + \frac{\sum_j TotalHH_j}{\sum_j TotalEmp_j} \times TotalEmp_i}{Area_i}$$

If $LUD_i \geq 2000$, Area Type for TAZ i is 1,

If $150 \leq LUD_i < 2000$, Area Type for TAZ i is 2,

If $LUD_i < 150$, Area Type for TAZ i is 3.

Where,

LUD_i is Land Use Density for TAZ i,

$Area_i$ is the area for TAZ i,

$TotalHH_j$ is Total Household (HH+HH_STUD) for TAZ j,

$\sum_j TotalHH_j$ is Total Household for all the region,

$TotalEmp_j$ is Total Employment (IND+RET+HWY+OFF+SER+SPUNIV +SPSC+ SPAIR +SPHOSP) for TAZ j,

$\sum_j TotalEmp_j$ is Total Employment for all the region.

4.3 Auto Terminal Time Matrix File

Auto terminal time matrix (Auto_TerminalTime.mtx in Input\Parameters\) should be updated once SE data are modified, because auto terminal times change when the area type of either origin TAZ or destination TAZ changes. The matrix can be created automatically by running the "TRM SE Check and Post-processing Tool". The following formula is used to create the matrix.

$$ATT_{ij} = TOTT_{i} + TDTT_{j}$$

Where,

ATT_{ij} is Auto Terminal Time for auto trips between Origin TAZ i and Destination TAZ j,

$TOTT_{i}$ is Trip Origin Terminal Time for TAZ i, as shown in Table 4-2,

$TDTT_{j}$ is Trip Destination Terminal Time for TAZ j, as shown in Table 4-2.

Table 4-2 Trip Origin and Destination Terminal Time for Different Types of TAZs

TAZ Type	Description	Trip Origin Terminal Time	Trip Destination Terminal Time
1	Parking Restriction=1 (CBD/University, parking severely restricted)	2	4
2	Parking Restriction=2 (CBD/University, parking moderately restricted)	2	3
3	ATYPE=1 (LUD >=2,000, Urban)	2	2
4	ATYPE=2 (LUD>=150 and <2,000, Suburban)	1	2
5	ATYPE=3 (LUD <150, Rural)	1	1

Parking restriction information is listed in file "Parking_Restriction_TAZ.dbf", which comes along with the "TRM SE Check and Post-processing Tool". Parking restriction has a higher priority than area type in the determination of TAZ type. For example, if a TAZ has ATYPE=2 but also has Parking Restriction=2, this TAZ is a Type 2 TAZ. Therefore it has Trip Origin Terminal Time of 2 minutes and Trip Destination Terminal Time of 3 minutes.

4.4 Through (E-E) Trip Matrix File

Three approaches to deriving through trip matrices are introduced as follows. While the first one is considered to be a better approach, the other two are not bad options when a quick turnaround is essential.

1) Deriving from Traffic Volumes at External Stations

In the socioeconomic data table (in the Input\SEData\ directory) of your working scenario, find these fields: ADT, PCTCV, PCTAUTOEE, and PCTCVEE. They respectively represent the two-way total traffic volume, the percent of commercial vehicles in the total traffic, the percent of passenger auto

through traffic in the total passenger auto traffic, and the percent of commercial vehicle through traffic in the total commercial vehicle traffic, at each external station.

For each external station, derive its two-way through traffic volume by vehicle type using the formula below:

Passenger auto through traffic = ADT * (100 – PCTCV)/100 * PCTAUTOEE/100
Commercial vehicle through traffic = ADT * PCTCV/100 * PCTCVEE/100

Divide the through traffic volumes as derived above by 2 to get the number of origin ends and destination ends, assuming the two numbers are the same for each external station, which is not a bad assumption in general.

Use the base year through trip matrix, which you can find in the Input\SEData\ directory of the 2005 model, as a seed matrix and use the through traffic volume as derived above as zonal origin and destination marginal totals, apply the TransCAD Fratar procedure to get the through trip matrix for your working scenario. This step needs to be carried out twice, one for passenger autos and the other for commercial vehicles.

As a note, the Fratar procedure is just a pure mathematical operation, which adjusts matrix cell values to match matrix marginals but does not consider anything from the engineering perspective. A well-known weakness of the Fratar procedure is that, if the value of a cell in the seed matrix is zero (i.e. no through trip interchanges between that specific external station pair in the base year), that cell will still have a value of zero after the matrix fratared. In reality this might not be true, as there might have some trip interchanges in the future due to travel pattern changes. Therefore, you need to do some reasonableness checks on the results output from the procedure.

More sophisticated approaches will be developed in version 5 of the TRM to derive through trip matrices, which will also eliminate the need for manual preparation of this file.

2) Deriving by Applying a Uniform Growth Factor

The uniform growth factor method applies a single growth rate for the entire study area. A new through traffic matrix can be obtained by applying the uniform growth factor to each cell in the base year through traffic matrix. The value of the growth factor can be determined based on professional judgment of the user, some general rules of thumb, or other reasonable methods. For example, an annual increase of 2 – 3% is not a bad assumption for traffic volume forecasting. Therefore, a 2015 through traffic matrix may be obtained by multiplying the 2005 base year through traffic matrix by $(1 + 0.02)^{10}$, assuming an annual increase of 2%.

3) Deriving by Interpolation

If you have through trip matrices from two known scenarios (e.g. 2005 and 2035) and you are confident that the one you are working on (e.g. 2015) has a linear relationship with the two and should have values somewhere in the middle, you may want to try the interpolation approach. To do the interpolation, you need to have a weight associated with either of the known matrices, which represents the contribution of the known matrices to the new matrix to be derived. As a note, the two weights

have to sum up to 1 or 100%. For example, assuming the weights of the two known matrices are 0.6 and 0.4, respectively, the new matrix will be derived as follows:

New through trip matrix = first known matrix * 0.6 + second known matrix * 0.4

Determination of the weights can be based on your professional judgment or other reasonable assumptions. A simple and quick one can be using the length of the intervals between years; for example, if you are forecasting for year ***b*** by interpolating the known matrices for years ***a*** and ***c***, where $a < b < c$, the weight can be derived as follows:

$$\text{Weight}_a = (c - b)/(c - a)$$
$$\text{Weight}_c = (b - a)/(c - a)$$

By using this formula, it has been implicitly assumed that the growth rate is constant throughout the years without compounding. Again, this procedure needs to be carried out separately for passenger autos and commercial vehicles.

4.5 Timed Transfer Wait Time Table Files

To reduce transfer times between certain transit routes, transit agencies may coordinate the operation schedules for those routes. Timed transfer wait time tables (TimedTransferWaitTime_AM.bin & TimedTransferWaitTime_OP.bin) are the places where the user can specify such coordination. The tables have seven data fields in each, namely, FROM_LINE, TO_LINE, BOARD_STOP, WAIT_TIME, FROM_NAME, TO_NAME, and BOARD_NODE. The user needs to manually code the last four fields and the model will fill the first three fields automatically during model execution based on the information supplied in the last four.

For each record in the table:

1) The FROM_NAME field should contain the name of the route travelers transfer from, and similarly, the TO_NAME field should contain the name of the route travelers transfer to. The names of the routes should match exactly those in the transit route system file (transit.rts) and are case sensitive.
2) Timed transfer wait time should be in the unit of minutes and go to the WAIT_TIME field.
3) The user also needs to identify the stop location where the travelers board the next transit route, and in the BOARD_NODE field specify the ID of the node (<u>not</u> stop ID) that lies under the stop in the model network.
4) Based on all the information provided in 1), 2), and 3), the model will find route IDs that correspond to the route names in the FROM_NAME and TO_NAME fields and fill them in the FROM_LINE and TO_LINE fields, respectively. The model will also find stop ID on the TO_LINE route that is located at the node as specified in the BOARD_NODE field. It then overwrites the transfer time calculated by TransCAD with the value specified in the WAIT_TIME field for that specific route pair at that specific boarding stop.

4.6 Mode Choice FORTRAN Program Control Files

Of the three sets of FORTRAN program control files in the TRM (i.e. one set for trip generation, one for trip distribution, and one for mode choice), only the mode choice set may need modifications, depending on the specification of modes in your working scenario relative to the base year 2005 model. Control files are used with one for each combination of trip purpose and time of day. Therefore, modifications should be evaluated carefully with respect to trip purposes as well as times of day.

The most possible modifications may include:

1) If HOV lanes are available, you need to turn the value of parameter HWY2P from F to T (F means no/false and T means yes/true). Also make sure a value for parameter FSKA2P has been specified in the control file, for example, FSKA2P ='..\..\Interim\AMHOV.BIN'. The value is the name and path of a highway skim matrix for high occupancy vehicles in TransCAD's binary file format (see Section 3.3 for the more information about HOV skim files). The TRM currently can only handle the situations where HOV lanes require minimal vehicle occupancy of 2 persons but not 3 persons yet, so leave HWY3P = F unchanged.

2) Even if you have HOV lanes in your working scenario, leave HOV = F unchanged. This parameter controls if HOV is treated as a separate choice in the model. The TRM chooses not to use HOV as a separate choice.

3) If express buses are available as a mode, set the value of parameter EXPBUS = T; otherwise F. When EXPBUS = T, you must specify a value for parameter FSKEXP, for example, FSKEXP ='..\..\Interim\AMP.BIN', which is an express bus skim matrix (see Section 3.3 for more information about the express bus skim files). In addition, you must also specify the constants for the express bus utility functions for the 5 socioeconomic strata. These constants are stored respectively in parameters KEXP(1), KEXP(2), KEXP(3), KEXP(4), and KEXP(5) in the control file. Values of these constants have been calibrated by TRMSB using the 2006 Triangle Household Travel Survey data as well as the Transit On-board Survey data. They vary by trip purpose and time of day and can be found from the 2010 model as included on the data CD.

4) If rail is available as a mode, set the value of parameter RAIL = T; otherwise F. When RAIL = T, you must specify a value for FSKRAL, for example, FSKRAL ='..\..\Interim\AMR.BIN', which is a rail skim matrix (see Section 3.3 for more information about rail skim files). Unlike the express bus, you don't need to specify the constants for the rail utility functions, as they take the default value of zero in the TRM.

4.7 CREATING POST 2005 EXTERNAL TRANSIT TRIP MATRIX

4.7.1 Assumptions

The current shortcut described in this memo is designed based on the following assumptions:

1) The external transit trips would be always produced from those and only those external stations that had observed transit trips in the 2006TOB. I.e. No other external station would produce any in the future, and all of the current stations would always produce some in the future. This is not a realistic assumption but useful for now until we have further info to support otherwise.
2) The relationship between daily external transit trip production and auto cross-boundary|external station, i.e., percent of auto cross-boundary allocated to external transit trips, would remain the same as of 2005 as in 2006TOB. I.e., there would be no increase or decrease.
3) The 2006TOB observed 2005 % peak and % off-peak for external transit trips production would remain the same for all TRM v.5 model years. I.e., there will be no peak and off-peak percent split change at any relevant external station.
4) The attraction ends would remain the same as of 2006TOB observed in 2005, until any further observed info to support otherwise. I.e., no other internal TAZ would attract any transit external trips other than the observed ones.
5) The access modes would remain the same.

4.7.2 TRM v.5 Shortcut Approach Step-by-Step

Below is the step-by-step instruction of how TRM v.5-2010 external transit trip tables are developed using the current shortcut approach.

Step 1 - Derive Auto Cross-Boundary ADT

The approach assumes a relationship between transit E-I trip (all auto when passing the external stations) and the Auto cross-boundary ADT.

The annual average weekday traffic count for each external station is the variable ADT in scenario\input\SEData\SE_ModelYear.bin. The ADT is the sum of commercial vehicles and residence automobiles:

ADT|ModelYear = Auto ADT|ModelYear + CV ADT|ModelYear

That is, the Auto ADT at each relevant external station:

Auto ADT|ModelYear = ADT|ModelYear - CV ADT|ModelYear
= ADT|ModelYear * (1 – PctCV|ModelYear / 100)

Where,

- ADT|ModelYear: Average weekday daily traffic
- PctCV|ModelYear: Percent commercial vehicle traffic of total ADT. This can be the same as base year, or in a scenario test, changed by user per.
- PctAutoEE|ModelYear: Percent auto through trip (E-E) of total auto ADT. This can be the same as base year or in a scenario test, changed by user.

Since,

Auto ADT|ModelYear = Auto EE ADT|ModelYear + Auto cross-boundary ADT|ModelYear

Auto EE ADT|ModelYear = Auto ADT|ModelYear * (PctAutoEE|ModelYear / 100)

The auto cross-boundary ADT at each relevant external station can be calculated as follows:
Auto cross-boundary ADT|ModelYear = Auto ADT|ModelYear * (1 – PctAutoEE|ModelYear/100)

Table 4-3 displays the so-derived 2010 auto cross-boundary ADT at relevant external station.

Table 4-3 TRM v.5 - 2010 Auto Cross-Boundary ADT

External Station TRM v.5-TAZ	External Station Roadway Name	2010 Average Weekday Daily Traffic Count ADT	2010 % Commercial Vehicle PctCV	2010 % Auto Through (E-E) PctAutoEE	2010 Auto ADT = ADT * (1 – PctCV / 100)	2010 Auto Cross-Boundary ADT = Auto ADT * (1 – PctAutoEE / 100)
2583	NC 57 / Semora Rd	5,800	16.00	2.64	4,872	4,744
2598	I 85	32,000	13.10	26.23	27,808	20,513
2603	US 1 / Capital Blvd	13,400	11.82	9.45	11,816	10,700
2619	US 64	23,000	15.90	13.67	19,343	16,698
2638	US 70 Byp	13,800	17.46	31.40	11,391	7,814
2645	I 40	17,000	14.60	30.72	14,518	10,058
2655	NC 42	2,200	7.97	0.00	2,025	2,025
2657	US 1 / Jefferson Davis Highway	22,000	11.96	24.94	19,369	14,538
2659	Pittsboro Goldston Rd / SR 1010	1,500	3.93	0.00	1,441	1,441
2666	NC 87	2,670	8.01	27.48	2,456	1,781
2668	Saxapahaw Bethlehe Ch. Rd / SR 2146	2,500	4.02	0.00	2,400	2,400
2673	I 40/I 85	82,000	14.80	32.78	69,864	46,964
2674	US 70 / N. 7th St	8,000	7.29	36.00	7,417	4,747

Step 2 - Calculate Factor|ModelYear of Auto Cross-Boundary ADT

From aforementioned assumption, we know that for any model year (2005 or future), the peak (or off-peak) external transit trip production of each relevant external station,

$$\text{Ext.Transit-PK (or OP)}|_{\text{ModelYear}} = \text{Auto cross-boundary ADT}|\text{ModelYear} * \%\ \text{transit}|2005 * \%\ \text{Peak (or Off-Peak)}|2005$$

This gives us the ratio, as shown in Table 4-4, for model year=2010.

$$\text{Ext.Transit-PK (or OP)}|_{\text{ModelYear}} \ / \ \text{Ext.Transit-PK (or OP)}|_{2005} = \text{Auto cross-boundary ADT}|\text{ModelYear} \ / \ \text{Auto cross-boundary ADT}|2005 = \text{Factor}|_{\text{ModelYear}}$$

Table 4-4 TRM v.5 – 2010 Auto Cross-Boundary ADT Ratio Factor

External Station ID	External Station Roadway Name	2005 Auto Cross-Boundary ADT Auto XB|2005	2010 Auto Cross-Boundary ADT Auto XB|2010	Factor|2010 = Auto XB|$_{2010}$ / Auto XB|$_{2005}$
2583	NC 57 / Semora Rd	4,804	4,744	0.99
2598	I 85	21,099	20,513	0.97
2603	US 1 / Capital Blvd	11,049	10,700	0.97
2619	US 64	12,916	16,698	1.29
2638	US 70 Byp	8,349	7,814	0.94
2645	I 40	10,712	10,058	0.94
2655	NC 42	2,851	2,025	0.71
2657	US 1 / Jefferson Davis Highway	15,033	14,538	0.97
2659	Pittsboro Goldston Rd / SR 1010	1,745	1,441	0.83
2666	NC 87	1,827	1,781	0.98
2668	Saxapahaw Bethlehe Ch. Rd / SR 2146	1,846	2,400	1.30
2673	I 40/I 85	48,878	46,964	0.96
2674	US 70 / N. 7th St	4,579	4,747	1.04

Step 3 - Estimate Future Model Year Peak (Off-Peak) External Transit Trips

Step 2 shows that the ratio of external transit trip production between future model year and 2005 equals to the ratio of auto cross-boundary ADT between the two years, which means the future model year external transit trip equals 2005 external transit trips multiplies to the ratio of auto cross-boundary ADT between the two years:

$$\text{Ext.Transit-PK (or OP)}|_{\text{ModelYear}} = \text{Ext.Transit-PK (or OP)}|_{2005} * \text{Factor}|_{\text{ModelYear}}$$

Tables 4-5 and 4-6 display the external transit trip productions for the peak and off-peak periods, respectively, for model year 2010.

Table 4-5 TRM v.5 - 2010 Peak Transit External Trip Tables

External Transit Trip Table TRM v.5	Production External Station TRM v.5	Attraction Internal TAZ TRM v.5	2005 - Peak External Transit Trip	Factor|2010 = Auto XB|$_{2010}$ / Auto XB|$_{2005}$	2010 - Peak External Transit Trip = Ext.Transit - PK|$_{2005}$ * Factor|$_{2010}$
Trip 2: Loc-Park&Ride	2673	628	11.96	0.96	11.49
	2655	628	9.84	0.71	6.99
	2583	519	50.12	0.99	49.49
	2674	436	188.52	1.04	195.42

External Transit Trip Table TRM v.5	**Production External Station** TRM v.5	**Attraction Internal TAZ** TRM v.5	**2005 - Peak External Transit Trip**	**Factor|2010** = Auto XB|$_{2010}$ / Auto XB|$_{2005}$	**2010 - Peak External Transit Trip** = Ext.Transit - PK|$_{2005}$ * Factor|$_{2010}$
	2674	519	3.22	1.04	3.34
	2666	519	3.22	0.98	3.14
	2673	519	7.03	0.96	6.75
Trip 3: Loc-Kiss&Ride	2619	532	4.11	1.29	5.32
	2645	532	4.11	0.94	3.86
Trip 5: Exp-Park&Ride; Auto-Intercept	2598	435	3.92	0.97	3.81
	2673	636	16.63	0.96	15.98
	2673	2033	13.13	0.96	12.62
	2674	2012	14.48	1.04	15.01
	2674	2121	15.45	1.04	16.01
	2668	2033	15.17	1.30	19.72
	2674	1635	1.19	1.04	1.24
	2673	2121	11.88	0.96	11.42
	2673	2029	11.88	0.96	11.42
	2673	2029	11.88	0.96	11.42
	2673	2029	5.31	0.96	5.10
	2668	2012	3.85	1.30	5.01
	2673	2020	3.85	0.96	3.70
	2673	2030	4.95	0.96	4.76
	2668	2033	4.81	1.30	6.25
	2673	2028	4.81	0.96	4.62
	2673	2032	7.43	0.96	7.14
	2674	2033	7.88	1.04	8.17
	2673	2030	6.15	0.96	5.91
	2657	2026	5.70	0.97	5.51
	2673	2029	13.13	0.96	12.62
	2673	2029	14.48	0.96	13.92
	2673	2029	10.34	0.96	9.94
	2619	2026	4.36	1.29	5.64
	2673	2032	3.94	0.96	3.79
	2657	2028	30.04	0.97	29.05
	2673	2029	6.59	0.96	6.33
	2657	2029	25.39	0.97	24.56
	2655	2025	25.39	0.71	18.03
Trip 6: Exp-Kiss&Ride	2674	1635	1.65	1.04	1.71
	2638	1976	2.08	0.94	1.95
	2603	1899	0.48	0.97	0.47
	2645	1815	4.33	0.94	4.07

Table 4-6 TRM v.5 – 2010 Off-Peak Transit External Trip Tables

External Transit Trip Table TRM v.5	**Production External Station** TRM v.5	**Attraction Internal TAZ** TRM v.5	**2005 - Off-Peak External Transit Trip**	**Factor|2010** = Auto XB|$_{2010}$ / Auto XB|$_{2005}$	**2010 - Off-Peak External Transit Trip** = Ext.Transit-OP|$_{2005}$ * Factor|$_{2010}$
Trip 2: Loc-Park&Ride	2673	628	8.00	0.96	7.68
	2619	628	7.82	1.29	10.11
	2638	628	17.49	0.94	16.37
	2673	2030	20.66	0.96	19.85
	2657	520	2.49	0.97	2.41
	2598	436	2.42	0.97	2.35
	2674	2029	8.77	1.04	9.09
	2673	2032	5.95	0.96	5.72
	2674	2123	2.17	1.04	2.25
	2674	2029	4.96	1.04	5.14
	2673	2026	7.55	0.96	7.26
	2673	2027	11.04	0.96	10.61
	2674	435	9.62	1.04	9.97
Trip 3: Loc-Kiss&Ride	2645	1083	2.03	0.94	1.91
	2673	628	6.98	0.96	6.70
	2673	624	9.44	0.96	9.07
	2673	1133	6.26	0.96	6.01
	2655	2124	16.28	0.71	11.56
Trip 5: Exp-Park&Ride; Auto-Intercept	2673	2029	5.07	0.96	4.87
	2673	2035	6.86	0.96	6.59
	2657	2032	6.86	0.97	6.64
	2673	2032	5.09	0.96	4.89
	2673	2032	2.97	0.96	2.85
	2673	2028	3.11	0.96	2.99
	2659	2029	60.07	0.83	49.62
Trip 6: Exp-Kiss&Ride	2645	1083	0.85	0.94	0.80

Step 4 - Create Future Model Year External Transit Trip Tables in TransCAD

The last step is to create future model year external transit trip TransCAD format matrix files (to be used in TRM v.5) using the data estimated from Step 3.

You need to create two TransCAD matrix files, for peak and off-peak, respectively:
TRM Model\scenario\input\transit\Transit_External_PK.mtx and Transit_External_OP.mtx

1) Create an Excel file with the following tabs:

PK_Trip2, PK_Trip3, PK_Trip5, PK_Trip6
OP_Trip2, OP_Trip3, OK_Trip5 and OK_Trip6

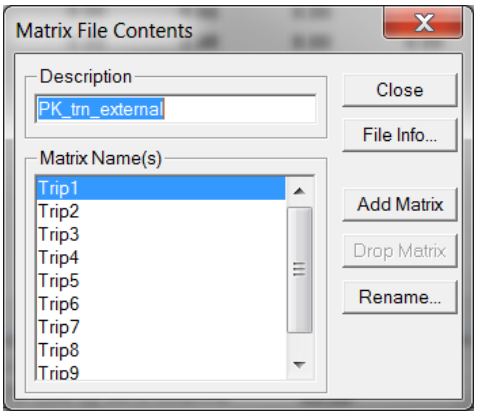
2) Put the info from Tables 3 and 4 in appropriate Tabs. E.g., put info in section of "Trip 2: Loc-Park&Ride" in Table 3 (PK) to Tab "PK_Trip2" as below. You may have only column Trip_2010 for instance (NO need to have three years values here. But putting them in one file could save your trouble keeping multiple Excel files.

	A	B	C	D	E
1	External_TAZ	Internal_TAZ	Trip_2005	Trip_2010	Trip_2035
2	2673	628	11.96	11.49	19.53
3	2655	628	9.84	6.99	12.88
4	2583	519	50.12	49.49	57.06
5	2674	436	188.52	195.42	177.68
6	2674	519	3.22	3.34	3.04
7	2666	519	3.22	3.14	4.66
8	2673	519	7.03	6.75	11.48
9					

PK_Trip2 | PK_Trip3 | PK_Trip5

3) You can copy the year 2005 matrix files, Transit_External_PK.mtx and Transit_External_OP.mtx, to a different location (e.g., under your model year scenario folder)

4) The TransCAD matrix files Transit_External_PK/OP.mtx have the following structure:



5) Set **all cell values of all matrices** in both PK and OP matrix files to **zero.**

6) Open your Excel file, Tab 'PK_Trip2', use the Trip_2010 value to update the Trip2 matrix in the Transit_External_PK.mtx matrix file if you are creating 2010 external transit table.

7) Continue with info in Tabs to update matrices 'PK_Trip3', 'PK_Trip5', and 'PK_Trip6', to complete the Transit_Exernal_PK.mtx.

8) Repeat for Transit_Exernal_OP.mtx.

Chapter 5 – Data Dictionary for Input and Output Files

5.1 Input Files

5.1.1 Universe Highway Geographic File (Highway.dbd)

1) Line Layer:

Field Name	Description	Notes
ID	Link ID	
Length	Link length (in miles)	
Dir	Traffic flow direction relative to topological direction of the link	0 = two-way 1 = one-way along the topological direction of the link -1 = one-way against the topological direction of the link
RoadName	Road Name	
FCLASS	Federal Functional Classes (FFC) in NC numbering convention	11 = Urban interstate 12 = Urban freeway expressway 13 = Urban principal arterial 14 = Urban minor arterial 15 = Urban collector 16 = Urban local 21 = Rural interstate 22 = Rural principal arterial 23 = Rural minor arterial 24 = Rural major collector 25 = Rural minor collector 26 = Rural local
FCGroup	Aggregation of FFC with some adjustments, which is used for VDF parameter lookup.	1=Freeway 2=Major Arterial 3=Minor Arterial 4=Collector 5=Local 999=Centroid Connector
ABLINKTIME	Space holders for storing transit travel time or walk time for links with a Mode value of 1, 3, 4, or 5 in the transit background geographic file	
BALINKTIME		
ABNONTRANSITTIME		
BANONTRANSITTIME		
County	Name of the county where the link exists	**Must use the full name of the county, like Chatham**
COUNT_ID(AB)	Count station ID: AB direction	These four fields are not maintained. The separate traffic count file, TrafficCount_Observed_2005.bin, keeps the most accurate information.
COUNT_ID(BA)	Count station ID: BA direction	
COUNT_DirRatio	Directional ratio when a two-way count needs to be split directionally	
COUNT_ID	Count station ID	
ProjID	Future project ID	
ProjName	Future project name	
ProjTime	Future project open-to-traffic time (month-year)	
Predecessor	IDs of future projects that serve as predecessor projects for this subject project, if any	

Direction	Traffic flow direction relative to topological direction of the link	The value in field Dir should be identical to this one.
LanesAB	Number of lanes: AB direction	
LanesBA	Number of lanes: BA direction	
Med_Lt	Median/left turn treatment indicator	1 = NO median or continuous left turn lane; 2 = With median/turn bays or continuous left; and 99 = Median or left turn treatment irrelevant
PostSpd	Posted speed limit (in mph)	20 = Posted speed <= 20 25 = Posted speed 25 35 = Posted speed 30 or 35 40 = ONLY for Special = 26 45 = Posted speed 40 or 45 or Special = 24 or 25 50 = ONLY for Special = 22 or 23 55 = Posted speed 50 or 55 or Special = 21 60 = Posted speed 60 65 = Posted speed 65 70 = Posted speed 70 99 = Speed irrelevant
SignlDns	Signal density indicator	1 = Less than 2 signals per mile 2 = 2 - 3 signals per mile 3 = 4 - 6 signals per mile 4 = 5 - 7 signals per mile 5 = Greater than 7 signals per mile 99 = Signals irrelevant
Special	Special classification	1 = Interstate/Freeway 2 = Suburban Freeway 3 = Urban Freeway 4 = Rural Highway 5 = Suburban Freeway / Expressway 6 = Collector / Distributor 21 = Freeway to freeway ramps 22 = Freeway to freeway loop ramp with weave 23 = Freeway to freeway loop ramp 24 = Freeway to arterial ramp/loop 25 = Arterial to freeway ramp/loop 26 = Arterial to arterial ramp/loop 31 = Centroid connector 41 = HOV link 42 = HOT link 43 = Toll link 54 = Parking lot link 55 = Transit only 99 = All other highway link types
Mode	Link mode	1 = Walk Access Link 3 = CBD Walk Link 4 = Walk Link in Parking Lot 5 = Transit Only Link 99 = Highway Link/Centroid Connector NOTE: The non-motorized modes MUST match the modes in file Mode.DBF

AreaType	Link area type	1=urban, 2=suburban, & 3=rural
Toll_SOVAM	Toll charges ($) for SOVs in AM peak	These nine fields are added to this file and their values are populated automatically by the program in step "Prepare Geo Files". Only those links with Special = 42 or 43 have non-null values, and the value is calculated as toll rate ($/mile) * link length (miles)
Toll_HOVAM	Toll charges ($) for HOVs in AM peak	
Toll_CVAM	Toll charges ($) for trucks in AM peak	
Toll_SOVPM	Toll charges ($) for SOVs in PM peak	
Toll_HOVPM	Toll charges ($) for HOVs in PM peak	
Toll_CVPM	Toll charges ($) for trucks in PM peak	
Toll_SOVOP	Toll charges ($) for SOVs in off peak	
Toll_HOVOP	Toll charges ($) for HOVs in off peak	
Toll_CVOP	Toll charges ($) for trucks in off peak	

2) Node Layer:

Field Name	Description	Notes
ID	Node ID	
Longitude	Node longitude	
Latitude	Node latitude	
PARKINGNODE	Park-and-ride lot indicator	1 if the node is designated as a parking lot for park-and-ride trips
CBD Walk		Not used any more
6digitTAZ	Census TAZ identifier	Unique ID used by planners, but not used in the model
County	County where the node exists	Not used in the model
TAZ	TAZ ID if the node is a centroid of a TAZ	Positive integer value <=2389, which is the maximum external station ID

5.1.2 Transit System Files

(Transit.rts, Transit_AM.rts, & Transit_OP.rts)

1) Route Layer:

Field Name	Description	Notes
Route_ID	Route ID	TransCAD may assign a new Route ID when the same transit route system is modified or recreated.
Route_Name	Route Name	Route names are given by the user and won't be changed by TransCAD when a transit route system is created or modified. Coding convention: Operator + Space + Number/Code + Space + OB/IB/EB/WB/NB/SB + Colon(:) + Description
Operator	Transit operator name	1 = TTA 2 = CAT 3 = CHT 4 = DATA 5 = NCSU 6 = DUKE/NCCU 7 = Orange County (OPT) 8 = Cary
Company	A combination of transit agencies and transit modes, corresponding to the MODE_ID field in the	11 = TTA - Local 12 = CAT - Local

	important Mode.DBF file.	13 = CHT - Local 14 = DATA - Local 15 = Duke/NCSU Local 16 = Express 17 = TTA - Shuttle 18 = TTA - Rail
Mode	Transit mode	5 = Local bus route 7 = Express bus route or Rail route
AMPK_Hdwy	AM peak period route headway in minutes	
OP_Hdwy	Off peak route headway in minutes	
XferPen	To-this-route transfer penalty in minutes	Applies only when a transfer is made to this subject route
RFacLocal	IVTT weight for local buses	Automated; no manual input needed
RFacPrem	IVTT weight for express buses	Automated; no manual input needed
RFacRail	IVTT weight for rails	Automated; no manual input needed
FareFac	Fare weight	Input by the user; currently no special value but a value of 1 is applied universally
Fare	Average fare by route and company considering free riders, discount fare riders, and daily pass riders	TTA = $1.00 [local], $1.10 [express] CAT = $0.50 CHT = $0.00 DATA = $0.50 NCSU = $0.00 Duke = $0.00 All values are for year 2005
Line_No	Unique and fixed transit line number used by the TRM	

2) Stop Layer:

Field Name	Description	Notes
ID	Stop ID, unique system-wide	All these fields are determined by TransCAD and none of them are editable by the user
Longitude	Stop longitude	
Latitude	Stop latitude	
Route_ID	ID of the route this subject stop is on	
Pass_Count	The number of passages of the route on a highway link where the subject stop is located	
Milepost	Milepost on the route where the stop is located	
STOP_ID	Same value as ID	
NodeID	Highway node ID nearest to the stop	Determined and filled by the program automatically; a search range of 0.01 miles is used.

5.1.3 TAZ Geographic File (TRM2009TAZ_08042009.dbd)

Field Name	Description	Notes
ID	TAZ ID	Value <= 2317, the maximum internal TAZ ID
Area	Zonal area in square miles	
FINAL_TAZ	6-digit Census TAZ identifier	Unique ID used by planners
COUNTY	County where the TAZ is located	
District_12Co	District ID for TAZ aggregation	For district-to-district flow analysis

5.1.4 Demographic / Socioeconomic Data (SE_2010.bin)

Field Name	Description	Notes
TAZ	TAZ ID	
ATYPE	Area Type	Filled automatically when running SE Check and Post-processing Tool
HH	Non-Student Households	Total households = HH + HH_STUD. As a note, HH does not include HH_STUD
Stud_Off	Students living off-campus	
POP	Total population, only excluding Stud_On	
MEANINC	Zonal Mean Income	
DWELLUNIT	Dwelling Units	
Stud_On	Students living on-campus	
IND	Industrial Employees	Does not include employees in Special Generators; Total number of employees= IND+RET+HWY+OFF+SER +SPUNIV+SPSC+SPAIR +SPHOSP
RET	Retail Employees	
HWY	Highway Retail Employees	
OFF	Office Employees	
SER	Service Employees	
SPUNIV	Special Generator Employees - University	
SPSC	Special Generator Employees - Shopping Centers	
SPAIR	Special Generator Employees - Airport	
SPHOSP	Special Generator Employees - Hospitals	
INDPERC	% of total Special Generator Employees that is classified as Industrial Employees	
RETPERC	% of total Special Generator Employees that is classified as Retail Employees	
HWYPERC	% of total Special Generator Employees that is classified as Highway Retail Employees	
OFFPERC	% of total Special Generator Employees that is classified as Office Employees	
SERPERC	% of total Special Generator Employees that is classified as Service Employees	
ADT	ADT on external station links	
PctCV	% of ADT that is classified as CV	
PctAUTOEE	% of Auto traffic that is through traffic	
PctCVEE	% of CV traffic that is through traffic	
PARKCOST	Zonal Parking Cost (in cents)	No longer used in TRM v5
ZONEAREA	Area of TAZ in square miles	
SHORTWALKAM	Percent of the TAZ that is within the AM peak transit short walk distance (0 - 0.25 miles)	Filled automatically in step "Create Walk Access" by the model
LONGWALKAM	Percent of the TAZ that is within the AM peak transit long walk distance (0.25 - 0.5 miles)	
SHORTWALKOP	Percent of the TAZ that is within the off peak transit short walk distance (0 - 0.25 miles)	
LONGWALKOP	Percent of the TAZ that is within the off peak transit long walk distance (0.25 - 0.5 miles)	
DISTGROUP		
EXTERNAL	External Station Indicator	1 if the TAZ is an external station; otherwise, 0.
District	District ID	For district trip distribution analysis

AVEBLOCK	Average block size in miles	
NMPathLen	Path length for non-motorized modes (in miles)	
Enrollment	Enrolled students of elementary, middle, and high schools in the zone	
SCH_BUS	Percentage of students taking school buses	Not used any more in TRM v5
PASA	ID for parking analysis sub-area	1 = UNC campus 2 = Duke campus 3 = NCSU campus 4 = NCCU campus 5 = Chapel Hill CBD 6 = Durham CBD 7 = Raleigh CBD 8 = RDU
PASAYear	Indicator of PASA boundary (varies by TRM model year)	2005: TAZs are in a PASA for year 2005 model and beyond; 2009: TAZs are added to a PASA for year 2010 and beyond; 2011: TAZs are added for any model year beyond year 2010
PrkCosW1	Work trip parking cost per auto trip per traveler – drive alone	
PrkCosW2	Work trip parking cost per auto trip per traveler – 2-person carpool	PrkCosW2 = PrkCosW1/2 Except for Duke, where a special cost is used
PrkCosW3	Work trip parking cost per auto trip per travel – 3/+-person carpool	PrkCosW3 = PrkCosW1/3 Except for Duke, which is free
PrkCosO1	Other trip parking cost per auto trip per traveler – drive alone	Other trips include: HBShop, HBO, NHNW, and WBNH
PrkCosO2	Other trip parking cost per auto trip per traveler – 2-person carpool	PrkCosO2 = PrkCosO1/2
PrkCosO3	Other trip parking cost per auto trip per travel – 3/+-person carpool	PrkCosO3 = PrkCosO1/3
PrkCosU1	HBU trip parking cost per auto trip per traveler – drive alone	
PrkCosU2	HBU trip parking cost per auto trip per traveler – 2-person carpool	PrkCosU2 = PrkCosU1/2 Except for Duke, where a special cost is used
PrkCosU3	HBU trip parking cost per auto trip per travel – 3/+-person carpool	PrkCosU3 = PrkCosU1/3 Except for Duke, which is free
County	Name of the county the zone belongs to	

5.1.5 SE Distribution Weights Table (SE Distribution Weights for Transit.dbf)

Field Name	Description	Notes
BUFFER	Buffer rings surrounding transit stops	10 buffer rings within a radius of 0.5 miles. Buffer 1 is the most inner buffer and buffer 10 is the most outer one.
WEIGHT	Weight associated with each buffer ring	The closer the buffer to the stop, the higher the weight is.

5.1.6 Facility Lookup Table (FacilityType.bin)

Field Name	Description	Notes
LANES	Number of lanes per direction	These are the factors on which lookup of facility type and bus speed category is based. For details of these factors, please see the Universe Highway Geographic File (Highway.dbd)
POSTSPD	Posted speed limit in MPH	
MED_LT	Median/left turn treatment indicator	
SIGNLDNS	Signal density indicator	
SPECIAL	Special classification	
R_FACTYPE	Facility type value	Lookup returned value
R_BUS_SPEED_CAT	Bus speed category value	Lookup returned value

5.1.7 Speed Capacity Lookup Table (SpeedCapacity.bin)

Field Name	Description	Notes
FACTYPE	Facility type	The factor on which lookup of capacity and free flow speed is based.
R_PkHrCpLn	Capacity per hour per lane	Lookup returned value
R_FFSpeed	Free flow speed	Lookup returned value
R_CongSpd	Congested speed	No longer used
R_Alpha	Alpha parameter value for BPR VDF function	No longer used, since we have changed to Conical VDF function.
R_Beta	Beta parameter value for BPR VDF function	

5.1.8 Capacity Factor Lookup Table (CapacityFactor.bin)

Field Name	Description	Notes
FACTYPE	Facility type	The factors on which lookup of capacity factors is based.
AREATYPE	Area type for roadway facility.	
R_PKHRFCAM	Factor multiplied by the hourly capacity to get AM period capacity	Lookup returned value
R_PKHRFCPM	Factor multiplied by the hourly capacity to get PM period capacity	Lookup returned value
R_PKHRFCOFF	Factor multiplied by the hourly capacity to get OP capacity	Lookup returned value

5.1.9 Terminal Time Matrix Files

(Auto_TerminalTime.mtx and CV_TerminalTime.mtx)

Matrix Core Name	Description	Notes
TerminalTime	TAZ-to-TAZ terminal times for autos and commercial vehicles, respectively (in minutes)	They are a function of the area types of both origin and destination TAZs and generated automatically when running the SE Check and Post-processing Tool

5.1.10 Volume Delay Function Parameter Lookup Table (VDFConical.bin)

Field Name	Description	Notes
FCGROUP	Functional Class Group	The factor on which lookup of Alpha value and FCGroup type is based
R_Alpha	Alpha parameter value for Conical VDF function	Lookup returned value
R_Type	Functional class group description	Lookup returned value

5.1.11 Turn Penalty File (TurnPenalties.bin)

Field Name	Description	Notes
FROM_ID	Link ID from which the vehicle turns	
TO_ID	Link ID to which the vehicle turns	
PENALTY	Time penalty in minutes	

5.1.12 Bus Speed Equation Lookup Table (BusSpeed_Equations.bin)

Field Name	Description	Notes
bus speed category	Bus speed categories	1=Urban Freeway; 2=Urban Arterial; 3=Urban Local/One-way; 4=Suburban Freeway; 5=Suburban Arterial; 6=Suburban Local/One-way; 7=Rural Freeway; 8=Rural Arterial; 9=Rural Local/One-way
X1-AM	Lower highway speed boundary for AM peak	Input to Equation: Y = a + bX Where, Y = Calculated bus speed a & b are intercept and slope X = Input highway speed Units are in MPH
X2-AM	Higher highway speed boundary for AM peak	
b1-AM	Used in the equation as the "b" value if input highway speed X is below X1-AM; "a" is set to 0	
b2-AM	Used in the equation as the "b" value if input highway speed X is between X1-AM and X2-AM	
a-AM	Used in the equation as the "a" value if input highway speed X is between X1-AM and X2-AM	
Y2-AM	Maximum bus speed to use, if input highway speed X is greater than X2-AM	
X1-OP	Lower highway speed boundary for off peak	
X2-OP	Higher highway speed boundary for off peak	
b1-OP	Used in the equation as the "b" value if input highway speed X is below X1-OP; "a" is set to 0	
b2-OP	Used in the equation as the "b" value if input highway speed X is between X1-OP and X2-OP	
a-OP	Used in the equation as the "a" value if input highway speed X is between X1-OP and X2-OP	
Y2-OP	Maximum bus speed to use, if input highway speed X is greater than X2-OP	

5.1.13 Mode Table (Mode.DBF)

Field Name	Description	Notes
MODE_NAME	Names describing available modes	Takes one of the following values: Walk, CBD walk, Walk Funnel, Company 1 – 5, Company 1 EXP, Drive, TTA Shuttle, TTA Rail
MODE_ID	Corresponding mode ID as coded in the transit route system	1= Walk 3 = CBD Walk 4 = Walk Funnel 11 = Company 1 12 = Company 2 13 = Company 3 14 = Company 4 15 = Company 5 16 = Company 1 Exp 17 = TTA Shuttle 18 = TTA Rail 99 = Drive
TYPE	Type of the mode	W = Walk T = Transit H = Highway
MODE_ACC_D	Drive access	0 = Not used 1 = Used
MODE_EGR_D	Drive egress	
MODE_ACC_W	Walk access	
MODE_EGR_W	Walk egress	
MODE_WL	Walk to local bus	
MODE_WP	Walk to express bus	
MODE_WR	Walk to rail	
MODE_DL	Drive to local bus	
MODE_DP	Drive to express bus	
MODE_DR	Drive to rail	

5.1.14 Mode Transfer Table (ModeXfer.DBF)

Field Name	Description	Notes
FROM	From MODE_ID (i.e. transit companies in TRM)	See Mode Table (Mode.DBF) for the definition of MODE_ID
TO	To MODE_ID (i.e. transit companies in TRM)	
STOP	ID of the stop of the To Mode where transfers can only take place	Always keep this field blank
COST	Represents transfer time penalty between modes (companies)	Not used, since route-to-route transfer penalties are being used in TRM, which overwrite these mode-to-mode values anyway.
FARE	Average fare for transfer between modes (companies) in dollars	Values vary by company; a huge value of 999 is used to prohibit transfers

5.1.15 Timed Transfer Wait Time Tables

(TimedTransferWaitTime_AM.bin & TimedTransferWaitTime_OP.bin)

Field Name	Description	Notes

FROM_LINE	From-route ID	These three fields are filled by the model automatically in execution
TO_LINE	To-route ID	
BOARD_STOP	Stop ID where transfer boarding takes place	
WAIT_TIME	Wait time for transfer (in minutes)	These fields are user coded. FROM_NAME and TO_NAME should exactly match those in the transit route system file and are case sensitive.
FROM_NAME	From-route name	
TO_NAME	To-route name	
BOARD_NODE	Highway node ID for the stop where transfer boarding takes place	

5.1.16 Base Year Zonal Commercial Vehicles (CV_Vehicle_Base2005.dbf)

Field Name	Description	Notes
TAZ1	TAZ ID	
INDV1	Commercial autos for industrial employment	
INDV2	Commercial pickups/vans for industrial employment	
INDV3	Commercial trucks for industrial employment	
RETV1	Commercial autos for retail employment	
RETV2	Commercial pickups/vans for retail employment	
RETV3	Commercial trucks for retail employment	
HWYV1	Commercial autos for highway retail employment	
HWYV2	Commercial pickups/vans for highway retail employment	
HWYV3	Commercial trucks for highway retail employment	
OFFV1	Commercial autos for office employment	
OFFV2	Commercial pickups/vans for office employment	
OFFV3	Commercial trucks for office employment	
SRVV1	Commercial autos for service employment	
SRVV2	Commercial pickups/vans for service employment	
SRVV3	Commercial trucks for service employment	
SGINDUSTRY	Base year industrial employees	
SGRETAIL	Base year retail employees	
SGHWYRET	Base year highway retail employees	
SGOFFICE	Base year office employees	
SGSERVICE	Base year service employees	

5.1.17 Other Trip Rate Lookup Table (CV_Trip_Rate.dbf)

Field Name	Description	Notes
INTTYPE	Integers representing classification variable types as shown in field TYPE	
R_CARP	Production rates for commercial autos by employment type	
R_PUP	Production rates for commercial pickups/vans by employment type	
R_TRKP	Production rates for commercial trucks by employment type	
R_CARA	Attraction rates for commercial autos by employment type	

R_PUA	Attraction rates for commercial pickups/vans by employment type	
R_TRKA	Attraction rates for commercial trucks by employment type	
R_CVIEP	Production rates for commercial vehicle IE trips based on external station link CV IE ADT	
R_CVIEA	Attraction rates for commercial vehicle IE trips by employment type	
R_AUTOIEP	Production rates for auto IE trips based on external station link auto IE ADT	
R_AUTOIEA	Attraction rates for auto IE trips by employment type and dwelling units	
TYPE	Classification variable types	INDV1 = Industrial CV autos INDV2 = Industrial CV pickups INDV3 = Industrial CV trucks RETV1 = Retail CV autos RETV2 = Retail CV pickups RETV3 = Retail CV trucks HWYV1 = Hwy retail CV autos HWYV2 = Hwy retail CV pickups HWYV3 = Hwy retail CV trucks SERVV1 = Service CV autos SERVV2 = Service CV pickups SERVV3 = Service CV trucks OFFV1 = Office CV autos OFFV2 = Office CV pickups OFFV3 = Office CV trucks INDUSTRY = Industrial employees RETAIL = Retail employees HWYRETAIL = Highway retail employees OFFICE = Office employees SERVICE = Service employees CVIEADT = CV IE ADT NONRETEMP = Non-retail employees TOTDU = Total zonal dwelling units AUTOIEADT = Auto IE ADT NONINDEMP = Non-industrial employees

5.1.18 Gravity Model Friction Factor Table (Gravity_FrictionFactor.dbf)

Field Name	Description	Notes
TIME	Trip length in minutes	
CV1IIFF	Friction factors for commercial auto I-I trips	
CV2IIFF	Friction factors for commercial van/pickup I-I trips	
CV3IIFF	Friction factors for commercial truck I-I trips	
CVIEFF	Friction factors for commercial vehicle IE trips	
AUTOIEFF	Friction factors for auto IE trips	

5.1.19 HBU Trip Rates (HBU Trip Rates.DBF)

Field Name	Description	Notes
STUD_TYPE	Student types	On-campus: Stud_on Off-campus: Stud_Off
TRIP_RATE	Trip rates associated with the two student types	Including both motorized and non-motorized

5.1.20 HBU Trip Campus Allocation Percentages (HBU Trip Campus Allocation Percentages.DBF)

Field Name	Description	Notes
TAZ	TAZ ID	
Duke_Off	Percentage of zonal off-campus college student trip productions allocated to Duke	For each TAZ, the four percentages add up to 100%; otherwise, 0.
NCSU_Off	Percentage of zonal off-campus college student trip productions allocated to NCSU	
UNC_Off	Percentage of zonal off-campus college student trip productions allocated to UNC	
NCCU_Off	Percentage of zonal off-campus college student trip productions allocated to NCCU	
Duke_On	Percentage of zonal on-campus college student trip productions allocated to Duke	For each TAZ, the four percentages add up to 100%; otherwise, 0.
NCSU_On	Percentage of zonal on-campus college student trip productions allocated to NCSU	
UNC_On	Percentage of zonal on-campus college student trip productions allocated to UNC	
NCCU_On	Percentage of zonal on-campus college student trip productions allocated to NCCU	

5.1.21 HBU Trip TAZ Allocation Index File (HBU Trip TAZ Allocation Index.bin)

Field Name	Description	Notes
TAZ	TAZ ID	
University	Which university that TAZ belongs to	1 = Duke 2 = NCSU 3 = UNC 4 = NCCU Note: A TAZ is classified only to one of the three universities.
TAZ_Adjust	Percent adjustment for allocation of trip attractions to the TAZ	

5.1.22 Duke HBU Adjustment Factor File (Duke_HBU_Factors.mtx)

Matrix Core Name	Description	Notes
Trip1	Adjustment factors (multipliers) used to calibrate HBU transit trips for Duke University	A factor of 4.0 is used for 27 PA pairs within Duke

		University. No adjustments made to the other PA pairs.

5.1.23 Air Passenger Trip Rate File (AirPassenger_Rate.dbf)

Field Name	Description	Notes
COUNTY	County ID	1 = Wake 2 = Durham 3 = Orange 4 = Other
NAME	County Name	Wake, Durham, Orange, or Other
HB_HH1	Home-based airport person trip rate for low income households	
HB_HH2	Home-based airport person trip rate for medium-low income households	
HB_HH3	Home-based airport person trip rate for medium-high income households	
HB_HH4	Home-based airport person trip rate for high income households	
WB_EMP	Employee work-based airport person trip rate	
PR_HH	Private-residence-based airport person trip rate	
NHNW_EMP	Employee non-home non-work based airport person trip rate	

5.1.24 Non-motorized Trip Split Model Specification File (Non-Motorized Trip Split Models.dbf)

Field Name	Description	Notes
VARIABLES	Explanatory variable name (including the constant)	
HBW_PK	Coefficients of the explanatory variables used in HBW peak model; null if the variable is not used	
HBW_OP	Coefficients of the explanatory variables used in HBW off-peak model; null if the variable is not used	
HBSH_PK	Coefficients of the explanatory variables used in HBShop peak model; null if the variable is not used	
HBSH_OP	Coefficients of the explanatory variables used in HBShop off-peak model; null if the variable is not used	
HBSC_PK	Coefficients of the explanatory variables used in HBSchool peak model; null if the variable is not used	
HBSC_OP	Coefficients of the explanatory variables used in HBSchool off-peak model; null if the variable is not used	
HBO_PK	Coefficients of the explanatory variables used in HBO peak model; null if the variable is not used	
HBO_OP	Coefficients of the explanatory variables used in HBO off-peak model; null if the variable is not used	
WBNH_PK	Coefficients of the explanatory variables used in WBNH peak model; null if the variable is not used	
WBNH_OP	Coefficients of the explanatory variables used in WBNH off-peak model; null if the variable is not used	
NHNW_PK	Coefficients of the explanatory variables used in NHNW peak model; null if the variable is not used	

NHNW_OP	Coefficients of the explanatory variables used in NHNW off-peak model; null if the variable is not used	
HBU	Coefficients of the explanatory variables used in HBU daily model; null if the variable is not used	

5.1.25 Non-motorized Trip Split Model Constant Factor File (Non-Motorized Trip Split Model Constant Factors.dbf)

Field Name	Description	Notes
STRATA	HH Strata	
HBW_PK	Factors (multipliers) by hh strata for the constant used in HBW peak non-motorized trip split model	
HBW_OP	Same as above, except for HBW off-peak model	
HBSH_PK	Same as above, except for HBShop peak model	
HBSH_OP	Same as above, except for HBShop off-peak model	
HBSC_PK	Same as above, except for HBSchool peak model	
HBSC_OP	Same as above, except for HBSchool off-peak model	
HBO_PK	Same as above, except for HBO peak model	
HBO_OP	Same as above, except for HBO off-peak model	
WBNH_PK	Same as above, except for WBNH peak model	
WBNH_OP	Same as above, except for WBNH off-peak model	
NHNW_PK	Same as above, except for NHNW peak model	
NHNW_OP	Same as above, except for NHNW off-peak model	
HBU	Same as above, except for HBU daily model	

5.1.26 Transit Share in Motorized Modes (Transit Share in Motorized Modes.dbf)

Field Name	Description	Notes
PURPORSE	Trip purpose	
STRATA1_PK	HH strata 1 transit share by trip purpose for peak period	
STRATA2_PK	HH strata 2 transit share by trip purpose for peak period	
STRATA3_PK	HH strata 3 transit share by trip purpose for peak period	
STRATA4_PK	HH strata 4 transit share by trip purpose for peak period	
STRATA5_PK	HH strata 5 transit share by trip purpose for peak period	
STRATA1_OP	HH strata 1 transit share by trip purpose for off-peak period	
STRATA2_OP	HH strata 2 transit share by trip purpose for off-peak period	
STRATA3_OP	HH strata 3 transit share by trip purpose for off-peak period	
STRATA4_OP	HH strata 4 transit share by trip purpose for off-peak period	
STRATA5_OP	HH strata 5 transit share by trip purpose for off-peak period	

5.1.27 Walk Share in Non-Motorized Modes (Walk Share in non-Motorized Modes.dbf)

Field Name	Description	Notes
PURPORSE	Trip purpose	
WalkShare	Walk share by trip purpose	

5.1.28 Directional Time-of-Day Factors (HourlyFactor.bin)

Field Name	Description	Notes
HOUR	24 intervals with one for each hour of an entire day	Values in all the fields below for all the hourly intervals in this table are 0, except for 7 (7:00-8:00), 12 (12:00-13:00), and 16 (16:00-17:00). These three represent AM peak, off peak, and PM peak, respectively.
DEP_HBW	Percent of daily HBW trips departing from home by hour	Sum up to a regional total of 50%
RET_HBW	Percent of daily HBW trips returning home by hour	Sum up to a regional total of 50%
DEP_SHP	Percent of daily HBShop trips departing from home by hour	Sum up to a regional total of 50%
RET_SHP	Percent of daily HBShop trips returning home by hour	Sum up to a regional total of 50%
DEP_SCH	Percent of daily HBSchool trips departing from home by hour	Sum up to a regional total of 50%
RET_SCH	Percent of daily HBSchool trips returning home by hour	Sum up to a regional total of 50%
DEP_OTH	Percent of daily HBO trips departing from home by hour	Sum up to a regional total of 50%
RET_OTH	Percent of daily HBO trips returning home by hour	Sum up to a regional total of 50%
DEP_WBNH	Percent of daily WBNH trips departing from home by hour	Sum up to a regional total of 50%
RET_WBNH	Percent of daily WBNH trips returning home by hour	Sum up to a regional total of 50%
DEP_NHNW	Percent of daily NHNW trips departing from home by hour	Sum up to a regional total of 100%
RET_NHNW	Percent of daily NHNW trips returning home by hour	Sum up to a regional total of 0%
DEP_UNV	Percent of daily HBU trips departing from home by hour	Sum up to a regional total of 50%
RET_UNV	Percent of daily HBU trips returning home by hour	Sum up to a regional total of 50%
DEP_CVIE	Percent of daily CV IE trips departing from external stations to internal TAZs by hour	Sum up to a regional total of 50%
RET_CVIE	Percent of daily CV IE trips returning external stations from internal TAZs by hour	Sum up to a regional total of 50%
DEP_CVCARII	Percent of daily CV auto I-I trips departing from origin TAZs to destination TAZs by hour	Sum up to a regional total of 50%
RET_CVCARII	Percent of daily CV auto I-I trips returning to origin TAZs from destination TAZs by hour	Sum up to a regional total of 50%
DEP_CVPUII	Percent of daily CV pickup I-I trips departing from origin TAZs to destination TAZs by hour	Sum up to a regional total of 50%
RET_CVPUII	Percent of daily CV pickup I-I trips returning to origin TAZs from destination TAZs by hour	Sum up to a regional total of 50%
DEP_CVTRKII	Percent of daily CV truck I-I trips departing from origin TAZs to destination TAZs by hour	Sum up to a regional total of 50%
RET_CVTRKII	Percent of daily CV truck I-I trips returning to origin TAZs from destination TAZs by hour	Sum up to a regional total of 50%
DEP_AUTOIE	Percent of daily Auto IE trips departing from external stations to internal TAZs by hour	Sum up to a regional total of 50%
RET_AUTOIE	Percent of daily Auto IE trips returning external stations from internal TAZs by hour	Sum up to a regional total of 50%
CVEEPER	Percent of daily CV EE (through) trips by hour	Sum up to a regional total of 100%
AUTOEEPER	Percent of daily Auto EE (through) trips by hour	Sum up to a regional total of 100%

5.1.29 Transit Transfer Movement Tables

(Transit_Transfer_AM.bin & Transit_Transfer_OP.bin)

Field Name	Description	Notes
FROM_LINE	ID of the route transfer from	
ALIGHT_STOP	ID of the alighting stop of the route transfer from	
BOARD_STOP	ID of the boarding stop of the route transfer to	
TO_LINE	ID of the route transfer to	

5.1.30 Transit Operator and Company Dictionary File (Transit Operator and Company Dictionary.dbf)

Field Name	Description	Notes
OperatorID	Operator IDs as used in the transit route system file	1 = TTA 2 = CAT 3 = CHT 4 = DATA 5 = NCSU 6 = Duke/NCCU 7 = Orange County (OPT) 8 = Cary
OperatorNm	Operator names	
CompanyID	Company IDs as used in the transit route system file	1 = TTA Local Routes 2 = CAT/Cary Local Routes 3 = CHT Local Routes 4 = DATA Local Routes 5 = Duke/NCSU/NCCU Local 6 = Routes 7 = All Express Routes 8 = TTA Shuttle 9 = All Rail Routes
CompanyNm	Company names	

5.1.31 Observed Vehicle Trip Matrix File (Highway_TripsOD_Observed_2005.mtx)

Matrix Core Name	Description	Notes
PK_WRK	Peak period TAZ-to-TAZ HBW person trip interchanges	
PK_SHP	Peak period TAZ-to-TAZ HBShop person trip interchanges	
PK_SCH	Peak period TAZ-to-TAZ HBSchool person trip interchanges	
PK_OTH	Peak period TAZ-to-TAZ HBO person trip interchanges	
PK_WBNH	Peak period TAZ-to-TAZ WBNH person trip interchanges	
PK_NHNW	Peak period TAZ-to-TAZ NHNW person trip interchanges	
OP_WRK	Off peak TAZ-to-TAZ HBW person trip interchanges	
OP_SHP	Off peak TAZ-to-TAZ HBShop person trip interchanges	
OP_SCH	Off peak TAZ-to-TAZ HBSchool person trip interchanges	
OP_OTH	Off peak TAZ-to-TAZ HBO person trip interchanges	
OP_WBNH	Off peak TAZ-to-TAZ WBNH person trip interchanges	
OP_NHNW	Off peak TAZ-to-TAZ NHNW person trip interchanges	

5.1.32 Observed Highway Traffic Count Data (TrafficCount_Observed_2005.bin)

Field Name	Description	Notes
ID	Highway Link ID	Must match those in highway network geographic file
Daily Counts	Daily counts	
Screenline	Screenline ID	
Cutline	Cutline ID	
COUNT_ID	Count station ID	

5.1.33 Observed Transit Ridership Data (Transit_Ridership_Observed_2005.dbf)

Field Name	Description	Notes
COMPANY	Transit agency name	
RIDERSHIP	Daily transit ridership	

5.1.34 Peak Period Parking Capacity by PASA and Trip Purpose (ParkCap.bin)

Field Name	Description	Notes
PASA	ID for parking analysis sub-area	1 = UNC campus 2 = Duke campus 3 = NCSU campus 4 = NCCU campus 5 = Chapel Hill CBD 6 = Durham CBD 7 = Raleigh CBD 8 = RDU
CapHBW	Peak period parking capacity for HBW trip	
CapHBSh	Peak period parking capacity for HBShop trip	
CapHBO	Peak period parking capacity for HBO trip	
CapHBU	Peak period parking capacity for HBU trip	
CapNHNW	Peak period parking capacity for NHNW trip	
CapWBNH	Peak period parking capacity for WBNH trip	

5.1.35 External – Internal Transit Trip Tables by Time of Day (Transit_External_PK.mtx and Transit_External_OP.mtx)

Matrix Core Name	Description	Notes
Trip1	Walk access local bus trips	
Trip2	Park-and-ride local bus trips	
Trip3	Kiss-and-ride local bus trips	
Trip4	Walk access express bus trips	
Trip5	Park-and-ride express bus trips	
Trip6	Kiss-and-ride express bus trips	
Trip7	Walk access rail trips	
Trip8	Park-and-ride rail trips	

Trip9	Kiss-and-ride rail trips	

5.1.36 Trip Generation FORTRAN Program Control File (trmgen.ctl)

```
&xinfiles soced_file =  '..\..\Interim\dem_tg.bin',          ! Socioeconomic data file for Trip Generation (generated automatically by TransCAD script)
          trnwlk_file = '..\..\Interim\amwp.bin',            ! Walk to transit skim file (generated automatically by TransCAD script)
          trndrv_file = '..\..\Interim\amdr.bin',            ! Drive to transit skim file (generated automatically by TransCAD script)
          hwytme_file = '..\..\Interim\amlov.bin',           ! SOV highway skim file (generated automatically by TransCAD script)
          adjzne_file =  'sch_adj.prn',                      ! School bus percentage and adjacent zones for HBSchool trips

&xoutfiles freport = '..\..\Interim\tg.rep',                 ! Trip generation program report
           strata_file =  '..\..\Interim\hhstrata.txt',      ! Households by strata
           accessib_file = '..\..\Interim\racc_str.dat',     ! Accessibility measure for non-motorized model
           accstr_file =  '..\..\Interim\accstr.txt',        ! Accessibility measure for attraction share model
           fwrkend = '..\..\Interim\wrkend.txt',             ! Home-based work trip productions and attractions
           fshpend = '..\..\Interim\shpend.txt',             ! Home-based shop trip productions and attractions
           fothend = '..\..\Interim\othend.txt',             ! Home-based other trip productions and attractions
           fschend = '..\..\Interim\schend.txt',             ! Home-based school trip productions and attractions
           fwbnhend = '..\..\Interim\wbnhend.txt',           ! Work-based non home trip productions and attractions
           fnhnwend = '..\..\Interim\nhnwend.txt',           ! Non-home non-work trip productions and attractions
           fvehown = '..\..\Interim\tghh.txt',               ! Households stratification (by income, size, children, auto, worker)
           fnonmot = '..\..\Interim\nonmot.txt' /            ! Non-motorized trip productions and attractions; not used in TRM v5

&param zones = 2678                                          ! Total number of zones (internal and external)
       trnfac=0.01,                                          ! transit skim conversion factor
       hwytmefac=1.0,                                        ! Highway time conversion factor
       hwydstfac=1.0,                                        ! Highway distance conversion factor
       fexp=-2.0                                             ! Power unit for accessibility measure
       schbuspct=0.7992,0.5419,0.4297,0.3057,0.2321          ! Percentage of students taking school buses by HH strata (for HBSchool purpose)
       calibrate=0                                           ! Set to 0 for application & set to 1 for calibration (does not include on-campus students)
```

5.1.37 Destination Choice FORTRAN Program Control Files

(dchbw_pk.ctl, dchbw_op.ctl, dcshp_pk.ctl, dcshp_op.ctl, dcsch_pk.ctl, dcsch_op.ctl, dcoth_pk.ctl, dcoth_op.ctl, dcwbnh_pk.ctl, and dcwbnh_op.ctl dcnhnw_pk.ctl, and dcnhnw_op.ctl)

File **dchbw_pk.ctl** is used below for the illustration purpose. As a note, the values in the file may not reflect the latest calibration. Please refer to the 2010 model provided in the data CDROM for the most accurate values.

```
$PARAMS

 HWYSKIM='..\..\Interim\AMLOV.BIN'                ! Highway skim file (generated automatically by TransCAD script)
 TRNSKIM='..\..\Interim\AMWP.BIN'                 ! Transit skim file (generated automatically by TransCAD script)
 TGEN='..\..\Interim\WRKEND.TXT'                  ! Home-based work trip production and attraction (generated by trip generation program)
 HHDATA='..\..\Interim\DEM_TDHBW.BIN'             ! Socioeconomic data file for HBW Trip Distribution (generated automatically by TransCAD
                                                  script)

 PEROUT='..\..\Interim\WRKPK_PER.BIN'             ! Output TAZ-to-TAZ HBW peak period person trip table
 RPTFILE='..\..\Output\DCWRKPK.RPT'               ! Output report file for HBW peak period
 RPTATR='..\..\Interim\WRKPK.ATR'                 ! Output intermediate iteration summary for HBW peak period
 IMPMTX='..\..\Interim\WRKPK_IMP.BIN'             ! Output composite impedance table for HBW peak period

 PERFCT=0.749                                     ! Period Factor
 TRNCOEF=0.6,0.1,0.0,0.0,0.0                      ! Transit coefficients by strata
 CIMPED=-0.1653,-0.1550,-0.1479,-0.1239,-0.1293   ! Composite impedance coefficients by strata
 DCOEFF=0,0,0,0,0                                 ! Distance coefficients by strata
 E1COEF=-1.047,-0.6579,0.2278,0.3474,0.3157       ! Industrial employment coefficients by strata
 E2COEF=1.0,1.0,1.0,1.0,1.0                       ! Retail employment coefficients by strata
 E3COEF=1.0,1.0,1.0,1.0,1.0                       ! Highway retail employment coefficients by strata
 E4COEF=-1.047,-0.6579,0.2278,0.3474,0.3157       ! Office employment coefficients by strata
 E5COEF=-1.047,-0.6579,0.2278,0.3474,0.3157       ! Service employment coefficients by strata
 H1COEF=0,0,0,0,0                                 ! Households coefficients by strata
 H2COEF=0,0,0,0,0                                 ! Population coefficients by strata
 H3COEF=0,0,0,0,0                                 ! NOT USED
 H4COEF=0,0,0,0,0                                 ! NOT USED
 H5COEF=0,0,0,0,0                                 ! University beds coefficients by strata

 MAXITER=50                                       ! Maximum iterations
 ATTRVAL=F                                        ! Use attraction value
 SIZEVAR=T                                        ! Use size variables
 DEBUG=F                                          ! Generate debug output
 CTOLER=10                                        ! Closure tolerance (%)
 NORMP=T,T,T,T,T                                  ! Normalize productions by strata
 NORMA=F,F,F,F,F                                  ! Normalize attractions by strata
```

```
 MAXZON=2678                                    ! Maximum zone number
$
```

5.1.38 Mode Choice FORTRAN Program Control Files

(mchbw_pk.ctl, mchbw_op.ctl, mcshp_pk.ctl, mcshp_op.ctl, mcsch_pk.ctl, mcsch_op.ctl, mcoth_pk.ctl, mcoth_op.ctl, mcwbnh_pk.ctl, mcwbnh_op.ctl mcnhnw_pk.ctl, mcnhnw_op.ctl, mcunv_pk.ctl, and mcunv_op.ctl,)

File **mchbw_pk.ctl** is used below for the illustration purpose. As a note, the values in the file may not reflect the latest calibration. Please refer to the 2010 model provided in the data CDROM for the most accurate values.

```
&Files
   FSKLCL='..\..\Interim\AML.BIN'                ! Input local bus skims
   FSKEXP='..\..\Interim\AMP.BIN'                ! Input express bus skims
   FSKRAL='..\..\Interim\AMR.BIN'                ! Input rail skims (Only specified when parameter RAIL = T)
   FSKA0P='..\..\Interim\AMLOV.BIN'              ! Input drive alone (SOV) auto skims
   FSKA2P='..\..\Interim\AMHOV.BIN'              ! Input HOV auto skims (Only specified when parameter HWY2P = T)
   FPERIN='..\..\Interim\WRKPK_PER.BIN'          ! Input person trip table for HBW peak period
   FZWALK='..\..\Interim\MCWALK.BIN'             ! Input short walk and long walk percentages and times
   FPCOST='..\..\Interim\PARKCOST.BIN'           ! Input parking cost
   FMDOUT='..\..\Interim\HBW_PK.BIN'             ! Output person trip table by mode for HBW peak period
   FRPORT='..\..\Output\HBW_PK.RPT"              ! Output report file for HBW peak period
   FUSERB='..\..\Interim\UBHBW_PK.BIN'           ! Output summit file
   FAINDR='..\..\Interim\HBW_PK.DRV'             ! Output Auto Intercept Drive Access Trip Table
   FAINTR='..\..\Interim\HBW_PK_TRN.ASC'         ! Output Auto Intercept Transit Trip Table
   FLGSUM='..\..\Interim\LSHBW_PK.BIN'           ! Output: LOGSUM file
   FPASAT='..\..\Interim\PASAHBW_PK.BIN'         ! Output: Summary of auto-vehicle trips by PASA

/
&PARAMS
   NZONES=2678                                   ! Maximum Zone Number
   NCATS=5                                       ! Number of Strata
   parkuse=1                          ! Parking cost use 0=HBK12, 1=HBW, 2=Other (HBShop & HBO), 3=HBU, 4=NHNW, 5=WBNH
   shadincr=500.0                                ! Shadow price increment for parking capacity constraint calculations
   NIter=5                                       ! Maximum iterations: for mode choice model calibration only

/
&OPTIONS
```

```
  DRYRUN=F                                                ! DRY RUN
  DEBUG=F                                                 ! GENERATE DEBUG OUTPUT
  HWY2P=T                                                 ! HIGHWAY 2-PERSON CARPOOL ("T" requires Highway hov2 SKIM)
  HWY3P=F                                                 ! HIGHWAY 3-PERSON CARPOOL
  CALIB=F                                                 ! GENERATE CALIBRATION OUTPUT
  USERBEN=F                                               ! GENERATE FTA SUMMIT USER BENEFIT FILES
  HOV=F                                                   ! Whether HOV is modeled as a separate choice
  EXPBUS=T                                                ! Whether EXPRESS BUS model is used
  RAIL=T                                                  ! Whether RAIL mode is used
  WORK=T                                                  ! Work Purpose
  NMOT=F                                                  ! Whether NON-MOTORIZED modes are used
  LCLKR=T                                                 ! Whether LOCAL KISS&RIDE mode is used
  AUTINT=T                                                ! Whether AUTO INTERCEPT mode is used
  LCLDRV=T                                                ! Whether LOCAL PARK&RIDE mode is used
  UNIV=F                                                  ! Whether this control file is used for the home based university purpose

/
&SELECTS
  I(1)=1,-2389                                            ! Production Zones
  J(1)=1,-2389                                            ! Attraction Zones
  TDAY='PEAK'                                             ! Time of Day: Peak/Off-Peak
  TPURP='HBW'                                             ! Trip Purpose
  ALTNAME='05 BASE YEAR'                                  ! Alternative Name
  MDLYEAR=2010                                            ! Auto vehicle trip summary by PASA

/
&PARMS
  CIVT=-0.025                                             ! IVT Coefficient
  CWAIT1=-0.050                                           ! Initial Wait Time Coefficient
  CWAIT2=-0.050                                           ! Transfer Wait Time Coefficient
  CTWALK=-0.050                                           ! Walk Access (Centroid) Time Coefficient
  CDRIVE=-0.050                                           ! Drive Access Time Coefficient
  COCOST=-0.00439,-0.00545,-0.00188,-0.00175,-0.00086          ! Auto Operating Cost Coefficient
  CPCOST=-0.00439,-0.00545,-0.00188,-0.00175,-0.00086          ! Parking Cost Coefficient
  CXFERS=0.0                                              ! Transfer Coefficient
  CCBD=0.0                                                ! CBD Transfer Walk Time Coefficient
  CLSPRM=0.5                                              ! LogSum Coefficient for Premium Mode
  CLSSUB=0.5                                              ! LogSum Coefficient for Sub Mode
```

```
ACPM=10.0                ! Auto Travel Cost (Cents per Mile)
OCC3P=3.5                ! HOV3+ Occupancy Rate
INTDA=0.8                ! Proportion of intra-zonal auto drive-alone trips
INT2P=0.1                ! Proportion of intra-zonal 2-person auto trips
INT3P=0.1                ! Proportion of intra-zonal 3+ person auto trips
HOVMIN=0.1               ! Time savings necessary to implement HOV stuff
ADJFCT=0.3               ! Adjust Factor (Convergance, 0~1)
KTRN(1)=   2.84190       ! Transit Constant for Strata 1
KTRN(2)=    .76150       ! Transit Constant for Strata 2
KTRN(3)=   -.65366       ! Transit Constant for Strata 3
KTRN(4)=  -1.63728       ! Transit Constant for Strata 4
KTRN(5)=   -.66564       ! Transit Constant for Strata 5
KSR(1)=    .00000        ! Share-Ride Constant for Strata 1
KSR(2)=  -1.35023        ! Share-Ride Constant for Strata 2
KSR(3)=   -.31436        ! Share-Ride Constant for Strata 3
KSR(4)=   -.99790        ! Share-Ride Constant for Strata 4
KSR(5)=  -1.07895        ! Share-Ride Constant for Strata 5
KATR(1)=   .00000        ! Auto Intercept Constant for Strata 1
KATR(2)=   .50680        ! Auto Intercept Constant for Strata 2
KATR(3)=   .00000        ! Auto Intercept Constant for Strata 3
KATR(4)=  -.38210        ! Auto Intercept Constant for Strata 4
KATR(5)=   .67290        ! Auto Intercept Constant for Strata 5
K3P(1)=   -.07192        ! HOV3+ Constant for Strata 1
K3P(2)=   -.09254        ! HOV3+ Constant for Strata 2
K3P(3)=   -.20948        ! HOV3+ Constant for Strata 3
K3P(4)=   -.25792        ! HOV3+ Constant for Strata 4
K3P(5)=   -.54407        ! HOV3+ Constant for Strata 5
KDRV(1)=  -4.22501       ! Drive to Transit Constant for Strata 1
KDRV(2)=  -4.92343       ! Drive to Transit Constant for Strata 2
KDRV(3)=  -3.36811       ! Drive to Transit Constant for Strata 3
KDRV(4)=  -3.51199       ! Drive to Transit Constant for Strata 4
KDRV(5)=  -2.74009       ! Drive to Transit Constant for Strata 5
KPNR(1)=   -.89265       ! Park-n-Ride Constant for Strata 1
KPNR(2)=   .00000        ! Park-n-Ride Constant for Strata 2
KPNR(3)=   -.28015       ! Park-n-Ride Constant for Strata 3
KPNR(4)=   -.12312       ! Park-n-Ride Constant for Strata 4
KPNR(5)=   -.17329       ! Park-n-Ride Constant for Strata 5
KEXP(1)= -0.22845        ! Express Bus Constant for Strata 1
```

KEXP(2)= -0.22845 ! Express Bus Constant for Strata 2
KEXP(3)= -0.22845 ! Express Bus Constant for Strata 3
KEXP(4)= -0.22845 ! Express Bus Constant for Strata 4
KEXP(5)= -0.22845 ! Express Bus Constant for Strata 5

5.2 Output Files

5.2.1 Highway Line Geographic File (Highway_Line.dbd)

1) Line Layer:

Field Name	Description	Notes
All the Fields from the Line Layer of Universe Highway Geographic File	Please see the Universe Highway Geographic File (Highway.dbd)	
FACTYPEAB	Facility type – AB direction	Filled automatically in step "Create Network" by the model
FACTYPEBA	Facility type – BA direction	
AB_BUS_SPEED_CAT	Bus speed category – AB direction	
BA_BUS_SPEED_CAT	Bus speed category – BA direction	
ABHRCAPACITY	Hourly lane capacity – AB direction	
BAHRCAPACITY	Hourly lane capacity – BA direction	
ABAMCAPACITY1	AM pre-peak-hour 1.5-hr link capacity – AB direction	
BAAMCAPACITY1	AM pre-peak-hour 1.5-hr link capacity – BA direction	
ABAMCAPACITY2	AM peak-hour link capacity – AB direction	
BAAMCAPACITY2	AM peak-hour link capacity – BA direction	
ABAMCAPACITY3	AM post-peak-hour 1.5-hr link capacity – AB direction	
BAAMCAPACITY3	AM post-peak-hour 1.5-hr link capacity – BA direction	
ABPMCAPACITY1	PM pre-peak-hour 1.5-hr link capacity – AB direction	
BAPMCAPACITY1	PM pre-peak-hour 1.5-hr link capacity – BA direction	
ABPMCAPACITY2	PM peak-hour link capacity – AB direction	
BAPMCAPACITY2	PM peak-hour link capacity – BA direction	
ABPMCAPACITY3	PM post-peak-hour 1.5-hr link capacity – AB direction	
BAPMCAPACITY3	PM post-peak-hour 1.5-hr link capacity – BA direction	
ABOPCAPACITY	Off peak link capacity – AB direction	
BAOPCAPACITY	Off peak link capacity – BA direction	
ABFFSPEED	Free flow speed - AB direction	
BAFFSPEED	Free flow speed - BA direction	
ABFFTIME	Free flow travel time - AB direction	
BAFFTIME	Free flow travel time - BA direction	
ABALPHA	Alpha value for Conical VDF - AB direction	
BAALPHA	Alpha value for Conical VDF - BA direction	
ABCONGSPD	Congested speed - AB direction	Initially filled in step "Create Network" with free-flow speeds or times. Later updated in step "Highway Assignment" with congested speeds or times after AM assignment is finished.
BACONGSPD	Congested speed - BA direction	
ABCONGTIME	Congested travel time - AB direction	
BACONGTIME	Congested travel time - BA direction	

2) Node Layer:

- Exactly the same as the Node Layer of the Universe Highway Geographic File (Highway.dbd)

5.2.2 Transit Background Line File (Transit_Line.dbd)

1) Line Layer:

Field Name	Description	Notes
All the Fields from the Line Layer of Universe Highway Geographic File	Please see the Universe Highway Geographic File (Highway.dbd)	
ABLINKTIME	Non-transit-on-highway link travel time – AB direction (Not really used by the model, but still have to stay in the file. Will clean it later.)	For walk-access links, CBD walk links, and parking lot walk links (mode =1, 3 & 4, respectively), it is walk time in minutes defined as Length/3*60; for transit-only links (mode = 5), it is driving time defined as Length/PostSpd*60. AB(BA)LINKTIME is exactly the same as AB(BA)NONTRANSITTIME
BALINKTIME	Non-transit-on-highway link travel time – BA direction (Not really used by the model, but still have to stay in the file. Will clean it later.)	
ABNONTRANSITTIME	Non-transit-on-highway link travel time – AB direction	
BANONTRANSITTIME	Non-transit-on-highway link travel time – BA direction	
ABAMFFTIME	Transit travel time on highway for the peak period – AB direction	Calculated for highway links and CBD links only (mode = 99 or 3) as Length / AB(BA)_AM(OP)_BUS _SPEED * 60 (in minutes)
BAAMFFTIME	Transit travel time on highway for the peak period – BA direction	
ABOPFFTIME	Transit travel time on highway for the off-peak period – AB direction	
BAOPFFTIME	Transit travel time on highway for the off-peak period – BA direction	
ABAMLINKTIME	Transit related travel time for the peak period – AB direction	For highway links (mode = 99), copies over transit travel time in AB(BA)AM(OP)FFTIME; for all other links (mode = 1, 3, 4,and 5), copies over the value in AB(BA)NONTRANSITTIME
BAAMLINKTIME	Transit related travel time for the peak period – BA direction	
ABOPLINKTIME	Transit related travel time for the off-peak period – AB direction	
BAOPLINKTIME	Transit related travel time for the off-peak period – BA direction	
ABWALKTIME	Walk time – AB direction	No value for freeway/expressway related facilities and centroid connectors
BAWALKTIME	Walk time – BA direction	
ABAMDRIVETIME	Auto drive time for the peak period – AB direction	Same as AB(BA)CONGTIME in Highway line geographic file
BAAMDRIVETIME	Auto drive time for the peak period – BA direction	
ABOPDRIVETIME	Auto drive time for the off-peak period – AB direction	Same as AB(BA)FFTIME in Highway line geographic file
BAOPDRIVETIME	Auto drive time for the off-peak period – BA direction	
AB_BASE_SPEED	Free flow base speed for transit – AB direction	Same as AB(BA)FFSPEED in Highway Line Geographic File
BA_BASE_SPEED	Free flow base speed for transit – BA direction	
AB_CONG_SPEED	Congested base speed for transit – AB direction	Same as AB(BA)CONGSPD in Highway Line Geographic File

BA_CONG_SPEED	Congested base speed for transit – BA direction	
AB_BUS_SPEED_CATEGORY	Transit speed category – AB direction	Used to get bus equation parameters from the Bus Speed Equation Lookup Table for calculating transit travel speeds
BA_BUS_SPEED_CATEGORY	Transit speed category – BA direction	
AB_AM_BUS_SPEED	Transit speed for the peak period – AB direction	Calculated for highway links and CBD links only (mode = 99 or 3) based on AB(BA)_CONG_SPEED and bus equation parameters, and used for calculation of AB(BA)AMFFTIME
BA_AM_BUS_SPEED	Transit speed for the peak period – BA direction	
AB_OP_BUS_SPEED	Transit speed for the off-peak period – AB direction	Calculated for highway links and CBD links only (mode = 99 or 3) based on AB(BA)_BASE_SPEED and bus equation parameters, and used for calculation of AB(BA)OPFFTIME
BA_OP_BUS_SPEED	Transit speed for the off-peak period – BA direction	

2) Node Layer:

Field Name	Description	Notes
All the Fields from the Node Layer of Universe Highway Geographic File	Please see the Universe Highway Geographic File (Highway.dbd)	
KissingNodes	Indicates if a node is a kiss-n-ride location	1 if the node is a kiss-and-ride location; otherwise null

5.2.3 Walk Access Times (WalkTime.bin)

Field Name	Description	Notes
TAZ	TAZ ID	
WalkPct1	Percent of TAZ in walk range (0 – 0.05 miles) to stops	
WalkPct2	Percent of TAZ in walk range (0 – 0.1 miles) to stops	
WalkPct3	Percent of TAZ in walk range (0 – 0.15 miles) to stops	
WalkPct4	Percent of TAZ in walk range (0 – 0.2 miles) to stops	
WalkPct5	Percent of TAZ in walk range (0 – 0.25 miles) to stops	
WalkPct6	Percent of TAZ in walk range (0 – 0.3 miles) to stops	
WalkPct7	Percent of TAZ in walk range (0 – 0.35 miles) to stops	
WalkPct8	Percent of TAZ in walk range (0 – 0.4 miles) to stops	
WalkPct9	Percent of TAZ in walk range (0 – 0.45 miles) to stops	
WalkPct10	Percent of TAZ in walk range (0 – 0.5 miles) to stops	
ShortPct	Percent of TAZ in short walk range (0 – 0.25 miles)	
LongPct	Percent of TAZ in long walk range (0.25 – 0.5 miles)	
ShortTime	Average walk time of the TAZ in short walk range	
LongTime	Average walk time of the TAZ in long walk range	
WalkTime	Average walk time of the TAZ in walk range	WalkTime = ShortTime * ShortPct + LongTime * LongPct

5.2.4 Highway Skim Matrix Files

(AMLOV.mtx, AMHOV.mtx, OPLOV.mtx, OPHOV.mtx, AMCV.mtx, and OPCV.mtx)
(AMLOV2.mtx, AMHOV2.mtx, OPLOV2.mtx, and OPHOV2.mtx)

1) AMCV.mtx, and OPCV.mtx

Matrix Core Name	Description	Notes
Time	Travel time in minutes, which includes toll-converted time based on value of time	
Distance	Travel distance in miles	
Time_true	Travel time in minutes, no tolls included	
Toll_XXXYY (Skim)	Toll by vehicle occupancy and time of day	XXX ∈ [SOV, HOV, CV] YY ∈ [AM, OP]

2) AMLOV.mtx, AMHOV.mtx, OPLOV.mtx, and OPHOV.mtx

Matrix Core Name	Description	Notes
Time	Travel time in minutes, which includes toll-converted time based on value of time	
Distance	Travel distance in miles	

3) AMLOV2.mtx, AMHOV2.mtx, OPLOV2.mtx, and OPHOV2.mtx

Matrix Core Name	Description	Notes
Time	Travel time in minutes, no tolls included	
Distance	Travel distance in miles	
Toll_SOV(HOV/CV)AM(OP) (Skim)	Toll by vehicle occupancy and time of day	

5.2.5 Premium Transit Skim Matrix Files

(AMDRIVE.mtx, AMWALK.mtx, and OPWALK.mtx)

Matrix Core Name	Description	Notes
Fare	Transit fare in dollar * 100	
Initial Wait Time	Initial wait time in minutes * 100	
Transfer Wait Time	Transfer wait time in minutes * 100	
Number of Transfers	Average number of transfers	
Prem IVT	In-vehicle travel time on express buses and rails (in minutes * 100)	
WalkTime (Walk)	Walk time on walk access links and highway links (in minutes * 100)	
DriveTime (Drive)	Drive time on highway links and centroid connectors (in minutes * 100)	
WalkTime (CBDWalk)	Walk time on CBD highway links (in minutes * 100)	
Local IVT	In-vehicle travel time on local buses (in minutes * 100)	

5.2.6 Transit Skim Matrix Files by Transit Mode, Access Mode, and Time of day

(AMKLSKIM1.mtx, AMKPSKIM1.mtx, AMKRSKIM1.mtx, AMDLSKIM1.mtx, AMDPSKIM1.mtx, AMDRSKIM1.mtx, AMWLSKIM1.mtx, AMWPSKIM1.mtx, AMWRSKIM1.mtx, OPKLSKIM1.mtx, OPKPSKIM1.mtx, OPKRSKIM1.mtx, OPDLSKIM1.mtx, OPDPSKIM1.mtx, OPDRSKIM1.mtx, OPWLSKIM1.mtx, OPWPSKIM1.mtx, and OPWRSKIM1.mtx)

Note: Since the size of these matrix files is too large and takes too much disk space, only AMDRSKIM1.mtx and AMWRSKIM1.mtx are kept for debugging purpose, if any bugs exist, and all other matrix files are deleted in the middle of the model run.

Matrix Core Name	Description	Notes
Fare	Transit fare in dollars * 100	
Initial Wait Time	Initial wait time in minutes * 100	
Transfer Wait Time	Transfer wait time in minutes * 100	
Number of Transfers	Average number of transfers	
WalkTime (Walk)	Walk time on walk access links (in minutes * 100)	
WalkTime (Drive)	Walk time on highway links (in minutes * 100)	
WalkTime (CBDWalk)	Walk time on CBD highway links (in minutes * 100)	
WalkTime (Walk Funnel)	Walk time on walk funnels (in minutes * 100)	
DriveTime (Drive)	Drive time on highway links and centroid connectors (in minutes * 100)	
LinkTime (Local)	IVTT on local buses (in minutes * 100)	
LinkTime (Express)	IVTT on express buses (in minutes * 100)	
LinkTime (Shuttle)	IVTT on shuttle buses (in minutes * 100)	
LinkTime (Rail)	IVTT on rails (in minutes * 100)	

5.2.7 Transit Skim Matrix Files by Transit Mode and Time of day for All access Modes

(AML.mtx, AMP.mtx, AMR.mtx, OPL.mtx, OPP.mtx, and OPR.mtx)

Matrix Core Name	Description	Notes
Wait1_W	Initial wait time – Walk access	
Wait2_W	Transfer wait time – Walk access	
Xfer_W	Number of transfers – Walk access	
Walk_W	Walk time – Walk access	
CBDWalk_W	CBD walk time – Walk access	
Tmp1		
Shutl_W	IVTT on shuttle buses – Walk access	
Local_W	IVTT on local buses – Walk access	
Exp_W	IVTT on express buses – Walk access	
Rail_W	IVTT on rails – Walk access	
Fare_W	Transit fare – Walk access	
Wait1_D	Initial wait time – Park-n-ride	
Wait2_D	Transfer wait time – Park-n-ride	
Xfer_D	Number of transfers – Park-n-ride	
Walk_D	Walk time – Park-n-ride	
CBDWalk_D	CBD walk time – Park-n-ride	
Shutl_D	IVTT on shuttle buses – Park-n-ride	
Tmp2		

Drive_D	Drive time – Park-n-ride	
Tmp3		
Local_D	IVTT on local buses – Park-n-ride	
Exp_D	IVTT on express buses – Park-n-ride	
Rail_D	IVTT on rails – Park-n-ride	
Fare_D	Transit fare – Park-n-ride	
Wait1_K	Initial wait time – Kiss-n-ride	
Wait2_K	Transfer wait time – Kiss-n-ride	
Xfer_K	Number of transfers – Kiss-n-ride	
Walk_K	Walk time – Kiss-n-ride	
CBDWalk_K	CBD walk time – Kiss-n-ride	
Shutl_K	IVTT on shuttle buses – Kiss-n-ride	
Tmp4		
Drive_K	Drive time – Kiss-n-ride	
Tmp5		
Local_K	IVTT on local buses – Kiss-n-ride	
Exp_K	IVTT on express buses – Kiss-n-ride	
Rail_K	IVTT on rails – Kiss-n-ride	
Fare_K	Transit fare – Kiss-n-ride	

5.2.8 Trip Generation by Purpose Produced by TG FORTRAN Program

(WrkEnd.txt, ShpEnd.txt, SchEnd.txt, OthEnd.txt, WBNHEnd.txt and NHNWEnd.txt)

Column	Description	Notes
Column 1	TAZ ID	
Column 2	Productions from zero car households	
Column 3	Productions from low income with car(s) households	
Column 4	Productions from medium income with cars less than workers households	
Column 5	Productions from medium income with cars greater than or equal to workers households	
Column 6	Productions from high income with car(s) households	
Column 7	Attractions from zero car households	
Column 8	Attractions from low income with car(s) households	
Column 9	Attractions from medium income with cars less than workers households	
Column 10	Attractions from medium income with cars greater than or equal to workers households	
Column 11	Attractions from high income with car(s) households	

5.2.9 Home based University Trip Generation File (UnvEnd.txt)

Column	Description	Notes
Zone	TAZ ID	
STUD_ON_P	Zonal productions from college students living in on-campus dormitories	
STUD_OFF_P	Zonal productions from college students living in	

	off-campus households	
STUD_ON_A	Zonal attractions from college students living in on-campus dormitories	
STUD_OFF_A	Zonal attractions from college students living in off-campus households	

5.2.10 Air Passenger Trips (AirP.bin)

Field Name	Description	Notes
TAZID	TAZ ID	
CountyID	County ID	1 = Wake 2 = Durham 3 = Orange 4 = Other
HH1	Air passenger trips from low income households	
HH2	Air passenger trips from medium-low income households	
HH3	Air passenger trips from medium-high income households	
HH4	Air passenger trips from high income households	
HHs	Total number of households in the TAZ	
EMP	Total number of employees in the TAZ (i.e. regular + special)	
HBA	Home-based airport trips	Not balanced to the airport passenger trip control total
WBA	Work-based airport trips	Not balanced to the airport passenger trip control total
PRA	Private-residence-based (not home-based) airport trips	Not balanced to the airport passenger trip control total
OTHA	Other-place-based airport trips	Not balanced to the airport passenger trip control total
HBO	Home-based other trips	= HBA after it is balanced to the airport passenger trip control total
WBNH	Work-based non-home trips	= WBA after it is balanced to the airport passenger trip control total
NHNW	Non-home-non-work-based airport trips	= PRA + OTHA after they are balanced to the airport passenger trip control total

5.2.11 All-Mode, Motorized and Non-motorized Person Trip PA Matrix Files

(All-mode:
WrkPK_Per.mtx, ShpPK_Per.mtx, SchPK_Per.mtx, OthPK_Per.mtx,
WBNHPK_Per.mtx, and NHNWPK_Per.mtx;
WrkOP_Per.mtx, ShpOP_Per.mtx, SchOP_Per.mtx, OthOP_Per.mtx,
WBNHOP_Per.mtx, and NHNWOP_Per.mtx;
HBU_Per.mtx;
Motorized:
WrkPK_Per_M.mtx, ShpPK_Per_M.mtx, SchPK_Per_M.mtx, OthPK_Per_M.mtx,

WBNHPK_Per_M.mtx, NHNWPK_Per_M.mtx, and UnvPK_Per_M.mtx;
WrkOP_Per_M.mtx, ShpOP_Per_M.mtx, SchOP_Per_M.mtx, OthOP_Per_M.mtx,
WBNHOP_Per_M.mtx, NHNWOP_Per_M.mtx, and UnvOP_Per_M.mtx;
Nonmotorized:
WrkPK_Per_NM.mtx, ShpPK_Per_NM.mtx, SchPK_Per_NM.mtx, OthPK_Per_NM.mtx,
WBNHPK_Per_NM.mtx, and NHNWPK_Per_NM.mtx;
WrkOP_Per_NM.mtx, ShpOP_Per_NM.mtx, SchOP_Per_NM.mtx, OthOP_Per_NM.mtx,
WBNHOP_Per_NM.mtx, and NHNWOP_Per_NM.mtx;
HBU_Per_NM.mtx)

1) HBU_Per.mtx

Matrix Core Name	Description	Notes
UnivTrip_02XPTAZ	All-mode HBU student trip interchanges	In P-A format

2) HBU_Per_NM.mtx

Matrix Core Name	Description	Notes
Trips_NM	Non-motorized HBU student trip interchanges	In P-A format

3) All other trip matrix files

Matrix Core Name	Description	Notes
Trip1	Trip interchanges for HH strata 1 in PA format	In P-A format
Trip2	Trip interchanges for HH strata 2 in PA format	
Trip3	Trip interchanges for HH strata 3 in PA format	
Trip4	Trip interchanges for HH strata 4 in PA format	
Trip5	Trip interchanges for HH strata 5 in PA format	

5.2.12 Commercial Vehicle Trip PA Matrix File (PACV1.mtx)

Matrix Core Name	Description	Notes
CAR	Commercial auto trip interchange table	
PU	Commercial pickup trip interchange table	
TRK	Commercial truck trip interchange table	
CVIE	Commercial vehicle I-E trip interchange table	
AUTOIE	Passenger auto I-E trip interchange table	

5.2.13 Final Trip OD Matrix Files for Highway Assignment

(TOTAM_OD.mtx, TOTPM_OD.mtx, and TOTOP_OD.mtx)

1) TOTAM_OD.mtx and TOTPM_OD.mtx,

Matrix Core Name	Description	Notes
SOV1	SOV vehicle trip interchange table for pre-peak-hour shoulder	

HOV1	HOV vehicle trip interchange table for pre-peak-hour shoulder	
TRK1	Truck vehicle trip interchange table for pre-peak-hour shoulder	
SOV2	SOV vehicle trip interchange table for peak hour	
HOV2	HOV vehicle trip interchange table for peak hour	
TRK2	Truck vehicle trip interchange table for peak hour	
SOV3	SOV vehicle trip interchange table for post-peak-hour shoulder	
HOV3	HOV vehicle trip interchange table for post-peak-hour shoulder	
TRK3	Truck vehicle trip interchange table for post-peak-hour shoulder	

2) TOTOP_OD.mtx

Matrix Core Name	Description	Notes
SOV	SOV vehicle trip interchange table	
HOV	HOV vehicle trip interchange table	
TRK	Truck vehicle trip interchange table	

5.2.14 Final Trip PA Matrix Files for Transit Assignment

(PK_TRN.mtx and OP_TRN.mtx)

Matrix Core Name	Description	Notes
Trip1	Walk to Local Bus trip interchange table	
Trip2	Park-n-Ride to Local Bus trip interchange table	
Trip3	Kiss-n-Ride to Local Bus trip interchange table	
Trip4	Walk to Express Bus trip interchange table	
Trip5	Park-n-Ride to Express Bus trip interchange table	
Trip6	Kiss-n-Ride to Express Bus trip interchange table	
Trip7	Walk to Rail trip interchange table	
Trip8	Park-n-Ride to Rail trip interchange table	
Trip9	Kiss-n-Ride to Rail trip interchange table	

5.2.15 Highway Assignment Result Files – Sub-period (pre-peak-hour shoulder, peak hour, and post-peak-hour shoulder)

(AMP1.bin, AMP2.bin, AMP3.bin, PMP1.bin, PMP2.bin, and PMP3.bin)

Field Name	Description	Notes
ID1	Highway link ID	
AB_Flow_PCE	All vehicle volume in PCE: AB direction	
BA_Flow_PCE	All vehicle volume in PCE: BA direction	
Tot_Flow_PCE	All vehicle total volume in PCE: Total = AB + BA	
AB_Time	Travel time: AB direction	
BA_Time	Travel time: BA direction	
MAX_Time	Maximum travel time: AB or BA	

AB_voc	Volume to capacity ratio: AB direction	
BA_voc	Volume to capacity ratio: BA direction	
MAX_voc	Maximum volume to capacity ratio: AB or BA	
AB_V_Dist_T	Vehicle miles traveled: AB direction	
BA_V_Dist_T	Vehicle miles traveled: BA direction	
Tot_V_Dist_T	Volume miles traveled: Total = AB + BA	
AB_vht	Vehicle minutes traveled: AB direction	
BA_vht	Vehicle minutes traveled: BA direction	
TOT_vht	Volume minutes traveled: Total = AB + BA	
AB_speed	Travel speed: AB direction	
BA_speed	Travel speed: BA direction	
AB_VDF	Volume Delay Function value: AB direction	
BA_VDF	Volume Delay Function value: BA direction	
MAX_VDF	Maximum Volume Delay Function value: AB or BA	
AB_Flow_SOV1/2/3	SOV volume: AB direction	Number in the field title: 1: pre-peak-hour shoulder 2: peak-hour 3: post-peak-hour shoulder
BA_Flow_SOV1/2/3	SOV volume: BA direction	
AB_Flow_HOV1/2/3	HOV volume: AB direction	
BA_Flow_HOV1/2/3	HOV volume: BA direction	
AB_Flow_TRK1/2/3	Truck volume: AB direction	
BA_Flow_TRK1/2/3	Truck volume: BA direction	
AB_Flow	All vehicle volume: AB direction	
BA_Flow	All vehicle volume: BA direction	
Tot_Flow	All vehicle volume: Total = AB + BA	

5.2.16 Highway Assignment Result Files – Period Total

1) AMAssn1.bin and PMAssn1.bin

Field Name	Description	Notes
ID1	Highway link ID	
AB_Flow_PCE	All vehicle volume in PCE: AB direction	Sum of the fields with the same titles in AMP1.bin, AMP2.bin, and AMP3.bin for AM peak and PMP1.bin, PMP2.bin, and PMP3 .bin for PM peak
BA_Flow_PCE	All vehicle volume in PCE: BA direction	
Tot_Flow_PCE	All vehicle total volume in PCE: Total = AB + BA	
AB_Time	Travel time: AB direction	Sub-period volume weighted average travel time and speed
BA_Time	Travel time: BA direction	
AB_Speed	Travel speed: AB direction	
BA_Speed	Travel speed: BA direction	
AB_Flow_SOV	SOV volume: AB direction	Sum of the fields with the same titles* in AMP1.bin, AMP2.bin, and AMP3.bin for AM peak and PMP1.bin, PMP2.bin, and PMP3 .bin for PM peak. *Note: field titles in the sub-period files have an additional digit to indicate the sub-period, i.e. 1, 2, or 3.
BA_Flow_SOV	SOV volume: BA direction	
AB_Flow_HOV	HOV volume: AB direction	
BA_Flow_HOV	HOV volume: BA direction	
AB_Flow_TRK	Truck volume: AB direction	
BA_Flow_TRK	Truck volume: BA direction	
AB_Flow	All vehicle volume: AB direction	Sum of the fields with the same

BA_Flow	All vehicle volume: BA direction	titles in AMP1.bin, AMP2.bin, and AMP3.bin for AM peak and PMP1.bin, PMP2.bin, and PMP3 .bin for PM peak
Tot_Flow	All vehicle volume: Total = AB + BA	
AB_Flow_PCE1	All vehicle volume in PCE: AB direction & pre-peak-hour shoulder	= AB_Flow_PCE in AMP1.bin or PMP1.bin
BA_Flow_PCE1	All vehicle volume in PCE: BA direction & pre-peak-hour shoulder	= BA_Flow_PCE in AMP1.bin or PMP1.bin
AB_Flow_PCE2	All vehicle volume in PCE: AB direction & peak-hour	= AB_Flow_PCE in AMP2.bin or PMP2.bin
BA_Flow_PCE2	All vehicle volume in PCE: BA direction & peak-hour	= BA_Flow_PCE in AMP2.bin or PMP2.bin
AB_Flow_PCE3	All vehicle volume in PCE: AB direction & post-peak-hour shoulder	= AB_Flow_PCE in AMP3.bin or PMP3.bin
BA_Flow_PCE3	All vehicle volume in PCE: BA direction & post-peak-hour shoulder	= BA_Flow_PCE in AMP3.bin or PMP3.bin

2) OPAssn1.bin

Field Name	Description	Notes
ID1	Highway link ID	
AB_Time	Travel time: AB direction	
BA_Time	Travel time: BA direction	
MAX_Time	Maximum travel time: AB or BA	
AB_voc	Volume to capacity ratio: AB direction	
BA_voc	Volume to capacity ratio: BA direction	
MAX_voc	Maximum volume to capacity ratio: AB or BA	
AB_vmt	Vehicle miles traveled: AB direction	
BA_vmt	Vehicle miles traveled: BA direction	
TOT_vmt	Volume miles traveled: Total = AB + BA	
AB_vht	Vehicle minutes traveled: AB direction	
BA_vht	Vehicle minutes traveled: BA direction	
TOT_vht	Volume minutes traveled: Total = AB + BA	
AB_speed	Travel speed: AB direction	
BA_speed	Travel speed: BA direction	
AB_VDF	Volume Delay Function value: AB direction	
BA_VDF	Volume Delay Function value: BA direction	
MAX_VDF	Maximum Volume Delay Function value: AB or BA	
AB_Flow_SOV	SOV volume: AB direction	
BA_Flow_SOV	SOV volume: BA direction	
AB_Flow_HOV	HOV volume: AB direction	
BA_Flow_HOV	HOV volume: BA direction	
AB_Flow_CV	Commercial vehicle volume: AB direction	
BA_Flow_CV	Commercial vehicle volume: BA direction	
AB_Flow	All vehicle volume: AB direction	
BA_Flow	All vehicle volume: BA direction	
Tot_Flow	All vehicle volume: Total = AB + BA	

5.2.17 Highway Assignment Turning Movement Files

(TMV_AM1.bin, TMV_AM2.bin, TMV_AM3.bin, TMV_PM1.bin, TMV_PM2.bin, TMV_PM3.bin, and Intersection Turning Movements_OP.bin)

Field Name	Description	Notes
FROMLINK	From link for the turn	
TOLINK	To link for the turn	
NODE	Intersection node ID	
VOLUME	Total vehicle turning volume	VOLUME = VOLUME_SOV + VOLUME_HOV + VOLUME_TRK
VOLUME_SOV	SOV turning volume	
VOLUME_HOV	HOV turning volume	
VOLUME_TRK	Truck turning volume	

5.2.18 Transit Assignment Result Files – Transit Flows by Route (Output*_flw.bin)

Field Name	Description	Notes
ROUTE	Transit route ID	
FROM_STOP	From-stop ID	
TO_STOP	To-stop ID	
FROM_MP	Milepost of the from-stop	
TO_MP	Milepost of the to-stop	
TransitFlow	Transit flow (riders onboard) from the from-stop to the to-stop	
BaseIVTT	In-vehicle travel time (in minutes)	
Cost	General cost (in dollars)	
VOC	Volume to capacity ratio	Always null for TRM since TRM is not using capacity-constrained assignment methods

5.2.19 Transit Assignment Result Files – Aggregated Transit Flows on Highway Links (Output*_agg.bin)

Field Name	Description	Notes
ID1	Link ID	Match those in Transit Line geographic file
AB_TransitFlow	All route transit flow on the link: AB direction	
BA_TransitFlow	All route transit flow on the link: BA direction	
AB_NonTransit	All route non-transit flow on the link: AB direction	
BA_NonTransit	All route non-transit flow on the link: BA direction	
AB_TotalFlow	All route transit & non-transit flow on the link: AB direction	AB_TotalFlow = AB_TransitFlow + AB_NonTransit
BA_TotalFlow	All route transit & non-transit flow on the link: BA direction	Same as above, except for the BA direction
AB_Access_Walk_Flow	All route walk access flow on the link: AB direction	
BA_Access_Walk_Flow	All route walk access flow on the link: BA direction	

AB_Xfer_Walk_Flow	All route transfer walk flow on the link: AB direction	
BA_Xfer_Walk_Flow	All route transfer walk flow on the link: BA direction	
AB_Egress_Walk_Flow	All route walk egress flow on the link: AB direction	
BA_Egress_Walk_Flow	All route walk egress flow on the link: BA direction	
AB_Walk_Flow	All route all walk flow on the link: AB direction	AB_Walk_Flow = AB_Access_Walk_Flow + AB_Xfer_Walk_Flow + AB_Egress_Walk_Flow
BA_Walk_Flow	All route all walk flow on the link: BA direction	Same as above, except for the BA direction
AB_Drive_Flow	All route drive access flow on the link: AB direction	
BA_Drive_Flow	All route drive access flow on the link: BA direction	

5.2.20 Transit Assignment Result Files – Boarding/Alighting by Stop (Output*_ono.bin)

Field Name	Description	Notes
STOP	Stop ID	
ROUTE	Transit route ID	
On	Total number of riders boarding	
Off	Total number of riders alighting	
DriveAccessOn	Number of drive-access riders boarding	This field is available only in park-n-ride and kiss-n-ride boarding / alighting tables.
WalkAccessOn	Number of walk-access riders boarding	On = WalkAccessOn (or DriveAccessOn) + DirectTransferOn + WalkTransferOn
DirectTransferOn	Number of transfer riders boarding: transferred from another route at the same location	
WalkTransferOn	Number of transfer riders boarding: transferred from another route with some walking	
DirectTransferOff	Number of transfer riders alighting: transfer to another route at the same location	Off = DirectTransferOff + WalkTransferOff + EgressOff
WalkTransferOff	Number of transfer riders alighting: transfer to another route with some walking	
EgressOff	Total number of riders alighting and egressing the transit system	

5.2.21 Transit Assignment Result Files – Transfers among Routes and Stops (Output*_mov.bin)

Field Name	Description	Notes
FROM LINE	From-route ID	
TO LINE	To-route ID	
ALIGHT STOP	Alighting stop ID	
BOARD STOP	Boarding stop ID	
VOLUME	Transfer volume	

5.2.22 Transit Assignment Result Files – Walk Flows (Output*_wfl.bin)

Field Name	Description	Notes
ID1	Highway Link ID	Match those in Transit Line geographic file
AB_WalkFlow	All transit related walk (and drive) flow: AB direction	Only park-n-ride and kiss-n-ride tables contain transit-related drive flow, but not walk-access tables. In drive-access tables: AB(BA)_Flow = AB(BA)_Walk_Flow + AB(BA)_Drive_Flow In walk-access tables: AB(BA)_Flow = AB(BA)_Access_Walk_Flow+ AB(BA)_Xfer_Walk_Flow + AB(BA)_Egress_Walk_Flow
BA_WalkFlow	All transit related walk (and drive) flow: BA direction	
TOT_WalkFlow	All transit related walk (and drive) flow total: AB + BA	
AB_Access_Walk_Flow	Walk access walk flow: AB direction	
BA_Access_Walk_Flow	Walk access walk flow: BA direction	
TOT_Access_Walk_Flow	Walk access walk flow total: AB + BA	
AB_Xfer_Walk_Flow	Transfer walk flow: AB direction	
BA_Xfer_Walk_Flow	Transfer walk flow: BA direction	
TOT_Xfer_Walk_Flow	Transfer walk flow total: AB + BA	
AB_Egress_Walk_Flow	Egress walk flow: AB direction	
BA_Egress_Walk_Flow	Egress walk flow: BA direction	
TOT_Egress_Walk_Flow	Egress walk flow total: AB + BA	
AB_Walk_Flow	Transit related walk flow: AB direction	Only park-n-ride and kiss-n-ride tables contain these three fields, but not walk-access tables. AB(BA)_Walk_Flow = AB(BA)_Access_Walk_Flow+ AB(BA)_Xfer_Walk_Flow + AB(BA)_Egress_Walk_Flow
BA_Walk_Flow	Transit related walk flow: BA direction	
TOT_Walk_Flow	Transit related walk flow total: AB + BA	
AB_Drive_Flow	Transit related drive flow: AB direction	Only park-n-ride and kiss-n-ride tables contain these three fields.
BA_Drive_Flow	Transit related drive flow: BA direction	
TOT_Drive_Flow	Transit related drive flow total: AB + BA	

5.2.23 Transit Assignment Result Files – Stop-to-Stop PA Flows (Output*_s2s.mtx)

Matrix Core Name	Description	Notes
WalkAccess (or DriveAccess)	Stop to stop transit flow matrix in the PA format	The matrix core is named by TransCAD automatically. If the matrix is of a transit mode by walk access, the core is named "WalkAccess". If it is of park-and-ride or kiss-and-ride, the core is named "DriveAccess".

Matrix Indices	Description	Notes
Route names	Each route name as shown in the transit route system file is used to index the stop-to-stop matrix, so the matrix can be displayed with only the stops that belong to the chosen route(s).	One or two matrix indices can be chosen to display the matrix contents, one for the From box and one for the To box. This applies to all the other types of indices being described below. For matrix index, please refer to the Matrix chapter of TransCAD User's Guide.
Operator names	The name of each operator is used to index the stop-to-stop matrix, so the matrix can be displayed with only the stops that belong to the chosen operator(s).	If an operator is missing in the "Transit Operator and Company Dictionary.dbf" file, the index will be named as the word "Operator" plus the operator's ID as used in the transit route system file.
Company names	The name of each company (actually a mix with mode) is used to index the stop-to-stop matrix, so the matrix can be displayed with only the stops that belong to the chosen company(s)/mode(s).	If a company is missing in the "Transit Operator and Company Dictionary.dbf" file, the index will be named as the string "Comp/Mode" plus the company's ID as used in the transit route system file.
Rail by operator	The stop-to-stop matrix is indexed by rail mode AND its operator, if any. The index name is the Operator name plus the string "Rail (All)".	If an operator is missing in the "Transit Operator and Company Dictionary.dbf" file, the index will be named as the concatenation of the word "Operator", the operator's ID, and the string "Rail (All)" in the order.

5.2.24 Drive Access Origin TAZ to Parking Lot Drive Time Matrix Files

(origin_parking_AMDL.mtx, origin_parking_AMDP.mtx, origin_parking_AMDR.mtx, origin_parking_AMKL.mtx, origin_parking_AMKP.mtx, and origin_parking_AMKR.mtx, origin_parking_OPDL.mtx, origin_parking_OPDP.mtx, origin_parking_OPDR.mtx, origin_parking_OPKL.mtx, origin_parking_OPKP.mtx, and origin_parking_OPKR.mtx)

Matrix Core Name	Description	Notes
Drive Time	Origin TAZ to parking lot drive time in minutes	Rows are TAZ IDs and columns are parking lot node IDs

5.2.25 Drive Access TAZ to TAZ Parking Lot Choice Matrix Files

(parking_AMDL.mtx, parking_AMDP.mtx, parking_AMDR.mtx, parking_AMKL.mtx, parking_AMKP.mtx, and parking_AMKR.mtx, parking_OPDL.mtx, parking_OPDP.mtx, parking_OPDR.mtx, parking_OPKL.mtx, parking_OPKP.mtx, and parking_OPKR.mtx)

Matrix Core Name	Description	Notes
Parking Nodes	Chosen parking lot node ID for each TAZ pair	

5.2.26 Trip Mode Split Produced by Mode Choice FORTRAN Program

(HBW_PK.bin, SHP_PK.bin, SCH_PK.bin, OTH_PK.bin, WBNH_PK.bin, NHNW_PK.bin, UNV_PK.bin, HBW_OP.bin, SHP_OP.bin, SCH_OP.bin, OTH_OP.bin, WBNH_OP.bin, NHNW_OP.bin, and UNV_OP.bin)

Field Name	Description	Notes
IZ	Origin TAZ ID	
JZ	Destination TAZ ID	
Trip1	Walk access local bus trips	
Trip2	Park-and-ride local bus trips	
Trip3	Kiss-and-ride local bus trips	
Trip4	Walk access express bus trips	
Trip5	Park-and-ride express bus trips	
Trip6	Kiss-and-ride express bus trips	
Trip7	Walk access rail trips	
Trip8	Park-and-ride rail trips	
Trip9	Kiss-and-ride rail trips	
Trip10	Non-motorized trips - Walking	Not used in TRM
Trip11	Non-motorized trips - Biking	Not used in TRM
Trip12	Drive alone highway trips	
Trip13	2 person carpool trips	
Trip14	3+ person carpool trips	
Trip15	Auto intercept trips	

5.2.27 Mode Choice Parking Related Shadow Price File (ShadPrice.bin)

Field Name	Description	Notes
ZONE	TAZ ID	
ShadHBW	Peak period parking capacity constraint resulted shadow price for HBW trip	
ShadHBSh	Peak period parking capacity constraint resulted shadow price for HBShop trip	
ShadHBO	Peak period parking capacity constraint resulted shadow price for HBO trip	
ShadHBU	Peak period parking capacity constraint resulted shadow price for HBU trip	
ShadNHNW	Peak period parking capacity constraint resulted shadow price for NHNW trip	
ShadWBNH	Peak period parking capacity constraint resulted shadow price for WBNH trip	

5.2.28 Mode Choice Resulting Auto Vehicle Trip Production and Attraction Summary Files by PASA and Trip Purpose

(PASAHBW_PK.bin, PASASHP_PK.bin, PASASCH_PK.bin, PASAOTH_PK.bin, PASAHBU_PK.bin, PASANHNW_PK.bin, PASAWBNH_PK.bin, PASAHBW_OP.bin, PASASHP_OP.bin, PASASCH_OP.bin, PASAOTH_OP.bin, PASAHBU_OP.bin, PASANHNW_OP.bin, PASAWBNH_OP.bin)

Field Name	Description	Notes
PASA	ID for parking analysis sub-area	1 = UNC campus 2 = Duke campus 3 = NCSU campus 4 = NCCU campus 5 = Chapel Hill CBD 6 = Durham CBD 7 = Raleigh CBD 8 = RDU
P	Auto vehicle trip productions summarized by PASA	
A	Auto vehicle trip attractions summarized by PASA	