

# Small Area Travel Demand Model Users Guide for Model Application



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August 21, 2008

# Table of Contents

Table of Contents.....	i
List of Tables.....	ii
List of Figures.....	ii
1 Introduction.....	1
1.1 Document Overview.....	1
1.2 Model Overview.....	1
1.3 Directory Structure and File Naming.....	2
1.4 Input Files.....	5
2 Getting Started.....	8
2.1 Loading the Application on your Computer.....	8
Step 1: Copy All Model Files.....	8
Step 2: Update and Move NCSAM.ini.....	8
Step 3: Move TPBLOGO.BMP and TRUCK41.BMP.....	8
Step 4: NCSAM.BIN file.....	8
Step 5: NCSAM.ARR file.....	9
Step 6: Compile the Resource Code to a Users Interface (UI).....	10
Step 7: Install Add-In.....	10
Step 8: Open the GUI.....	10
3 Base Year Model Application.....	11
3.1 Required Input Files and File Formats.....	11
Step 1: Prepare Input Files.....	11
Step 2: Setup the Base Year Scenario.....	11
Step 3: Run Base Year Model and Review Results.....	14
4 Changing Parameters Files.....	22
4.1 Prepare Network.....	22
4.2 Create Network.....	22
4.3 Trip Generation.....	23
4.4 Trip Distribution.....	24
4.5 Mode Split.....	25
4.6 Commercial Vehicles.....	25
4.7 External Stations.....	26
4.8 Time of Day.....	26
4.9 Highway Assignment.....	26
5 Model Report File.....	26
6 Scenario Planning.....	27
6.1 Scenario Inputs.....	27
6.2 Adding a New Scenario.....	27
6.3 Running a New Scenario.....	29
Appendix A.....	A-1

## List of Tables

Table 1 File Names and Descriptions in Parameters Directory .....	3
Table 2 Scenario Input Files .....	4
Table 3 Scenario Interim Files .....	4
Table 4 Scenario Output Files .....	5
Table 5 Model Support Files .....	5

## List of Figures

Figure 1 Travel Model System Diagram .....	2
Figure 2 Directory Structure Diagram .....	3

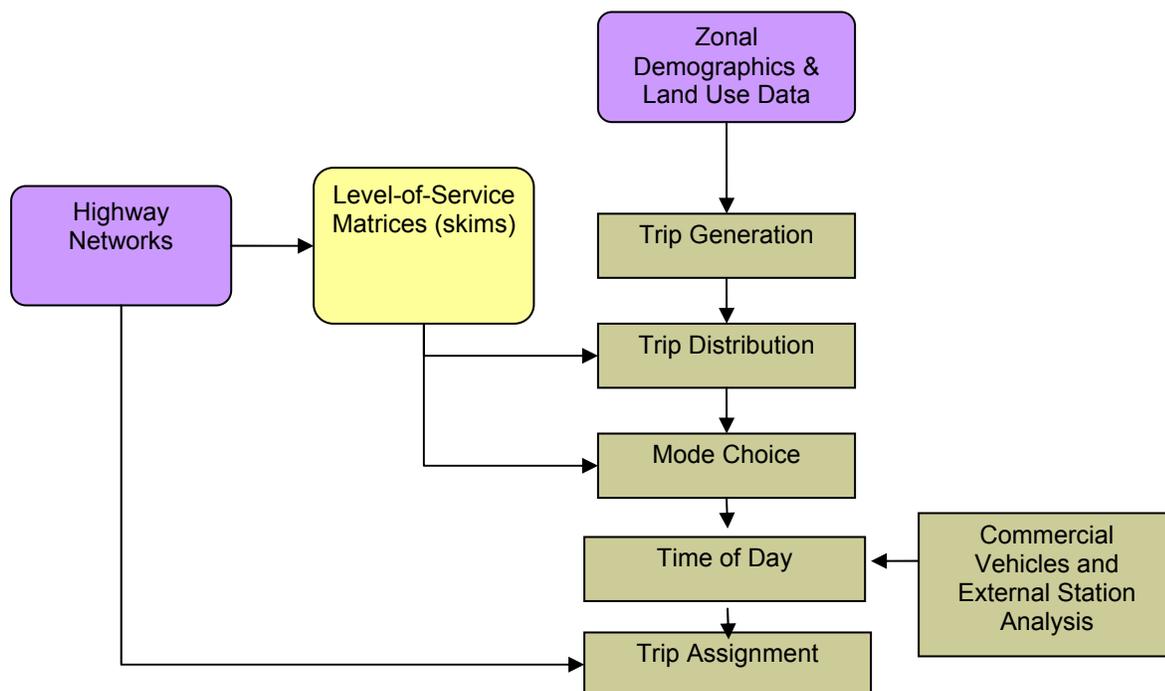
# 1 Introduction

## 1.1 Document Overview

This document is intended to serve as a user's guide for application of the North Carolina Small Area Model (NCSAM) as described in the NCDOT Small Area Travel Demand Model Procedures Manual. It provides relevant information necessary to understand how the model is applied through a Graphical User Interface (GUI), including creating scenarios, setting parameters, executing a model run, and reviewing output summaries and performance measures. This guide is accompanied by a DVD containing all relevant model files and programs. Chapter 2 of this document provides step-by-step instructions for installing the model on the user's computer and setting necessary parameters required by TransCAD to run the NCSAM. After following these steps the user is ready to execute a model run. Chapter 3 describes the model application process for the base year along with the required input data. After following the steps in this chapter, the user should be able to successfully execute a base year model run. If the GUI is being used for base year model development work then it may be necessary to adjust model parameters, such as trip rates and gamma coefficients, in order to achieve acceptable model performance measures. The process for changing these parameter files is discussed in Chapter 4. The model report file is described in Chapter 5 and Scenario Planning is discussed in Chapter 6.

## 1.2 Model Overview

The proposed overall structure of the recommended transportation model system is displayed in Figure 1. This schematic demonstrates that the application of the model begins with two key sets of input; the demographic, socio-economic, and land use information (at the traffic analysis zone level), and the transportation network data.



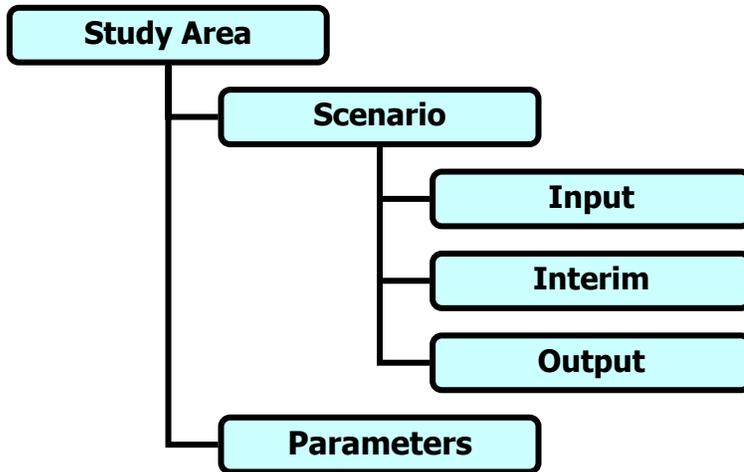
**Figure 1 Travel Model System Diagram**

The first model in the sequence is the trip generation model. Estimation of the magnitude of trip making is considered in terms of the range of possible types of trip purposes (i.e., Home-Based Work, Home-Based School, etc.). Following trip generation, linking of trip origins and trip destinations is accomplished by the trip distribution model. Person trips are converted to auto person trips through the application of simple mode split factors. Prior to time-of-day analysis, commercial vehicle trip generation and distribution is performed for commercial autos, pickups, and trucks. External-External (EE) trips are synthesized and External-Internal (EI) and Internal-External (IE) trips are estimated. The next step is estimating the proportion of travel (by trip purpose) occurring in the peak and off-peak periods as determined by a time-of-day factoring model. During this step the auto person trip tables are also converted to vehicle trips using auto occupancy factors by trip purpose. The final component of the model system is embodied in the assignment of travel to the highway network.

### **1.3 Directory Structure and File Naming**

Consistency in file naming conventions between various scenarios facilitates the applications of the model by multiple parties. Proper application of the GUI requires that a specific directory structure and set of file-naming conventions be used. This directory structure uniquely identifies the location of files for each analysis year and scenario. The required directory structure is shown in Figure 2 and the required parameter files are shown in Table 1 and required input files are shown in Table 2. The TransCAD scenario manager is used to create scenarios and will by default look for these files by the names shown in the respective tables and in the relative directory structure shown in Figure 2. The user can include other optional directories, such as a support files folder, as desired but these

directories are not required by the GUI. The scenario manager allows extensive flexibility for changing the file names and locations, after a scenario is created with the default names.



**Figure 2 Directory Structure Diagram**

The required parameter files are included in the parameters directory and are applied to all scenarios. These files are described in Table 1.

**Table 1 File Names and Descriptions in Parameters Directory**

File Name	Description
CAPACITY.BIN	BIN file with capacities for study area – MUST BE UPDATED BY USER
ALPHA.BIN	BIN file with standard values for alpha coefficient
HHSIZE.BIN	Default household size curve coefficients
AUTOS.BIN	Default auto ownership curve coefficients
JOINTDIST.BIN	Joint household size/auto ownership seed matrix
NCPRODRATES.BIN	Default trip production rates
NCATTRRATES.BIN	Default trip attraction rates
CVPRODRATES.BIN	Default commercial vehicle trip production rates
CVATTRRATES.BIN	Default commercial vehicle trip attraction rates
IXATTRRATES.BIN	Default IX trip attraction rates
GAMMACOEFFICIENTS_*.BIN	Default Gamma Coefficients
KFACTORS.MTX	User defined matrix of K-factors (if needed)
MODESHARES_*.BIN	Auto mode shares
VEHOCCUPANCYFACTORS_*.BIN	Vehicle occupancy factors
NC_HOURLY_*.BIN	PA to OD TOD conversions
PEAKFACTORS_*.BIN	Peak hour factors used to convert hourly capacity to time period capacity

\* Small area or large area (a small area is typically defined as an area with less than 50,000 and a large area as an area with greater than 50,000)

User required inputs are shown in Table 2. These inputs are scenario specific and should be placed in the input directory for the given scenario. These input files are described in more detail in Section 1.4.

**Table 2 Scenario Input Files**

File Name	Description
*_SEDATA.BIN	Zonal data inputs and external station inputs
BY_HIGHWAY.DBD	Base year highway line layer
*_HIGHWAY.DBD	Any future scenario line layer
*EE_TRIPS.MTX	Input through trip table for given year and/or scenario

\* Name or year of the scenario

An “Interim” folder is used to store interim files that are created during the model application process. These files are needed for reporting performance measures and running interim steps, but are not necessarily defined as final output.

**Table 3 Scenario Interim Files**

File Name	Description
HBWGC_PATH.MTX	Generalized cost skims by trip purpose
HBOGC_PATH.MTX	
NHBGC_PATH.MTX	
BALANCE_PA.BIN	Initial balanced productions and attractions for internal trip purposes prior to adding non-resident trips
PER_TRIPS.MTX	Person trip table
AUTOPER_TRIPS.MTX	Auto person trip table
CV_TRIPS.MTX	Commercial vehicle trip table
IX_TRIPS.MTX	IX trip table
AMVEH_TRIPS.MTX	Auto vehicle trip tables by time of day
MDVEH_TRIPS.MTX	
PMVEH_TRIPS.MTX	
OPVEH_TRIPS.MTX	
OP2VEH_TRIPS.MTX	Interim OP trip table for processing
AMCV_TRIPS.MTX	Commercial vehicle trip tables by time of day
MDCV_TRIPS.MTX	
PMCV_TRIPS.MTX	
OPCV_TRIPS.MTX	
OP2CV_TRIPS.MTX	
AMEE_TRIPS.MTX	Through trip tables by time of day
MDEE_TRIPS.MTX	
PMEE_TRIPS.MTX	
OPEE_TRIPS.MTX	
OP2EE_TRIPS.MTX	Interim OP EE trip table for processing
AMIX_TRIPS.MTX	IX trip tables by time of day
MDIX_TRIPS.MTX	
PMIX_TRIPS.MTX	
OPIX_TRIPS.MTX	
OP2IX_TRIPS.MTX	
*_TLD_**.MTX	Trip length distribution files by purpose and impedance

\* Trip purpose \*\* Impedance value (generalized cost, travel time, or distance)

Final output files for each scenario are maintained in the “output” folder for a given scenario.

**Table 4 Scenario Output Files**

File Name	Description
NETWORK.NET	Network file for path building and assignment
SHORTESTPATH.MTX	Skim matrix with zone to zone minimum travel time and associated distances.
GENCOST.MTX	Combined generalized cost matrix used in person trip distribution
BALANCE_PA2.BIN	Balanced productions and attractions for internal person trips (NHB*_NR trips included), CV trips, and IX trips.
BALANCE_CV.BIN	
BALANCE_IX.BIN	
AMTOT_TRIPS.MTX	Total vehicle trip tables by time of day
MDTOT_TRIPS.MTX	
PMTOT_TRIPS.MTX	
OPTOT_TRIPS.MTX	
AM_LINKFLOW.BIN	Total vehicle link flow by time of day
MD_LINKFLOW.BIN	
PM_LINKFLOW.BIN	
OP_LINKFLOW.BIN	
TOTAL_LINKFLOW.BIN	Daily total link flow

There are numerous support files that are not needed to run the models, but are useful in summarizing, analyzing, and visualizing data. These files are NOT required by the model, but may be useful to the user. A suggested approach is to create a directory under the Study Area Directory and to call this directory Support Files. This directory can maintain any files not needed for model application, but deemed useful by the user. As a minimum, the files listed in Table 5 are recommended.

**Table 5 Model Support Files**

File Name	Description
FINAL_STUDY_AREA.DBD	Geographic file showing the extent of the study/planning area. Useful for “clipping” data or creating maps.
*_TRACT	US Census Tract geography
*TAZ_FINAL.DBD	Final TAZ layer for the study area
SCREENLINES.DBD	Geographic file of model screenlines
*_COUNTS	Geographic file showing traffic count locations

\* Study area name

## 1.4 Input Files

### \*\_SEDATA.BIN

This file contains all the internal and external zone fields and input data required by the model. This file also includes several fields needed for model generated output. Other fields are optional and may or may not be useful to the user. See Appendix A for more detail on field names and field types.

Fields where data input is required by user:

1. TAZ
2. Population
3. Households
4. Vehicles
5. Industry
6. Retail
7. HwyRetail
8. Service
9. Office
10. TotEmp
11. Students
12. CV\*IND (where \* = 1:auto, 2:pickup, and 3:trucks)
13. CV\*RET (where \* = 1:auto, 2:pickup, and 3:trucks)
14. CV\*HWY (where \* = 1:auto, 2:pickup, and 3:trucks)
15. CV\*SER (where \* = 1:auto, 2:pickup, and 3:trucks)
16. CV\*OFF (where \* = 1:auto, 2:pickup, and 3:trucks)
17. IXP

Fields that must be present in order to receive model generated output:

1. \*p (where \* = hbw, hbo, hbsch, nhbw, nhbo, cv1, cv2, or cv3)
2. \*a (where \* = hbw, hbo, hbsch, nhbw, nhbo, cv1, cv2, cv3, or ix)
3. Cliterations
4. HHClosure
5. hhp\* (where \* = 1, 2, 3, 4, or 5 for household size)
6. hha\* (where \* = 0, 1, 2, or 3 for autos per household)
7. hhp\*a# (where \* = 1, 2, 3, 4, or 5; and # = 0, 1, 2, or 3 for every combination of household size and autos per household, respectively)

Optional fields that may or may not be included and populated:

1. District
2. PopDensity
3. HDDensity
4. EmpDensity

#### \* **HIGHWAY.BIN**

This file contains all the highway line layer fields and input data required by the model. This file also includes several fields needed for model generated output. Other fields are optional and may or may not be useful to the user. See Appendix A for more detail on field names and field types.

Fields where data input by user is required (all values of \* = AB or BA):

1. ID
2. Length
3. DIR
4. Posted Speed
5. FACTYPE\_CD
6. DIVIDED\_CD
7. \* Lanes
8. FUNCL\_CD

9. \* Count
10. DailyCount
11. Screenline

Fields that must be present in order to receive model generated output (all values of \* = AB or BA):

1. \*\_CAPPHPL
2. \*\_AMCAP
3. \*\_MDCAP
4. \*\_PMCAP
5. \*\_OPCAP
6. \*Initial Time
7. \* HBWGC
8. \* HBOGC
9. \* NHBGC
10. Alpha
11. \*\_VMT
12. TOT\_VMT

Optional fields that may or may not be included and populated:

1. Facility type
2. Divided
3. HOV
4. Toll
5. County
6. Name

**\*\_HIGHWAY\_.BIN (corresponding node layer)**

This \*\_HIGHWAY\_.BIN file has a corresponding node layer. There are several fields that are required by the model, these are listed below. See Appendix A for more detail on field names and field types.

Fields where data input is required by user:

1. ID
2. Longitude
3. Latitude
4. Centroid

**\*\_EE\_TRIPS.MTX**

This is the through trip matrix for a given scenario. For the base year scenario, this file is generated using the NCDOT SYNTH program. For future year scenarios the file is generated by applying a FRATAR procedure to the base year matrix based on forecast through trip ends for the external stations. It is very important that the Row and Column Indices in this file be named "From" and "To," respectively. Please see Appendix A for more detail.

## 2 Getting Started

### 2.1 Loading the Application on your Computer

#### Step 1: Copy All Model Files

To load the NCSAM and prepare for execution, copy all the files from the S drive S:\Shared\TPB Reference\TDM Procedures\GUI under the directory NCSAM to the desired location on the hard drive. Be sure to check the file properties and set all files to allow read and write access.

#### Step 2: Update and Move NCSAM.ini

Under the study area directory open NCSAM.ini with a text editor and modify the drive references to reflect the location of the model files on your computer. An example of this is shown below:

```
[Model Table]
d:\sanford\ncsam.bin
[UI File]
d:\sanford\ncsam.dbd
[Scenario File]
d:\sanford\ncsam.arr
[Data Directory]
d:\sanford
```

After the file has been updated and saved, move it to the TransCAD program directory, located under 'Program Files'. This is usually located under the D drive or the C drive where the 'tcw.exe' is installed. Check where the 'tcw.exe' is located by using 'Help-About' in TransCAD.

#### Step 3: Move TPBLOGO.BMP and TRUCK41.BMP

Move the file TPBLOGO.BMP and TRUCK41.BMP to the [TransCAD\bmp] directory. This will provide the necessary graphics for the GUI Main Menu.

#### Step 4: NCSAM.BIN file

All information about default file names, directory names and parameters is stored in the NCSAM.BIN file provided with the Small Area Model application files. When a new scenario is created, TransCAD will look for the NCSAM.BIN file and populate the new scenario with the default information. This file can be viewed from and edited within TransCAD as any binary file. If any changes are made to the default file names or to the model application structure, then the NCSAM.BIN file will need to be updated.

User specified parameters are also included in this file. The Number of Internal Zones, Area Type Code, and Average Wage Rate are unique to each planning area and MUST be updated each time the standard model is applied to a new study area. The value for Auto Operating Cost is based on a national average and may or may not be updated. Other parameters such as assignment iterations, NHBW NR factor, NHBO NR factor, IE Trip Factor, and K-factor Toggle may also be modified by the user if necessary. These are all described in more detail below.

1. The value for the Number of Internal Zones must be updated to reflect the number of internal zones in the new planning area. This value is initially set to zero for the standard model – if this value is not replaced with the number reflecting the number of internal zones for the planning area then the model will fail and an error message will be returned. **TIP:** If this happens, the user must delete the scenario that was created when the error message was received, open the NCSAM.BIN file, change the value for the internal zones, close the BIN file, and then recreate the scenario. If the scenario is not deleted and then recreated it will still remember the zero value since that was the value in the NCSAM.BIN file when the scenario was created. **TRAP:** The program does NOT check for whether or not you entered the correct value for the number in internal zones, it is up to the user to specify this correctly. If the value is incorrect the calculations will still be correct UNLESS the data was entered into the \*\_SEDATA.BIN file incorrectly. In other words, there should be no household or employment data for any of the external zones. If there is household and employment data for these zones AND the number of internal zones is entered incorrectly then there may be an error in the model calculations.
2. The value for the Area Type Code must be set to either “1” or “2” depending on whether you are working with a Small Area (1) or a Large Area (2).
3. The auto operating cost reflects a national average. This value could be updated if more local information is available.
4. The average wage rate should be updated to reflect the average wage rate for the study area.
5. The number of assignment iterations is set to 25 by default. This number can be increased if the user finds that the model does not reach equilibrium before this number of assignment iterations is reached.
6. The NHBW NR factor is the default value for the percentage of NHBW trips. This value can be changed to reflect the observed percentage of NHBW trips for the study area in question.
7. The NHBO NR factor is the default value for the percentage of NHBO trips. This value can be changed to reflect the observed percentage of NHBO trips for the study area in question.
8. The IE Trip Factor is used to indicate the percentage of household attractions in the external trip model that are actually internal-external trips. These trips will not be allowed to make non-resident non-home-based trips. Raising this value will reduce the number of non-resident trips and lowering this value will increase the number of non-resident trips.
9. The K-factor toggle is used as an indicator to the trip distribution model that a K-factor matrix should be used. If the value is set to 1 the user is required to create this matrix as an input file. For instructions on creating this file, please refer to the Small Area Model Procedures Manual.

### **Step 5: NCSAM.ARR file**

When a scenario is created specific information about that scenario is stored in the NCSAM.ARR file. This file contains specific information about all scenarios that have been created through the model GUI. This file is not editable except through the NCSAM user interface.

**NOTE:** *Any scenarios previously created and executed cannot be recreated with the same results if the NCSAM.ARR file is deleted and the NCSAM.BIN file is changed. If*

**scenarios need to be archived the entire set of directories with the NCSAM.BIN and the NCSAM.ARR files MUST be archived with the scenario data.**

### Step 6: Compile the Resource Code to a Users Interface (UI)

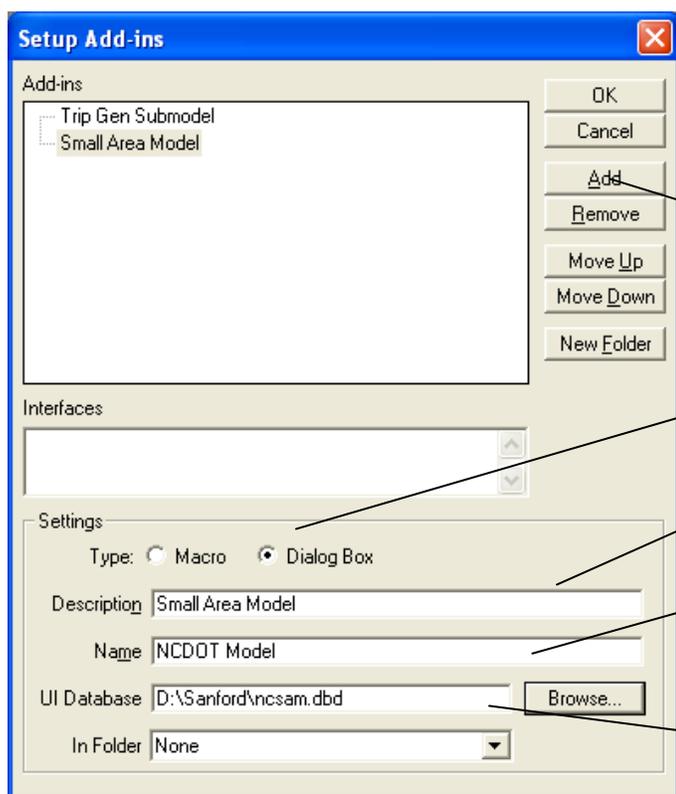
1. Tools – GISDK Developers kit – compile to UI
2. Use the window to navigate to [**Study Area**\NCSAM.RSC] – Open – Save As [**Study Area**\NCSAM] – Close GISDK Toolbox



Use this button to compile to UI

### Step 7: Install Add-In

1. Tools – Setup Add-Ins
2. Add – Fill out the window as shown below



First select this button to add a new Add-in

Dialog Box

You can give the Add-in any name

This MUST be "NCDOT Model" exactly

Browse to the directory where you stored the compiled program [**Study Area**\NCSAM.DBD]

3. OK - This adds the program to the Add-In list (See Tools – Add-Ins)

### Step 8: Open the GUI

1. Tools – Add-Ins – Small Area Model (**TIP:** this is going to be the name that you provide in the step above)

2. The model GUI will be displayed and you are now ready to set up scenarios and run the model.

### 3 Base Year Model Application

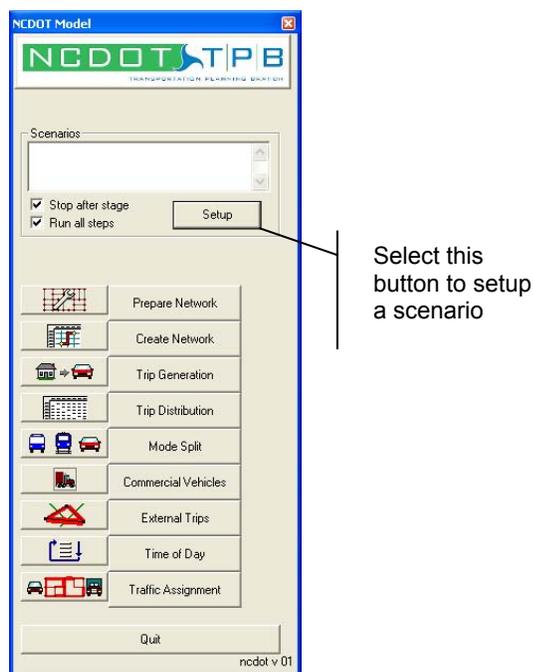
#### 3.1 Required Input Files and File Formats

##### Step 1: Prepare Input Files

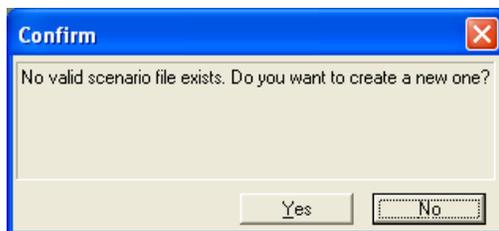
Prior to running the base year model application, the base year input files listed in Table 2 must be present in the directory [Base Year\Input]. These files must conform to a specified format for field names and types. These files are described in detail in Section 1.4 and Appendix A.

##### Step 2: Setup the Base Year Scenario

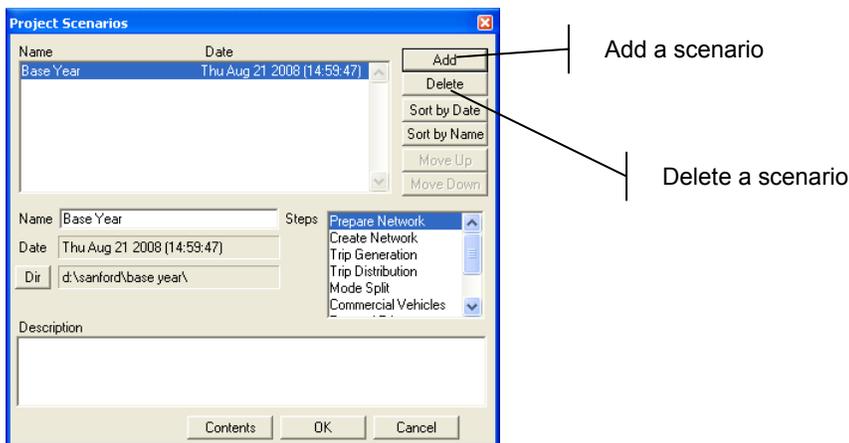
If the model has been properly set up and the model is initiated for a new study area, no scenarios will exist. To add a new scenario for the Base Year, click on the “Setup” button in the user interface.



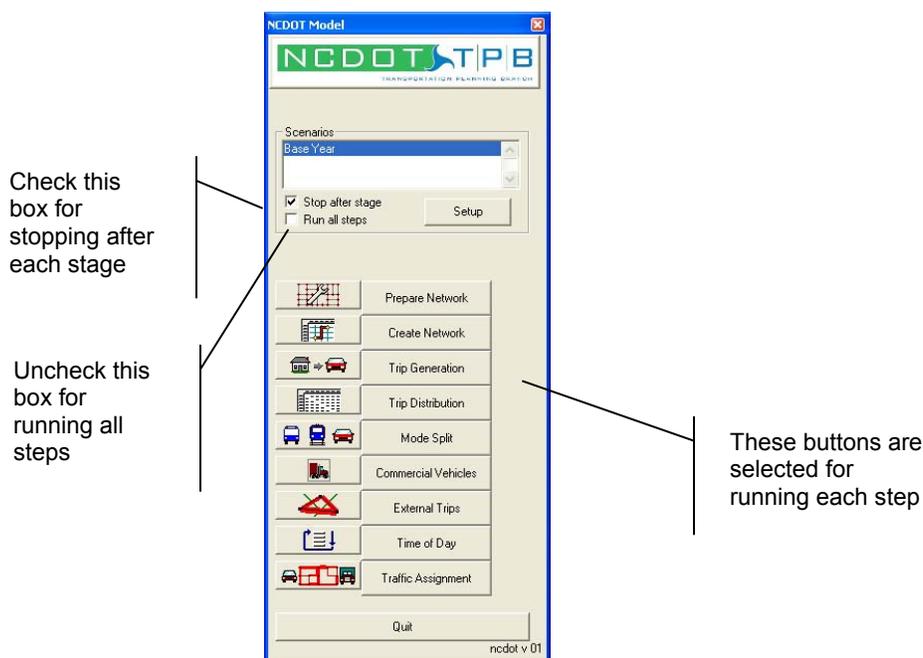
The following dialog box will appear.



Selecting “Yes” will result in the appearance of the Project Scenarios window.

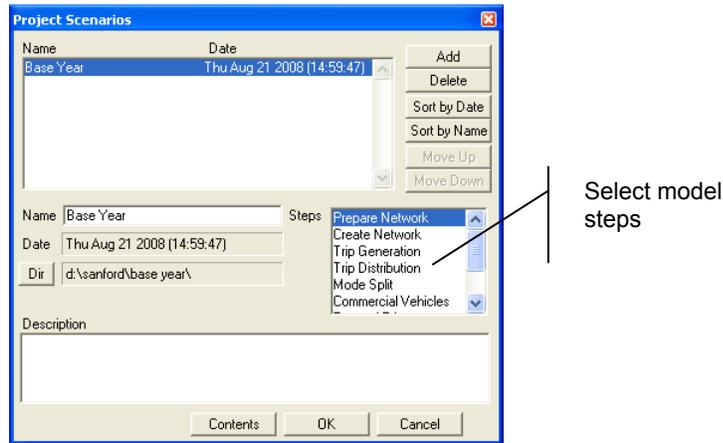


From the Project Scenarios window scenarios can be added, deleted, and sorted. Click on the “Add” button to add a scenario for the Base Year. A description can be provided if desired. It is important to change the directory location in this screen using the ‘Dir’ button to ‘d:\Study Area\Base Year\’ for the files to be read from appropriate locations. Clicking “OK” will close the Project Scenarios window and return you to the user interface where you will see that a Base Year scenario has been added.

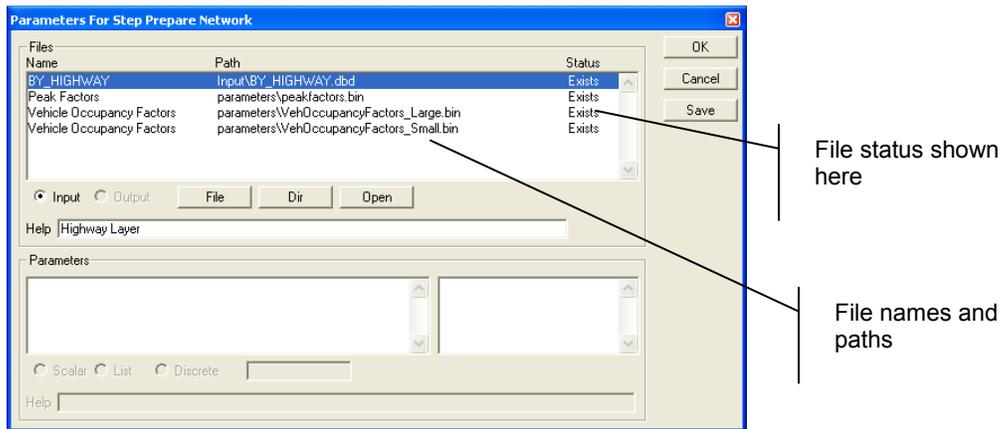


To confirm that all the necessary files and parameters are available for each step, follow the sequence of steps below. **TIP:** In general, files and parameters are always listed only once in the Step Parameters window, even if they are utilized in multiple steps. For this reason you will only see the files or parameters listed the first time they are utilized in a step, but not for subsequent steps. An example of this is the \*\_SEDATA.BIN file which is used as input for multiple steps, but is only listed once in the Trip Generation step.

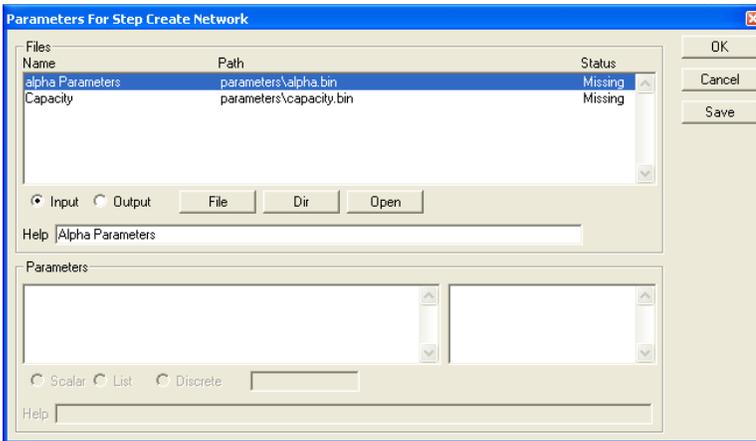
1. Highlight the “Base Year” scenario and select the “Setup” button to open the Project Scenarios window.



2. Highlight the “Prepare Network” step – select the “Contents” button – review the Input files to be sure that all needed files have a status of “exists” – click OK to close the window



3. Highlight the “Create Network” step – select the “Contents” button – review the Input files to be sure that all needed files have a status of “exists” – click OK to close the window



NOTE: Interim and Output files will be 'Missing' until the model is run.

4. Repeat this process for all remaining steps to confirm that all necessary input files exist.

### Step 3: Run Base Year Model and Review Results

The first time you run the base year model, you should stop after each stage so that you can check the reasonableness of the model output before moving on to the next step. Once the base year model has been fully checked and validated and is performing within acceptable ranges, all model steps can be run at one time. The model is run step by step by first removing the check mark from the "Run all steps" option on the user interface. To run a step, you simply click on the step you would like to run with the "Run all steps" unchecked and the option "Stop after stage" checked. The model will stop when it completes that step. To run all model steps you would reverse this process and uncheck "Stop after stage" and check "Run all steps". If you have previously run a step of the model and no changes have been made to that step you can start the model run at the next step.

The icons to the left of the stage buttons allow the user to select steps within the stage to execute. By default all steps within stages are selected for execution. The model stages and steps are discussed in more detail below.

### Prepare Network

The "Prepare Network" stage should be run anytime that edits to the geographic line layer have been made. This step does the following:

1. Model Checks
  - a. Are all the necessary fields present in the highway geographic line file?
  - b. Are the facility type codes consistent with the allowable codes?
  - c. Is each link classified as undivided, divided, or continuous left turn?
  - d. Do the functional classification codes match the allowable codes?
  - e. Are the AB and BA attributes consistent with the link topology?
2. Calculations
  - a. Calculate the initial travel time for each link (and direction)
  - b. Calculate an hourly capacity value for each unique combination of facility type, divided, and area type using the PARAMETERS\CAPACITY.BIN data table provided by the user

- c. Populate the alpha field of the highway geographic line file with values from the default PARAMETERS\ALPHA.BIN file
- d. Calculate the link HBW, HBO, and NHB generalized cost
- e. Calculate values for the time period capacity



Files Read during this Stage:

1. INPUT\\*\_HIGHWAY.DBD
2. PARAMETERS\CAPACITY.BIN [**NOTE:** This file should be specific to the planning region as noted in the Small Area Travel Demand Model Procedures Manual]
3. PARAMETERS\ALPHA.BIN
4. PARAMETERS\PEAKFACTORS\_\*.BIN

User Specified Parameters Read during this Stage:

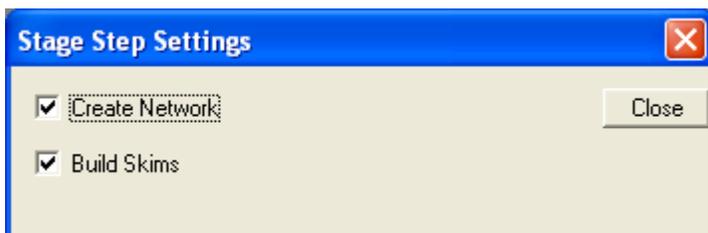
1. Auto operating cost [found in the file NCSAM.BIN]
2. Average wage rate [found in the file NCSAM.BIN]
3. Area type code 1 or 2 [found in the file NCSAM.BIN]

Files Output during this Stage:

1. Updated highway geographic line layer fields [INPUT\\*\_HIGHWAY.DBD]

## Create Network

The create network stage includes two steps, “Create Network” and “Build Skims”. The create network step is the process for converting the data in the geographic line file to the special data structure used by TransCAD to store important characteristics of the transportation system that are later used to evaluate the shortest path. During the build skims the minimum path between every TAZ pair is evaluated and the value for the minimum impedance is stored in a matrix file. The minimum path is evaluated based on the link value of the generalized cost (by trip purpose). The corresponding travel time and distance to the minimum generalized cost path is also stored in the matrix. The “Create Network” stage should always be run following the prepare network stage when the geographic line layer has been changed. If a new network is not created through this stage, then the model path builder or assignment algorithm will not recognize any of the new links or any of the new data attributes.



Files Read during this Stage:

1. INPUT\\*\_HIGHWAY.DBD

User Specified Parameters Read during this Stage:

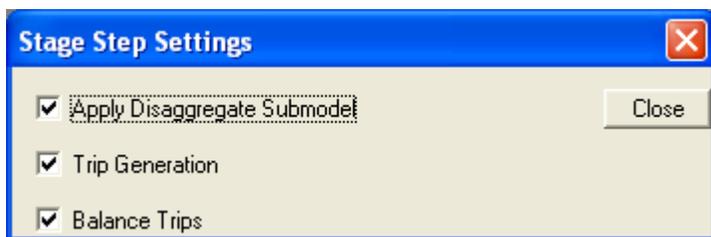
1. No parameters specified for this stage

Files Output during this Stage:

1. OUTPUT\NETWORK.NET
2. INTERIM\HBWGC\_PATH.MTX
3. INTERIM\HBOGC\_PATH.MTX
4. INTERIM\NHBGC\_PATH.MTX

### Trip Generation

The trip generation stage includes three steps: one for running the disaggregate submodel, another for estimating productions and attractions for internal trip purposes, and the other for balancing productions and attractions. During the disaggregate submodel step, the population, households, and autos per TAZ are used to calculate values of average persons per household and average autos per household. These values are used as input to a set of default curves that estimates the number of 1-person, 2-person, 3-person, 4-person, and 5+person households stratified by 0-auto, 1-auto, 2-auto, and 3+auto households. The \*\_SEDATA.BIN file is updated with these values. The trip generation step calculates the internal zonal productions and attractions and outputs to the report file the number of productions, the number of attractions, the P/A ratio, and the percent of trips for each trip purpose. The final step balances internal productions and attractions for each trip purpose. The NHBW non-resident (NR) trips and NHBO-NR trips are also calculated at this step.



Files Read during this Stage:

1. INPUT\\*\_SEDATA.BIN
2. PARAMETERS\HHSIZE.BIN
3. PARAMETERS\AUTOS.BIN
4. PARAMETERS\JOINTDIST.BIN
5. PARAMETERS\INCPRDRATES.BIN
6. PARAMETERS\INCATTRRATES.BIN

User Specified Parameters Read during this Stage:

1. Number of internal zones [found in the file NCSAM.BIN]
2. Percentage of IX household attractions that are IE trips [found in the file NCSAM.BIN]
3. Percentage of NHBW trips [found in the file NCSAM.BIN]

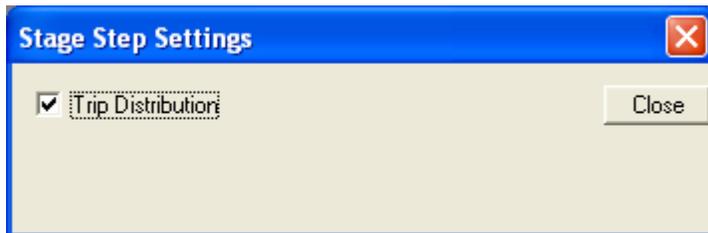
4. Percentage of NHBO trips [found in the file NCSAM.BIN]

Files Output during this Stage:

1. OUTPUT\BALANCE\_PA.BIN
2. OUTPUT\ BALANCE\_PA2.BIN
3. **SCENARIO\SCENARIO\_REPORT.TXT**

### Trip Distribution

The trip distribution stage pairs estimated productions and attractions by traffic analysis zone to each other. The resulting output is a trip table or a matrix of trips from every zone to every zone for each of the trip purposes specified in the model. This step also calculates the average generalized cost, average travel time, average distance, and percent intrazonal trips for each trip purpose. This data is appended to the report file. TransCAD MTX files of the trip distribution by generalized cost (GC), travel time (TT), and distance (DI) are also output so that the user can graph the trip length distribution curve for reasonableness checking purposes.



Files Read during this Stage:

1. PARAMETERS\GAMMACOEFFICIENTS\_\*.BIN
2. PARAMETERS\KFACTORS.MTX
3. OUTPUT\BALANCE\_PA2.BIN
4. INTERIM\HBWGC\_PATH.MTX
5. INTERIM\HBOGC\_PATH.MTX
6. INTERIM\NHBGC\_PATH.MTX

User Specified Parameters Read during this Stage:

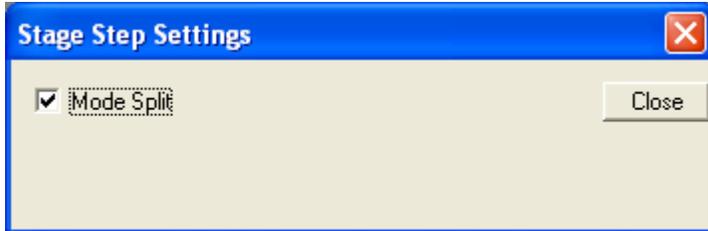
1. Area type code 1 or 2 [found in the file NCSAM.BIN]

Files Output during this Stage:

1. OUTPUT\GENCOST.MTX
2. INTERIM\\*\_TLD\_GC.MTX, where the \* indicates trip purpose (HBW, HBO, HBSCH, NHBW, or NHBO)
3. INTERIM\\*\_TLD\_TT.MTX, where the \* indicates trip purpose (HBW, HBO, HBSCH, NHBW, or NHBO)
4. INTERIM\\*\_TLD\_DI.MTX, where the \* indicates trip purpose (HBW, HBO, HBSCH, NHBW, or NHBO)
5. INTERIM\PER\_TRIPS.MTX
6. **SCENARIO\SCENARIO\_REPORT.TXT**

## Mode Split

During the mode split stage person trips are converted to person auto trips using default mode shares by trip purpose.



Files Read during this Stage:

1. INTERIMPER\_TRIPS.MTX
2. PARAMETERS\MODESHARES\_\*.BIN

User Specified Parameters Read during this Stage:

1. Area type code 1 or 2 [found in the file NCSAM.BIN]

Files Output during this Stage:

1. INTERIMAUTOPER\_TRIPS.MTX

## Commercial Vehicles

The commercial vehicle stage includes two steps: trip generation and trip distribution. The trip generation step estimates commercial vehicle productions and attractions for commercial autos (CV1), commercial pickup trucks (CV2), and commercial trucks (CV3). The unbalanced productions and attractions for each of the commercial vehicle types is output to the report file as is the P/A ratio so that reasonableness tests can be made if necessary. Finally, the productions and attractions are balanced. During the second step the balanced productions and attractions are paired through the trip distribution process. The resulting output is a trip table of commercial vehicle trips from every zone to every other zone for each of the vehicle types. This step also calculates the average generalized cost, average travel time, and average distance for each commercial vehicle trip type. This data is appended to the report file. TransCAD MTX files of the trip distribution by generalized cost (GC), travel time (TT), and distance (DI) are also output so that the user can graph the trip length distribution curve for reasonableness checking purposes.



Files Read during this Stage:

1. INPUT\\*\_SEDATA.BIN

2. PARAMETERS\CVATTRRATES.BIN
3. PARAMETERS\CVPRODRATES.BIN
4. PARAMETERS\GAMMACOEFFICIENTS\_\*.BIN
5. INTERIM\NHBGC\_PATH.MTX

User Specified Parameters Read during this Stage:

1. Area type code 1 or 2 [found in the file NCSAM.BIN]
2. Number of internal zones [found in the file NCSAM.BIN]

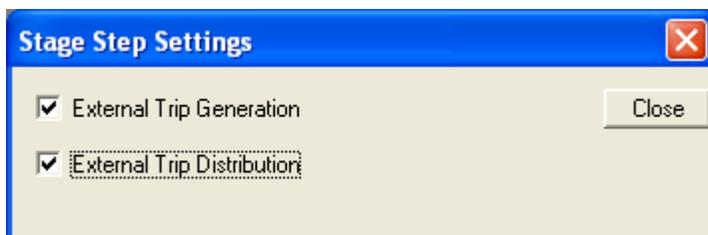
Files Output during this Stage:

1. OUTPUT\BALANCE\_CV.BIN
2. INTERIM\\*\_TLD\_GC.MTX, where the \* indicates trip purpose (CV1, CV2, or CV3)
3. INTERIM\\*\_TLD\_TT.MTX, where the \* indicates trip purpose (CV1, CV2, or CV3)
4. INTERIM\\*\_TLD\_DI.MTX, where the \* indicates trip purpose (CV1, CV2, or CV3)
5. INTERIM\CV\_TRIPS.MTX
6. **SCENARIO\_NAME\SCENARIO\_NAME\_REPORT.TXT**

### External Trips

The external station stage includes two steps: trip generation and trip distribution. The trip generation step estimates external station trip attractions. The external station trip productions are read directly from the \*\_SEDATA.BIN file. After calculating the external station trip attractions, the unbalanced productions and attractions are output to the report file as is the P/A ratio so that reasonableness tests can be made if necessary. Finally, the productions and attractions are balanced. During the second step the balanced productions and attractions are paired through the trip distribution process. The resulting output is a trip table of external-internal/internal-external trips between external station zones and internal zones. This step also calculates the average generalized cost, average travel time, and average distance for the IX trip type. This data is appended to the report file. TransCAD MTX files of the trip distribution by generalized cost (GC), travel time (TT), and distance (DI) are also output so that the user can graph the trip length distribution curve for reasonableness checking purposes.

**NOTE:** The through trip table is created external to the model GUI and is treated as a model input.



Files Read during this Stage:

1. INPUT\\*\_SEDATA.BIN
2. PARAMETERS\IXATTRRATES.BIN
3. INTERIM\NHBGC\_PATH.MTX
4. PARAMETERS\GAMMACOEFFICIENTS\_\*.BIN

User Specified Parameters Read during this Stage:

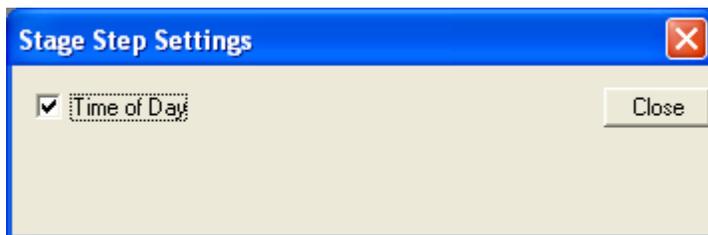
1. Area type code 1 or 2 [found in the file NCSAM.BIN]
2. Number of internal zones [found in the file NCSAM.BIN]

Files Output during this Stage:

1. OUTPUT\BALANCE\_IX.BIN
2. INTERIM\IX\_TRIPS.MTX
3. INTERIM\IX\_TLD\_GC.MTX
4. INTERIM\IX\_TLD\_TT.MTX
5. INTERIM\IX\_TLD\_DI.MTX
6. **SCENARIO\SCENARIO\_NAME\_REPORT.TXT**

### Time of Day

The “Time of Day” stage converts the 24-hour production-attraction person auto trip table to an origin-destination vehicle trip table by time of day: AM (6:00 a.m. to 10:00 a.m.), Midday (10:00 a.m. to 3:00 p.m.), PM (3:00 p.m. to 7:00 p.m.), and Off Peak (7:00 p.m. to 6:00 a.m.). Commercial vehicle and IX production-attraction trip tables are also converted to origin-destination trip tables for the four time periods. The through trip table is already in origin-destination format so this trip table is simply split into four time-of-day trip tables. After trip tables for all trip purposes have been converted to time-of-day trip tables all trip purposes by time of day are combined to create a total trip table for AM, MD, PM, and OP. These final trip tables are used as input for the highway assignment.



Files Read during this Stage:

1. INPUT\EETRIPS.MTX
2. INTERIM\AUTOPER\_TRIPS.MTX
3. INTERIM\CV\_TRIPS.MTX
4. INTERIM\IX\_TRIPS.MTX
5. PARAMETERS\INC\_HOURLY\_\*.BIN
6. PARAMETERS\VEHOCCUPANCYFACTORS\_\*.BIN

User Specified Parameters Read during this Stage:

1. Number of internal zones [found in the file NCSAM.BIN]

Files Output during this Stage:

1. INTERIM\AMVEH\_TRIPS.MTX
2. INTERIM\MDVEH\_TRIPS.MTX
3. INTERIM\PMVEH\_TRIPS.MTX
4. INTERIM\OP2VEH\_TRIPS.MTX and OPVEH\_TRIPS.MTX
5. INTERIM\AMCV\_TRIPS.MTX
6. INTERIM\MDCV\_TRIPS.MTX
7. INTERIM\PMCV\_TRIPS.MTX
8. INTERIM\OP2CV\_TRIPS.MTX and OPCV\_TRIPS.MTX
9. INTERIM\AMEE\_TRIPS.MTX

10. INTERIMMDEE\_TRIPS.MTX
11. INTERIMPMEE\_TRIPS.MTX
12. INTERIMOP2EE\_TRIPS.MTX and OEE\_TRIPS.MTX
13. INTERIMAMIX\_TRIPS.MTX
14. INTERIMMDIX\_TRIPS.MTX
15. INTERIMPMIX\_TRIPS.MTX
16. INTERIMOP2IX\_TRIPS.MTX and OPIX\_TRIPS.MTX
17. OUTPUT\AMTOT\_TRIPS.MTX
18. OUTPUT\MDTOT\_TRIPS.MTX
19. OUTPUT\PMTOT\_TRIPS.MTX
20. OUTPUT\OPTOT\_TRIPS.MTX

The OP2\*\_TRIPS.MTX files are interim files only and are not used in any final calculations.

### Traffic Assignment

The “Traffic Assignment” stage is the final stage of the NC Small Area Model. This stage consists of two steps, highway assignment by time of day and the creation of highway assignment validation reports. During the highway assignment step the trips for each time period are assigned to the individual links of the highway network using a user equilibrium assignment approach. The resulting output is five link flow BIN files, one for each time period and one for a daily flow. These tables can be joined to the highway line layer for viewing, analyzing, and thematic mapping. The second step in the “Traffic Assignment” stage involves the creation of several tables that are useful for model validation and for summary comparisons between various alternatives. The output tables include: Count Link VMT Summary by Facility Type, Screenline Report, Percent Root Mean Square Error by Facility Type, Percent Root Mean Square Error by Volume Group, and Assignment Summary by Volume Group. These tables are appended to the report file for the model scenario executed.



Files Read during this Stage:

1. INPUT\\*\_HIGHWAY.DBD
2. OUTPUT\NETWORK.NET
3. OUTPUT\AMTOT\_TRIPS.MTX
4. OUTPUT\MDTOT\_TRIPS.MTX
5. OUTPUT\PMTOT\_TRIPS.MTX
6. OUTPUT\OPTOT\_TRIPS.MTX

User Specified Parameters Read during this Stage:

1. Number of assignment iterations [found in the file NCSAM.BIN]

Files Output during this Stage:

1. OUTPUT\AM\_LINKFLOW.BIN
2. OUTPUT\MD\_LINKFLOW.BIN

3. OUTPUT\PM\_LINKFLOW.BIN
4. OUTPUT\OP\_LINKFLOW.BIN
5. OUTPUT\TOTAL\_LINKFLOW.BIN
6. **SCENARIO\_NAME\SCENARIO\_NAME\_REPORT.TXT**

## 4 Changing Parameters Files

If the model interface is being used to calibrate/validate a base year model then it may be necessary to adjust parameter files in order to achieve acceptable model output results. These parameter files should ONLY be changed during the base year calibration/validation process and should NEVER be changed for the application of a future year scenario without also verifying base year model calibration/validation results. The reasonableness of model performance and model output should be checked after running each stage of the model. This chapter discusses the parameter files utilized at each stage and provides guidance on possible adjustments that may be required for model calibration/validation purposes. This discussion includes both parameter files located in the PARAMETERS folder and user parameter values specified in the NCSAM.BIN model setup file. The files located in the PARAMETERS folder can be opened and edited directly in TransCAD. The parameter values specified in the NCSAM.BIN file can be modified by first opening the BIN file within TransCAD and then changing the value in the table.

### 4.1 Prepare Network

#### ALPHA.BIN

The alpha parameter required for the facility type specific volume delay function (VDF) is stored in this table. During the “Prepare Network” stage each link in the highway line layer is updated with an alpha value depending on the facility type of the link. During the “Traffic Assignment” stage this parameter is read as input into the VDF calculations. The alpha parameter controls the level of speed sensitivity to changes in congestion. During the highway validation process a review of the model speeds by facility type may reveal the need to modify this parameter for a given facility type in order to achieve more representative results. If this situation arises the ALPHA.BIN file can be modified.

#### CAPACITY.BIN

Per hour per lane capacity for each unique combination of facility type, divided code, and area type (if used) is required input for the model. This data is stored in the CAPACITY.BIN file and should be based on local conditions. Prior to setting up the base year model this file is created by the user using the NCLOS tool. The link capacity is a direct input to the VDF used during highway assignment. During the highway validation process a review of the model performance measures, such as speed by facility type or volumes by facility type, may reveal the need to modify the capacity values for a given facility type and/or for a given set of operational conditions (i.e. divided/undivided/continuous left turn or area type). Changes to the link capacity are made directly within the CAPACITY.BIN file.

### 4.2 Create Network

No parameter files are read during the create network stage.

## **4.3 Trip Generation**

### **HHSIZE.BIN**

This file contains the default household size curves developed from the census data tabulated for the communities represented in the North Carolina Combined Survey Database. This file should ONLY be updated with household sized curves derived specifically for the study area in question. This exercise should be reserved for advanced model users only.

### **AUTOS.BIN**

This file contains the default auto ownership curves developed from the census data tabulated for the communities represented in the North Carolina Combined Survey Database. This file should ONLY be updated with auto ownership curves derived specifically for the study area in question. This exercise should be reserved for advanced model users only.

### **JOINTDIST.BIN**

This file contains the joint household size/auto ownership seed matrix developed from the census data tabulated for the communities represented in the North Carolina Combined Survey Database. This file should ONLY be updated with a seed matrix derived specifically for the study area in question. This exercise should be reserved for advanced model users only.

### **NCPRODRATES.BIN**

The trip production rates by trip purpose for each combination of household size and auto ownership are tabulated in the NCPRODRATES.BIN file. During the trip generation step these rates are applied to the number of households by type to estimate the total trip productions by trip purpose. During the trip generation reasonableness checking process or during the highway validation process a review of the model performance measures may reveal the need to modify the trip production rates. If this situation arises the rates can be modified for a given trip purpose, a given household type, all trip purposes, or all household types.

### **NCATTRRATES.BIN**

The trip attraction rates by trip purpose for each attraction variable are tabulated in the NCATTRRATES.BIN file. During the trip generation step these rates are applied to the attraction variables (number of employees by employment type and number of households) to estimate the total trip attractions by trip purpose. During the trip generation reasonableness checking process or during the highway validation process a review of the model performance measures may reveal the need to modify the trip attraction rates. If this situation arises the rates can be modified using this file.

### **Percentage of NHBW Trips**

This value is used in the calculation of the NHBW non-resident trips. The assumption is that non-residents will make NHBW trips at the same rate as residents make NHBW trips. The default value is set to 11% which implies that 11% of the total trips are NHBW trips. After an initial run of the trip generation model this value should be checked against the study specific percent of NHBW trips and adjusted accordingly. This value can also be adjusted

up or down by the user if there is reason to believe that non-residents would make NHBW trips at a rate different from residents of the region.

### **Percentage of NHBO Trips**

This value is used in the calculation of the NHBO non-resident trips. The assumption is that non-residents will make NHBO trips at the same rate as residents make NHBO trips. The default value is set to 21% which implies that 21% of the total trips are NHBO trips. After an initial run of the trip generation model this value should be checked against the study specific percent of NHBO trips and adjusted accordingly. This value can also be adjusted up or down by the user if there is reason to believe that non-residents would make NHBO trips at a rate different from residents of the region.

### **Percentage of IX Household Attractions that are IE Trips**

This value is used in the calculation of both NHBW and NHBO non-resident trips. Recall that for the standard small area model the simplifying assumption is that all productions occur at the external stations. Indeed it is the case that households in the region make external trip productions. These trip productions are captured through the attraction coefficient in the external trip attraction equation. When calculating non-home-based trips made by non-residents we need to exclude the trips produced by households in the region. This factor captures that behavior by estimating the IX attractions that are actually household productions and then removing them from the calculation of non-home-based non-resident trips. The default value is set to 0.9, which implies that 90% of the IX household attractions are internal-external trips, or in other words, are productions. This value can be adjusted by the user if there is reason to believe that the percentage of IX household attractions is either higher or lower than 90%. This will have the effect of either increasing or decreasing the NHBW and NHBO non-resident trips.

## ***4.4 Trip Distribution***

### **GAMMACOEFFICIENTS\_\*.BIN**

The default gamma coefficients for small or large areas are stored in files GAMMACOEFFICIENTS\_\*.BIN where the \* represents SMALL or LARGE depending on the size of the study area. The gamma coefficients are input into the gamma function which is estimating friction factors. The gamma coefficients control the shape of the friction factor curve and, in turn, the value of the friction factor at each time interval. The value of the friction factor has a direct impact on the percentage of trips distributed within each time interval. During the trip distribution reasonableness checking process or during the highway validation process a review of the model performance measures may reveal that the average trip length by trip purpose is either too long or too short or the shape of the trip length frequency curve may not reflect the conditions you believe to be true for your area for a given trip purpose. In situations like this, the gamma coefficients can be adjusted to either increase or decrease the average trip length or to change the shape of the trip length frequency curve. All changes to gamma coefficients are made within this BIN file.

### **KFACTORS.MTX**

In rare cases adjustments to the gamma coefficients are not sufficient to achieve acceptable trip distribution results. In this situation k-factors can be applied. The standard model does not recommend utilizing k-factors. However, this placeholder file can be created by the user if needed. If a k-factor file is needed then the k-factor toggle must be set to 1.

## **K-factor Toggle**

The application of k-factors in the model is handled through a “toggle” parameter. If this parameter in the NCSAM.BIN file is set to 0 (the default condition) then no k-factor table is required as input and k-factors are not applied to the trip distribution model. If this value is set to 1, then the user must create a k-factor table and this table will be applied during the trip distribution stage.

## **Area Type Code**

This user specified code, located in the NCSAM.BIN file, is used to simply inform the model as to whether the study area is considered a small area (value set to 1) or a large area (value set to 2). This directs the program to use the appropriate parameter file for those parameters that differ for large and small areas.

## **4.5 Mode Split**

### **MODESHARES\_\*.BIN**

Auto shares by trip purpose are stored in this table. These values should be checked against locally observed data from the Census, the National Household Travel Survey, American Community Survey, or other local survey source for validity and adjusted as appropriate.

## **4.6 Commercial Vehicles**

### **CVPRODRATES.BIN**

The trip production rates for each commercial vehicle type are tabulated in the CVPRODRATES.BIN file. During the commercial vehicle trip generation step these rates are applied to the number of commercial vehicles by vehicle type and by employment type to estimate the total trip productions for CV1, CV2, and CV3. During the commercial vehicle trip generation reasonableness checking process a review of the model performance measures may reveal the need to modify these trip production rates. If this situation arises the rates can be modified.

### **CVATTRRATES.BIN**

The trip attraction rates by commercial vehicle for each attraction variable are tabulated in the CVATTRRATES.BIN file. During the commercial vehicle trip generation step these rates are applied to the attraction variables (number of employees by employment type and number of households) to estimate the total trip attractions by CV1, CV2, and CV3. During the trip generation reasonableness checking process a review of the model performance measures may reveal the need to modify the commercial vehicle trip attraction rates. If this situation arises the rates can be modified using this file.

### **GAMMACOEFFICIENTS\_\*.BIN**

As previously noted, the default gamma coefficients are stored in files GAMMACOEFFICIENTS\_\*.BIN. During the commercial vehicle trip distribution reasonableness checking process, a review of the model performance measures may reveal that the average trip length for the commercial vehicle trip purposes is either too long or too short or the shape of the trip length frequency curve may not reflect the conditions you believe to be true for your area. In situations like this, the gamma coefficients for the

commercial vehicles can be adjusted to either increase or decrease the average trip length or to change the shape of the trip length frequency curve. All changes to gamma coefficients are made within this BIN file.

## **4.7 External Stations**

### **IXATTRRATES.BIN**

The trip attraction rates for the IX trips for each attraction variable are tabulated in the IXATTRRATES.BIN file. During the IX trip generation step these rates are applied to the attraction variables (number of employees by employment type and number of households) to estimate the total trip attractions for the IX trip purpose. During the IX trip generation reasonableness checking process a review of the model performance measures may reveal the need to modify the IX trip attraction rates. If this situation arises the rates can be modified using this file.

### **GAMMACOEFFICIENTS\_\*.BIN**

As previously noted, the default gamma coefficients are stored in files GAMMACOEFFICIENTS\_\*.BIN. During the IX trip distribution reasonableness checking process a review of the model performance measures may reveal that the average trip length for the IX trips is either too long or too short or the shape of the trip length frequency curve may not reflect the conditions you believe to be true for your area. In situations like this, the gamma coefficients for the IX trip purpose can be adjusted to either increase or decrease the average trip length or to change the shape of the trip length frequency curve. All changes to gamma coefficients are made within this BIN file.

## **4.8 Time of Day**

### **NC\_HOURLY\_\*.BIN**

This file contains the default time-of-day and directional distribution tabulated from the communities represented in the North Carolina Combined Survey Database. This file should ONLY be updated if locally observed travel survey data is available for the study area in question. This exercise should be reserved for advanced model users only.

### **VEHOCCUPANCYFACTORS\_\*.BIN**

This file contains the default vehicle occupancy factors by trip purpose and by time of day (AM, MD, PM, and OP). This file should ONLY be updated if locally observed travel survey data is available for the study area in question.

## **4.9 Highway Assignment**

There are no parameter files read directly by the highway assignment stage, it is however important to recognized that the parameter files for all subsequent steps will have an impact on the performance measures for the highway assignment. A review of the highway assignment performance measures may reveal the need to adjust one or many of the before mentioned parameter files.

## **5 Model Report File**

A model report file is generated for each scenario that is specified and run. The report file is a text file that includes model performance outputs from each model stage where model

performance output is required. The output from each subsequent stage is simply appended to the end of the report file. If a given stage is run multiple times, as is often the case during reasonableness checking and validation, the output from each run will be appended to the end of the report. This provides for easy comparison of each run. Once the base year model has been fully checked and validated, the report file for the base year scenario can be deleted, the model can then be run from start to finish and the report file will include the model performance output for the full model run. This file can then be easily read into MS Excel or MS Word for use in the final model documentation.

## 6 Scenario Planning

As described previously, the user can create and edit scenarios by selecting the Setup button from the user interface. All information about default file names, directory names, and parameters are stored in the NCSAM.BIN file as described earlier. When a new scenario is created, TransCAD will look for the NCSAM.BIN file and populate the new scenario with the default information. This file can be viewed from and edited within TransCAD as any binary file. Specific information about all scenarios that a user has created is stored in the NCSAM.ARR file. This file is not editable except through the NCSAM user interface. If any structural changes are made to the application then changes may need to be made to the NCSAM.BIN file. If the NCSAM.BIN file is changed then scenarios previously created will need to be recreated in order for the modified parameters to be applied.

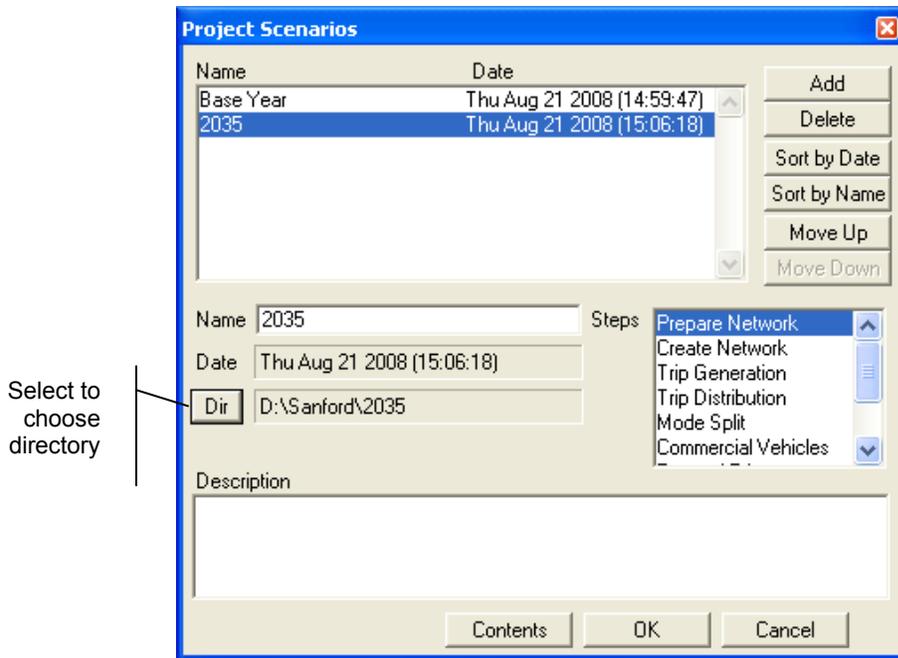
**NOTE:** *The ARR file is the way TransCAD archives the model run details for any given scenario. If the ARR file is deleted and the NCSAM.BIN file is changed then any scenario previously created and executed cannot be recreated with the same results. If scenarios need to be archived the entire set of directories, including the NCSAM.ARR and NCSAM.BIN files must be archived along with the scenario data.*

### 6.1 Scenario Inputs

The required files for running a new scenario include model parameter files and model input files. The model parameter files, listed in Table 1 and described in detail in Chapter 4, contain model constants, coefficients, rates, and other parameters that should not be changed from the base year. Only the input files listed in Table 2 can be updated without recalibrating the model set.

### 6.2 Adding a New Scenario

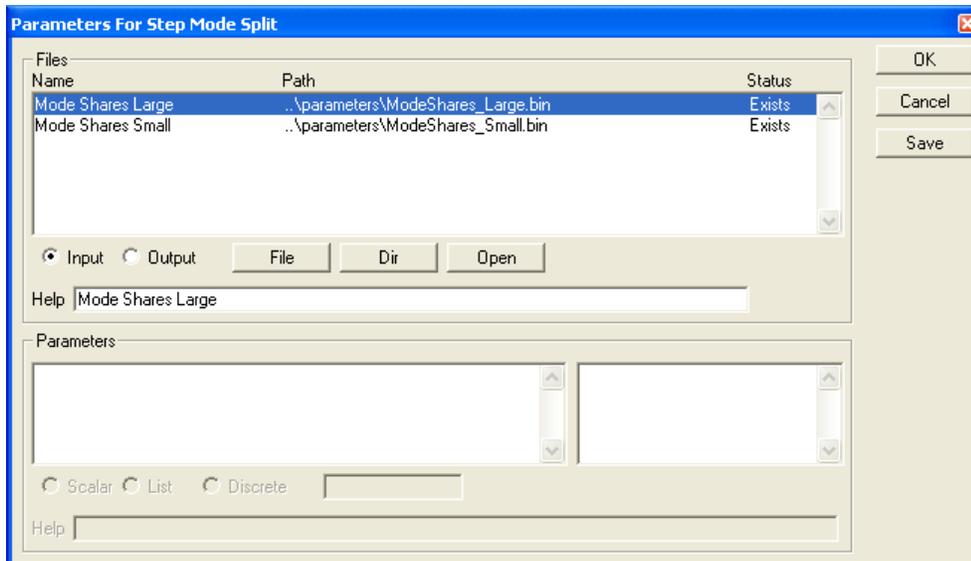
To add a new scenario click the “Setup” button on the user interface. The Project Scenarios window will be displayed. From this window scenarios can be added, deleted, and sorted. All available scenarios will be listed in the list box with the date and time of creation. A box is provided for a detailed description of the scenario.



Each scenario must have its own directory, and the directory and required subdirectories (See Figure 2) must already exist. If the directories exist, the user can select the DIR button and, using the Windows-like browser, select the location of the scenario data files and subdirectories. (See the screenshot below).



Each stage of the model application is listed in the “Parameters for Step...” list box as described previously. These are the same Stages listed on the model user interface. As demonstrated previously, selecting the Contents button will display the input and output data files, and any applicable parameter for the highlighted Stage. See the screenshot below.



The user can select to view either the input or the output files by selecting the appropriate radio button under the file listing scroll box. The status column indicates whether or not the file already exists. As with the base year scenario, the user should check to see that all input files exist before executing the model. Further, if performance testing and output files from previous runs need to be saved, the user can change the name and/or location of the output files in order to avoid overwriting existing files. Highlighted file can be changed with the File button. The Dir button allows for global changes to file locations. The Open button allows the user to open and view the TransCAD file that is highlighted in order to verify the contents.

The bottom section of the Contents window allows the user to change parameters for some stages. Any changes made to the parameters in this way will be applied to that scenario ONLY. To apply a parameter change to EVERY scenario the change must be made in the NCSAM.BIN file. Changes to this file should ONLY be made during the calibration/validation of the base year model.

### **6.3 Running a New Scenario**

Once all input files for the new scenario are ready and the scenario has been set up the user can then run through all of the model stages to prepare new model outputs for the scenario. The user must review the reasonableness of the results and compare the base year and other scenarios to verify that the model has been run correctly and the results are in line with the underlying changes in land use and transportation networks.

## Appendix A

**Table A-1 SEDATA File Format**

Field Name	Field Type	Width	Decimal	Data Value*	Description
TAZ	Integer (4 bytes)	10	0	R	Traffic analysis zone
District	Integer (4 bytes)	11	0	O	District code
Population	Integer (4 bytes)	11	0	R	Population in zone
Households	Integer (4 bytes)	11	0	R	Households in zone
Vehicles	Integer (4 bytes)	10	0	R	Autos in zone
Industry	Integer (4 bytes)	11	0	R	Industry employees
Retail	Integer (4 bytes)	11	0	R	Retail employees
HwyRet	Integer (4 bytes)	11	0	R	Highway retail employees
Service	Integer (4 bytes)	11	0	R	Service employees
Office	Integer (4 bytes)	11	0	R	Office employees
TotEmp	Integer (4 bytes)	11	0	R	Total employment
Students	Integer (4 bytes)	11	0	R	Students
CV1IND	Integer (4 bytes)	8	0	R	Autos at industry site
CV2IND	Integer (4 bytes)	8	0	R	Pickups at industry site
CV3IND	Integer (4 bytes)	8	0	R	Trucks at industry site
CV1RET	Integer (4 bytes)	8	0	R	Autos at retail site
CV2RET	Integer (4 bytes)	8	0	R	Pickups at retail site
CV3RET	Integer (4 bytes)	8	0	R	Trucks at retail site
CV1HWY	Integer (4 bytes)	8	0	R	Autos at highway retail site
CV2HWY	Integer (4 bytes)	8	0	R	Pickups at highway retail site
CV3HWY	Integer (4 bytes)	8	0	R	Trucks at highway retail site
CV1SER	Integer (4 bytes)	8	0	R	Autos at service site
CV2SER	Integer (4 bytes)	8	0	R	Pickups at service site
CV3SER	Integer (4 bytes)	8	0	R	Trucks at service site
CV1OFF	Integer (4 bytes)	8	0	R	Autos at office site
CV2OFF	Integer (4 bytes)	8	0	R	Pickups at office site
CV3OFF	Integer (4 bytes)	8	0	R	Trucks at office site
PopDensity	Real (8 bytes)	13	2	O	Population density
HHDensity	Real (8 bytes)	13	2	O	Household density
EmpDensity	Real (8 bytes)	13	2	O	Employment density
hbwp	Real (8 bytes)	13	3	M	HBW productions
hbwa	Real (8 bytes)	13	3	M	HBW attractions
hbop	Real (8 bytes)	13	3	M	HBO productions
hboa	Real (8 bytes)	13	3	M	HBO attractions
hbschp	Real (8 bytes)	13	3	M	HBSCH productions
hbscha	Real (8 bytes)	13	3	M	HBSCH attractions
nhbwp	Real (8 bytes)	13	3	M	NHBW productions
nhbwa	Real (8 bytes)	13	3	M	NHBW attractions
nhbop	Real (8 bytes)	13	3	M	NHBO productions
nhboa	Real (8 bytes)	13	3	M	NHBO attractions
cv1p	Real (8 bytes)	13	3	M	CV auto productions
cv1a	Real (8 bytes)	13	3	M	CV auto attractions
cv2p	Real (8 bytes)	13	3	M	CV pickup productions

cv2a	Real (8 bytes)	13	3	M	CV pickup attractions
cv3p	Real (8 bytes)	13	3	M	CV truck productions
cv3a	Real (8 bytes)	13	3	M	CV truck attractions
ixp	Real (8 bytes)	10	2	R	IX productions
ixa	Real (8 bytes)	10	2	M	IX attractions
Cliterations	Integer (4 bytes)	10	0	M	Disaggregate model iterations
HHClosure	Real (8 bytes)	13	7	M	Disaggregate model closure
hhp1	Real (8 bytes)	10	4	M	1 person households
hhp2	Real (8 bytes)	10	4	M	2 person households
hhp3	Real (8 bytes)	10	4	M	3 person households
hhp4	Real (8 bytes)	10	4	M	4 person households
hhp5	Real (8 bytes)	10	4	M	5+ person households
hha0	Real (8 bytes)	10	4	M	0 auto households
hha1	Real (8 bytes)	10	4	M	1 auto households
hha2	Real (8 bytes)	10	4	M	2 auto households
hha3	Real (8 bytes)	10	4	M	3+ auto households
hhp1a0	Real (8 bytes)	10	4	M	1 person, 0 auto households
hhp1a1	Real (8 bytes)	10	4	M	1 person, 1 auto households
hhp1a2	Real (8 bytes)	10	4	M	1 person, 2 auto households
hhp1a3	Real (8 bytes)	10	4	M	1 person, 3+ auto households
hhp2a0	Real (8 bytes)	10	4	M	2 person, 0 auto households
hhp2a1	Real (8 bytes)	10	4	M	2 person, 1 auto households
hhp2a2	Real (8 bytes)	10	4	M	2 person, 2 auto households
hhp2a3	Real (8 bytes)	10	4	M	2 person, 3+ auto households
hhp3a0	Real (8 bytes)	10	4	M	3 person, 0 auto households
hhp3a1	Real (8 bytes)	10	4	M	3 person, 1 auto households
hhp3a2	Real (8 bytes)	10	4	M	3 person, 2 auto households
hhp3a3	Real (8 bytes)	10	4	M	3 person, 3+ auto households
hhp4a0	Real (8 bytes)	10	4	M	4 person, 0 auto households
hhp4a1	Real (8 bytes)	10	4	M	4 person, 1 auto households
hhp4a2	Real (8 bytes)	10	4	M	4 person, 2 auto households
hhp4a3	Real (8 bytes)	10	4	M	4 person, 3+ auto households
hhp5a0	Real (8 bytes)	10	4	M	5+ person, 0 auto households
hhp5a1	Real (8 bytes)	10	4	M	5+ person, 1 auto households
hhp5a2	Real (8 bytes)	10	4	M	5+ person, 2 auto households
hhp5a3	Real (8 bytes)	10	4	M	5+ person, 3+ auto households

\* Required (R) Optional (O) or Model Generated (M)

**Table A-2 HIGHWAY Node Layer File Format**

Field Name	Field Type	Width	Decimal	Data Value*
ID	Integer (4 bytes)	10	0	R
Longitude	Integer (4 bytes)	10	0	R
Latitude	Integer (4 bytes)	10	0	R
Centroid	Integer (4 bytes)	10	0	R

\* Required (R) Optional (O) or Model Generated (M)

**Table A-3 HIGHWAY Line Layer File Format**

Field Name	Field Type	Width	Decimal	Data Value*	Description
ID	Integer (4 bytes)	10	0	R	Link ID
Length	Real (8 bytes)	10	2	R	Link length
Dir	Integer (2 bytes)	2	0	R	Link DIR
Posted Speed	Real (8 bytes)	10	2	R	Link posted speed
Facility Type	Character	24	0	O	Link facility type
FACTYPE_CD	Integer (4 bytes)	10	0	R	Link facility type code
Divided	Character	14	0	O	Link cross-section
DIVIDED_CD	Integer (4 bytes)	6	0	R	Cross-section code
AB Lanes	Integer (4 bytes)	6	0	R	Number of lanes AB
BA Lanes	Integer (4 bytes)	6	0	R	Number of lanes BA
HOV	Integer (2 bytes)	2	0	O	HOV indicator
Toll	Integer (2 bytes)	2	0	O	Toll indicator
FUNCL_CD	Integer (2 bytes)	6	0	R	Functional class code
AB_CAPPHPL	Integer (4 bytes)	8	0	M	Link capacity per hour per lane AB and BA
BA_CAPPHPL	Integer (4 bytes)	8	0	M	
AB_AMCAP	Integer (4 bytes)	8	0	M	AM link capacity AB and BA
BA_AMCAP	Integer (4 bytes)	8	0	M	
AB_MDCAP	Integer (4 bytes)	8	0	M	Midday link capacity AB and BA
BA_MDCAP	Integer (4 bytes)	8	0	M	
AB_PMCAP	Integer (4 bytes)	8	0	M	PM link capacity AB and BA
BA_PMCAP	Integer (4 bytes)	8	0	M	
AB_OPCAP	Integer (4 bytes)	8	0	M	OP link capacity AB and BA
BA_OPCAP	Integer (4 bytes)	8	0	M	
AB Initial Time	Real (8 bytes)	10	3	M	Initial link travel time AB and BA
BA Initial Time	Real (8 bytes)	10	3	M	
AB HBWGC	Real (8 bytes)	10	3	M	HBW link generalized cost AB and BA
BA HBWGC	Real (8 bytes)	10	3	M	
AB HBOGC	Real (8 bytes)	10	3	M	HBO link generalized cost AB and BA
BA HBOGC	Real (8 bytes)	10	3	M	
AB NHBGC	Real (8 bytes)	10	3	M	NHB link generalized cost AB and BA
BA NHBGC	Real (8 bytes)	10	3	M	
Alpha	Integer (2 bytes)	6	0	M	Link alpha code
AB Count	Integer (4 bytes)	10	0	R	Link count AB and BA
BA Count	Integer (4 bytes)	10	0	R	
DailyCount	Integer (4 bytes)	10	0	R	Link daily count
Screenline	Integer (4 bytes)	10	0	R	Screenline link indicator
County	Character	16	0	O	County name
Name	Character	32	0	O	Road name
AB_VMT	Integer (4 bytes)	8	0	M	Link VMT AB and BA
BA_VMT	Integer (4 bytes)	8	0	M	
TOT_VMT	Integer (4 bytes)	8	0	M	Total VMT

\* Required (R) Optional (O) or Model Generated (M)

**EE Trip Table**

This file is a standard TransCAD matrix with FROM station, TO station, and number of trips. It is critical that the Row Indices be name "From" and the Column Indices be named "To" in order for the GUI to successfully execute. For more information please see the procedures manual Section 13.2, Step 3.