



# NJRTM-E Users Guide (Cube 6 Version) Version 4

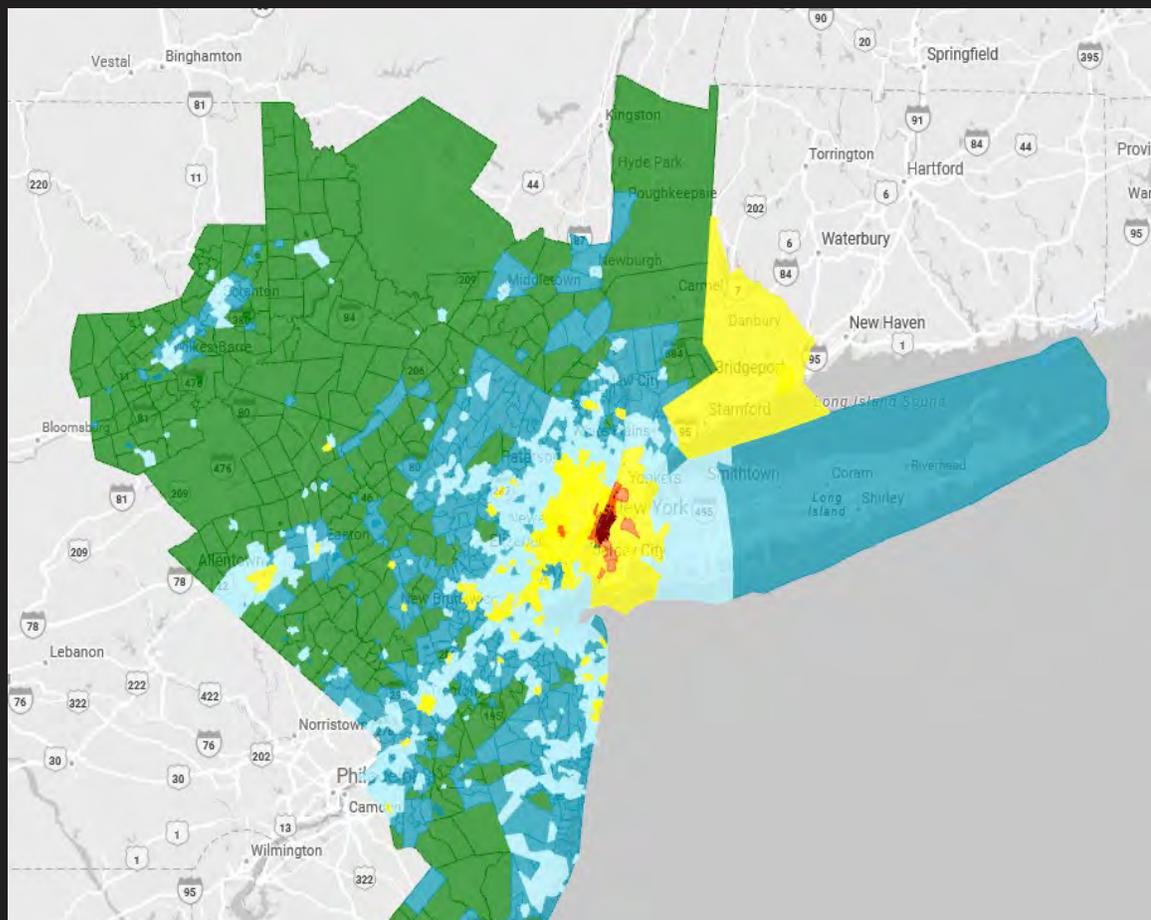
## 2023 Revalidation

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## 1.0 Introduction

The purpose of this Users Guide is to describe the development and execution of the North Jersey Regional Transportation Model – Enhanced (NJRTM-E) application within CUBE Voyager as well as provide guidance regarding typical applications of the regional model. The Users Guide is structured to describe the installation process and provide an overview of the model and its execution procedures. The Users Guide also includes a section describing typical applications of the model and the coding procedures for network adjustments, socio-economic data revisions, and revisions to cost related variables. The final section of the users guide includes series of appendices that provide file formats for all the input files used in the application.

The model version used in the 2023 Validation Project is the version originally developed as part of the 2017 Validation Project as a separate prototype model and incorporates potential adjustments to facets of the model that, at the time, were based on anticipated changes to travel characteristics due to the impact of Connected Autonomous Vehicles (CAV). Due to impacts on travel from other exogenous factors such as increased work from home and shopping from home activity, the ability to test changes in travel behavior became increasingly important. The “CAV” model version is now considered the primary version of the NJRTM-E. It provides the user the ability to adjust aspects of travel behavior such as the number of trips and the desire for longer or shorter trips to help replicate observed changes, While not a replacement for a validation, the model provides placeholders which allows the user to make broad adjustments in the model to simulate those potential changes. The base scenario would see these placeholders populated with either a “1” or another default factor that does not change the base scenario results however, if the user desires to test a change in travel behavior (e.g. lower work trips due to increased work from home activity) these placeholders would be changed to reflect recent observed travel pattern changes. This Users Guide includes a description of each of these features within section 5.0.

It should be noted that the intent of this user's guide is to provide instructions for the execution of the NJRTM-E with some limited discussion of typical operations of the CUBE Voyager package. Given the extensive capabilities of the CUBE package, it is not practicable to include a comprehensive discussion of all program features within this document. It is recommended that users requiring a more detailed description of the CUBE program as well as the development and use of scenarios applications should review the CUBE and Voyager documentation provided by Citilabs.

## 2.0 Model Installation

Since a key objective of the project was the development of a common model usable by multiple agencies, establishing a flexible installation process was a key consideration. Therefore, the NJRTM-E was designed specifically to minimize installation requirements. The model was developed almost exclusively with the Citilabs CUBE/Voyager software package and the ARCMAP GIS package. Currently, the ARCMAP GIS Package is used solely to calculate walk access buffers surrounding transit stations and is not required for any other model functions. As such it is not necessary to install ARCMAP to execute the regional model. With the pending release of the latest version of CUBE (Version 5), it is anticipated that the specific ARCMAP features required for the model will be integrated directly within CUBE, thereby minimizing the use of ARCMAP. The only routines not performed directly by Cube are related to specific transit and mode choice functions that were developed using C-Based programs. This includes customized C-Based programs for estimating mode choice.

The requirements for model installation are minimal. The only restriction is that the CUBE Voyager software and ARCMAP must be installed on the same hard drive where the NJRTM-E is located. While it is typically expected that this would be the “C” drive on most computer systems, it is possible to install the software on any available hard drive. Due to the large amount of files generated during a model execution, it is strongly recommended that the selected hard drive have a significant amount of available storage space. The specification for the computer used during the model development process is provided in Appendix A.

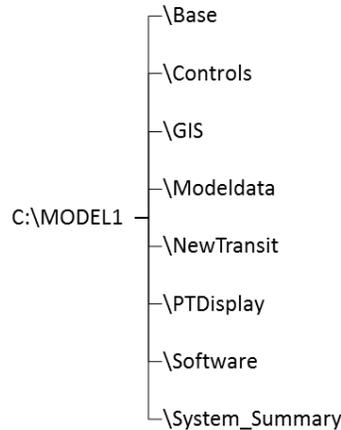
Prior to the installation of the NJRTM-E, the user should first install the Citilabs software along with ARCMAP if applicable. Specific installation instructions for these programs are available from Citilabs and ESRI. The NJRTM-E is provided in a single installation CD and the installation of the NJRTM-E is a straightforward two-step process. The first that involves creating a directory that will contain the model and the second step is to update the model controls to reflect the new model directory. An example of this process is as follows:

Step 1 - Create Model Directory

The user creates a main model directory on a specified hard drive. As an example the main model directory could be named as follows:

C:\NJRTM-E

The user then copies all of the files from the installation CD into the new model directory. After the copy process is completed the following directory structure will exist underneath the model directory:



Note that these subdirectories may not be renamed and must remain as a subdirectory of the main model directory (in this example “Model1”). The “model data” subdirectory contains individual folders representing input data for the networks and socio-economic data. The “base” subdirectory will contain individual output folders representing each scenario executed by the model. The “GIS” subdirectory contains all of the layer data and Visual Project Files (\*.VPR) which are user-defined displays of the network. The “PTDisplay” subdirectory stores the output various transit displays that can be viewed in ArcView. The “software” subdirectory contains various DLL files related to transit reporting functions as well as the compiled C-Based Mode Choice program. The “newtransit” folder contains various parameter and factor files for the Public Transit Module. The “System\_Summary”

contains the script and the results of System Summary sub-application. This application helps the analyst to prepare the summaries from various model components, from trip generation to trip assignment.

Step 2 – Update Directory References

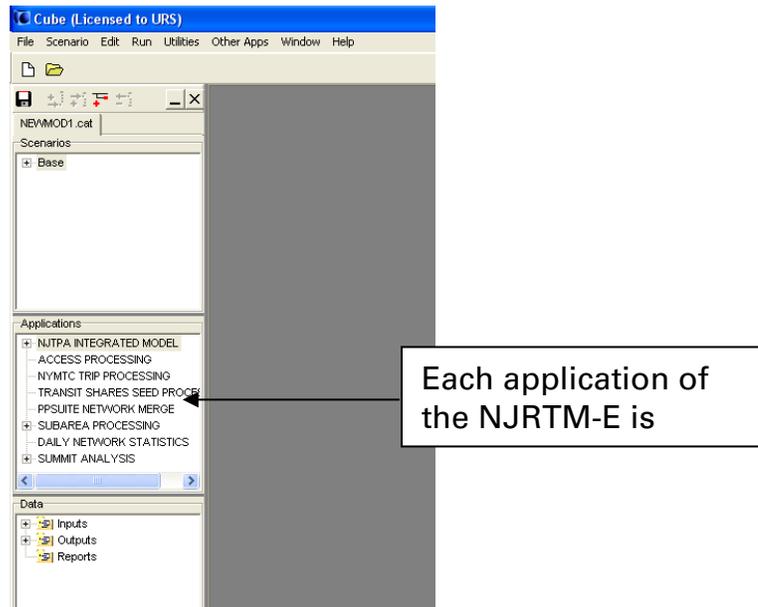
After the copy process has been completed CUBE will automatically reference each of the applications to the new model directory. To initiate this process user must first launch CUBE from Windows and then open the model catalog by selecting the “NEWMOD.CAT” file that resides in the main model directory, in this case “C:\model1”. This process is depicted in **Figure 1**. Note that after selecting the location of the existing catalog file (in this example NEWMOD.CAT), subsequent launches of Cube will provide an option to open the last catalog file as a default selection.

**Figure 1 - CUBE “Open Catalog” Dialog Box**



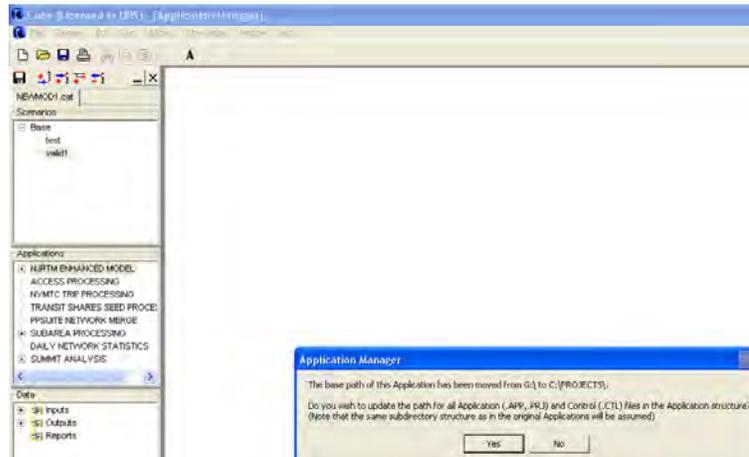
When this is complete, the left side of the CUBE display window will list the complete set of applications required for the NJRTM-E. This display is depicted in Figure 2.

Figure 2 – CUBE Display of Applications



To update the references the user simply double clicks each of the applications in sequence. For each application, a message shown in Figure 3 will appear indicating that CUBE will adjust the directory references automatically. In the example below, the model catalog file directory structure is being updated to “c:\model1” from the source location, in this case, an external hard-drive denoted as “G:\”

Figure 3 – CUBE Directory Referencing Message

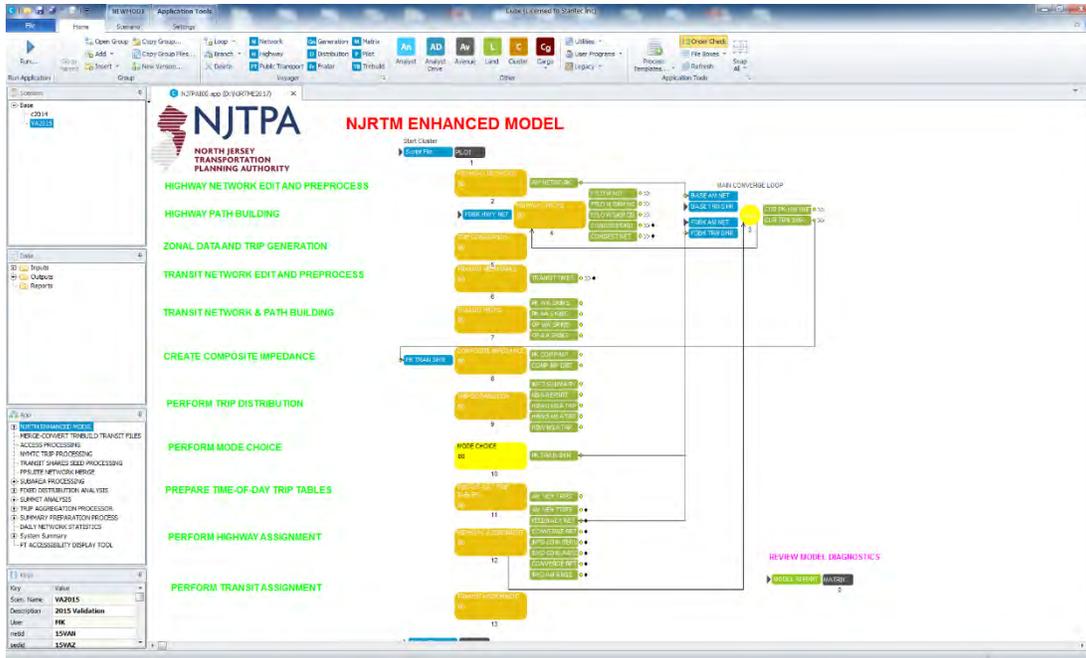


When the directory references for the first (main) application have been updated, a flowchart style figure will appear on the right side of the CUBE window as shown in Figure 4 on the following page. As each application is updated, the screen display will be adjusted to display the flowchart of that particular application with its associated routines. Each of these applications then resides in a

separate window within CUBE. After each application has had its directory reference updated the user can double-click the top application to view the NJRTM-E flowchart.

Once each of the applications has been referenced to the new directory structure, the installation process is fully complete. It is recommended that the user save the updated application catalog file by clicking the orange-tabbed save icon on the left side of the screen display. The model is then ready for use and execution. Note that the contents of each application as well as the execution procedures are described in the subsequent sections of this document.

**Figure 4 – CUBE Display of Main NJRTM-E Application**



### 3.0 Model Development Overview

In contrast to many regional travel demand models that serve the needs of a single client, The NJRTM-E was specifically developed to serve the needs of NJTPA, NJ Transit, and NJDOT. Each of these agencies had specific requirements that needed to be incorporated into this modeling process. One of the primary requirements was the utilization of NJ Transit's nested- logit mode choice model. This mode choice model includes extensive coding and path building procedures to properly represent all the competing transit network services within northern New Jersey. Many of these services are extended across the Hudson River in order to support the estimation of travel into New York City. In addition, the model includes the representation of primary transit services in Manhattan that act as a collector-distributor system for transit trips originating from New Jersey. This transit forecasting process was developed using CUBE's PT process.

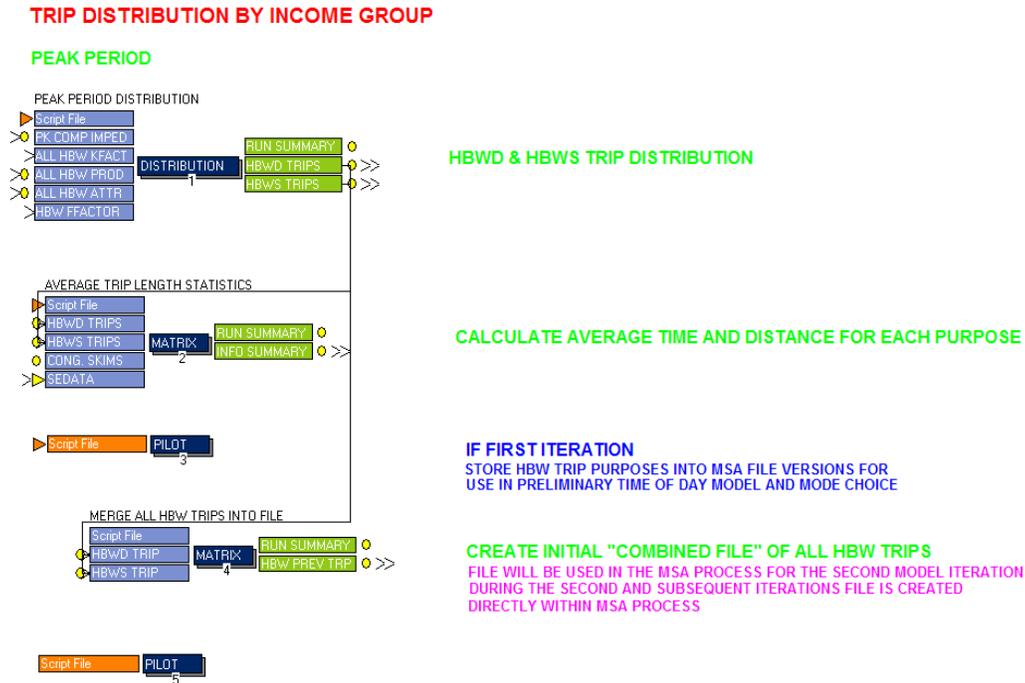
The overall NJRTM-E process was developed within Citilabs CUBE Voyager modeling package. The CUBE software provides many benefits that simplify the use and understanding of travel demand models. The CUBE environment displays the model as a flowchart depicting all of the various inputs, outputs, and model controls in a user-friendly graphical display. This interactive display provides an understanding of how the input and output files are used in each routine and enables the user to quickly edit input files and review the results within output files simply by selecting a file from the flowchart. The CUBE environment also controls all aspects of the execution of the model so that a user can view the ongoing progress of the execution while remaining active in the flowchart environment. The CUBE environment can also use other customized programs or previous versions of Citilabs software although this is currently not the case for the NJRTM-E.

### 4.0 Application Development

Within CUBE, groups of individual planning routines are typically processed as part of an individual "application". As discussed during the model installation procedure there are a series of applications that have been developed for the NJRTM-E. Referring back to Figure 4, the main application listed as the "NJRTM Enhanced Model" is the actual regional model. The remaining applications provide either specific input files for the regional model or perform specific post-processing procedures. These are referred to as support applications and their specific role and usage is described in greater detail in Section 5.13. The CUBE package also provides flexibility with the way the files and routines are displayed in the flowchart. For example, the model has established specific color coding schemes and file identification procedures to assist with the use and execution of the model.

Figure 5 displays a typical application within the NJRTM-E process. Note that each of the individual routines within the application contains a color-coding system that describes the routine controls, model input files, and model output files. Descriptions of the routine process and additional notes highlighting aspects of the process are provided as well.

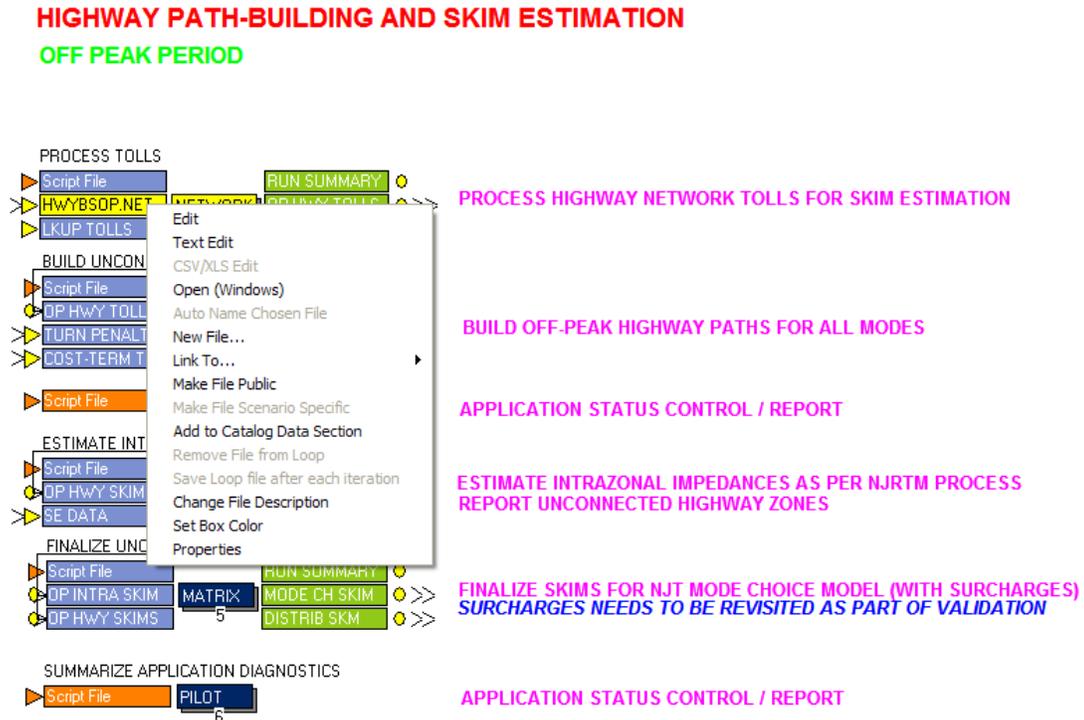
Figure 5 – Typical Application Display



Each of the routines is depicted in a dark blue box with the name of the routine. As an example the second routine in this application is a matrix processing function displays the Voyager routine name “MATRIX”. The input files and routine controls all shown in light blue to the left of each routine. Note that the routine controls are labeled as “script file” and each of the remaining input files has a short descriptive phrase to indicate the contents of the file. To the left of the routines are the output files displayed in green. Each of these files also contains a short descriptive phrase to indicate the contents of the output files. Note that to script files or controls for the PILOT routines are displayed in orange. The color orange is reserved for files that should not be modified by users.

Note that the user can access any of these files by simply double-clicking on a file box in the flowchart. CUBE will automatically launch the appropriate program to view the contents of a file. As an example double-clicking a script or control file will launch a text editor. Similarly, double clicking a RUN SUMMARY listing file will launch a text editor or browser file. Accessing a network file will launch the CUBE network editor, while accessing a matrix causes CUBE to display the matrix in a row/column format. Additional information about a file is also provided by right clicking a file as shown in Figure 6. In this example, the highway network in the first routine has been right clicked by the user. The user can then access this file under the standard EDIT option or additional TEXT EDITOR if applicable. Selecting the “PROPERTIES” option displays the actual file name along with a path directory structure where the file is located and other statistics such as file size and creation date.

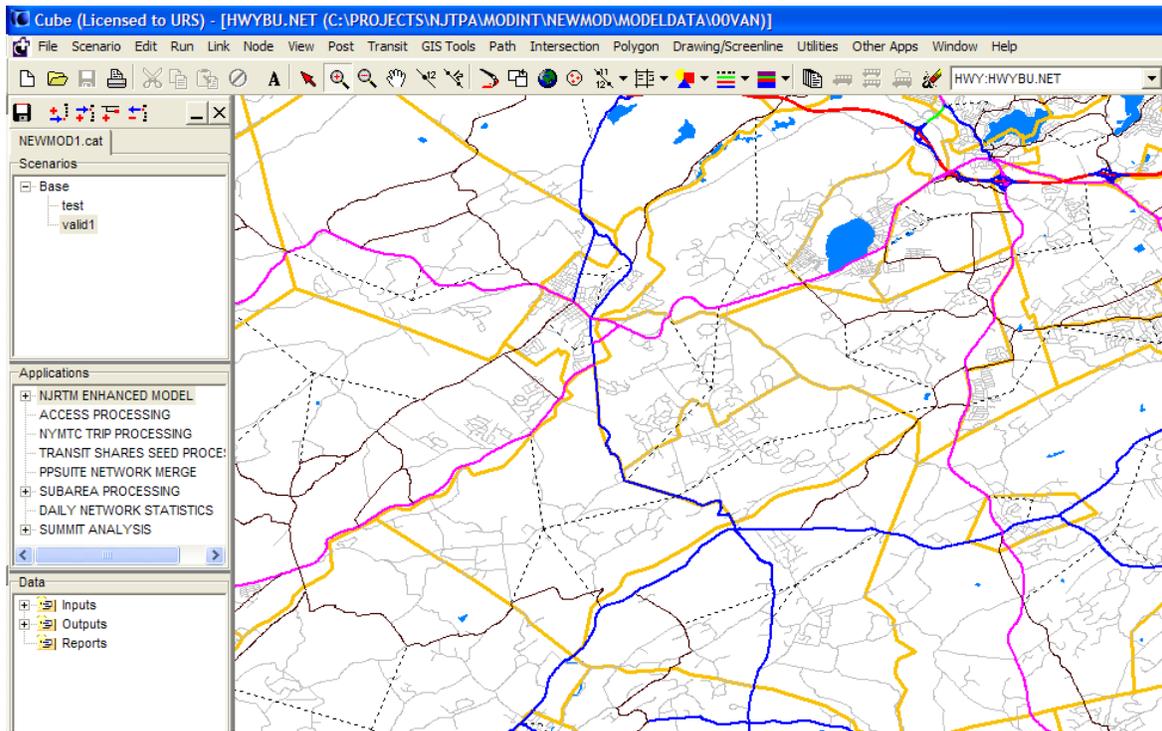
Figure 6 – Example of File Access via Right-Click Function



Referring back to Figure 5, the notations in colored text on the right side of each application page provide some information for the users understanding of how the routines are employed. The titles in black text as part of the flowchart links will be displayed as process descriptions by the task monitor during execution of the model. It should also be noted that each of the routines as a number associated with it. These numbers are the execution sequence that the application utilizes during a model run. In this example the DISTRIBUTION routine is executed first followed by a MATRIX routine. After the first two routines, the final three routines are executed if certain conditions are met. The PILOT routines control the conditional execution of the final MATRIX routine. The indentation of the final MATRIX routine provides a graphical indication that this routine is executed under the control of the PILOT routines. Additional information about execution control is provided later in this document under Section 6.

The NJRTM-E includes several standard user-defined displays for viewing highway and transit networks. These user defined displays are stored as \*.VPR files and these displays are automatically launched when the user accesses a highway or transit network under selected applications. Figure 7 provides a standard display of the transportation network provided in the highway network application.

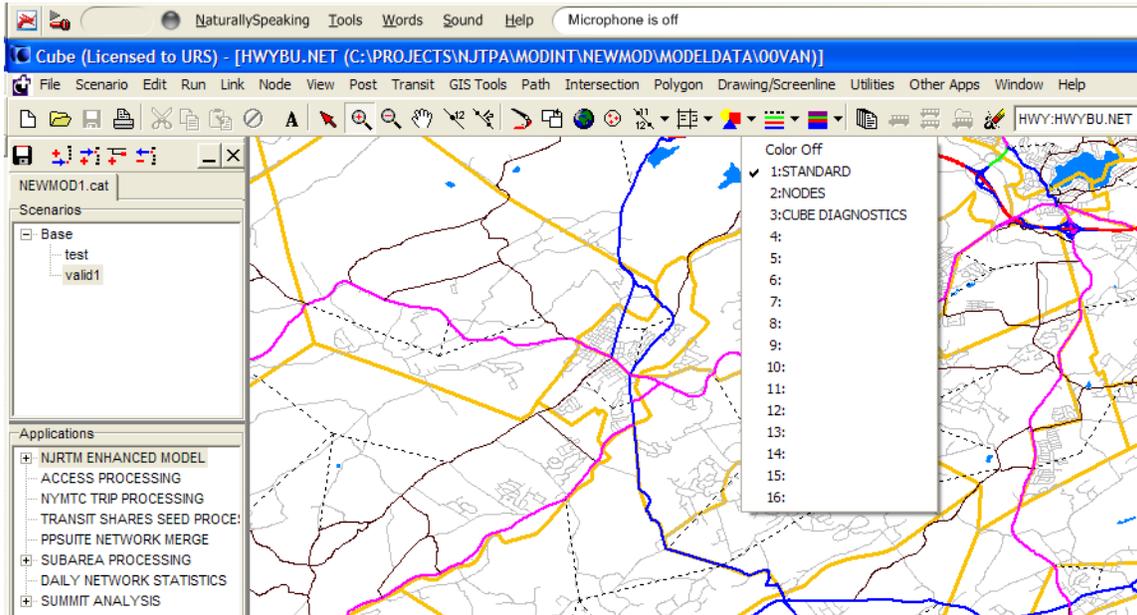
Figure 7 – Standard Transportation Network Display



As shown in the figure, the transportation network is displayed in a series of colors depending upon the facility type. The background street layer and water layer are included as well as the zonal boundary file displayed in the light orange color. The dashed lines represent centroid connectors. Note also that the transportation network has been shaped in this display to correspond to the actual alignment of the roadways. A complete listing of these user-defined displays and their uses is provided in Appendix B. Each of these displays contains a series of selectable choices for displaying links and their attributes of the networks along with additional background layers.

The background layers include an underlying street layer, and a layer of water bodies depicting river, streams, and lakes, as well as other boundary files defining the zonal system, municipal boundaries and county boundaries. Note that the street layer is provided only for the New Jersey and New York City areas in order to minimize the time required to load and refresh the display of the standard views. The list of available layers is provided in Appendix C. Note that each of the user-defined displays includes multiple selections for link and node categories. The user can easily transition between selection sets by clicking the CUBE node display icon (the “circle/triangle/square” symbol). As an example, Figure 8 demonstrates the multiple selections within the node category of the standard highway display.

**Figure 8 – Available Node Display Selections**



As shown in the figure this particular display has three node display options and others can be added based on the user’s specific needs. If desired, these initials settings can be permanently saved as part a particular the user-defined display file. Note that a more comprehensive discussion of CUBE’s display capabilities is provided within the CUBE documentation.

During the development of the applications, the user displays were created in a way to minimize unnecessary detail in order to minimize time for screen refreshing. As a result, some user profiles have a reduced number of background layers and shape displays. Note that these user-defined displays can be modified as necessary for any unique requirements and that background layers can be added or removed, as necessary. The user should consult the CUBE documentation for a more comprehensive description of these features and their control within the CUBE network display.

#### **4.1 Application Diagnostics and Reports**

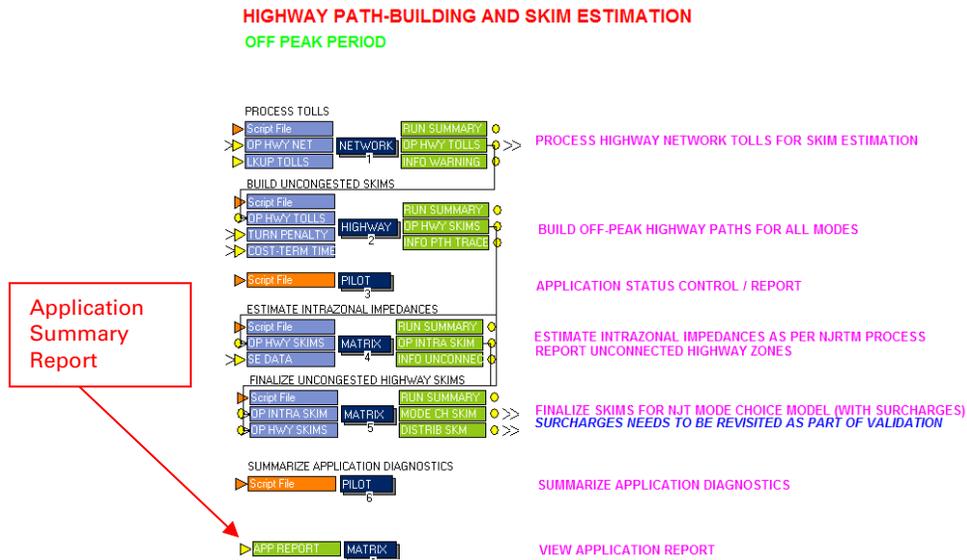
As part of the development of the application, a series of standard diagnostic listings and summary reports were developed. These listings and reports describe the overall execution of the model as well as any warnings or fatal messages. These reporting features were structured to provide both an overall summary of the model through multiple model iterations as part of the full feedback processing and a summary of specific model components that process input data for the modeling process. With this approach, the user can easily review the diagnostics of a full model run as well as results of individual components if an incremental execution process is more suitable for particular situations. Figure 9 provides a display of the relationships of the various reports.

**Figure 9 – Application Report Processing**

REPORT TYPE	REPORT CONTENTS
MODEL APPLICATION REPORT	DIAGNOSTICS BY COMPONENT AND BY ITERATION
MODEL COMPONENT REPORT	DIAGNOSTICS OF COMPONENT BY ITERATION
RUN SUMMARY LISTING	DIAGNOSTICS OF LAST EXECUTION OF A VOYAGER ROUTINE

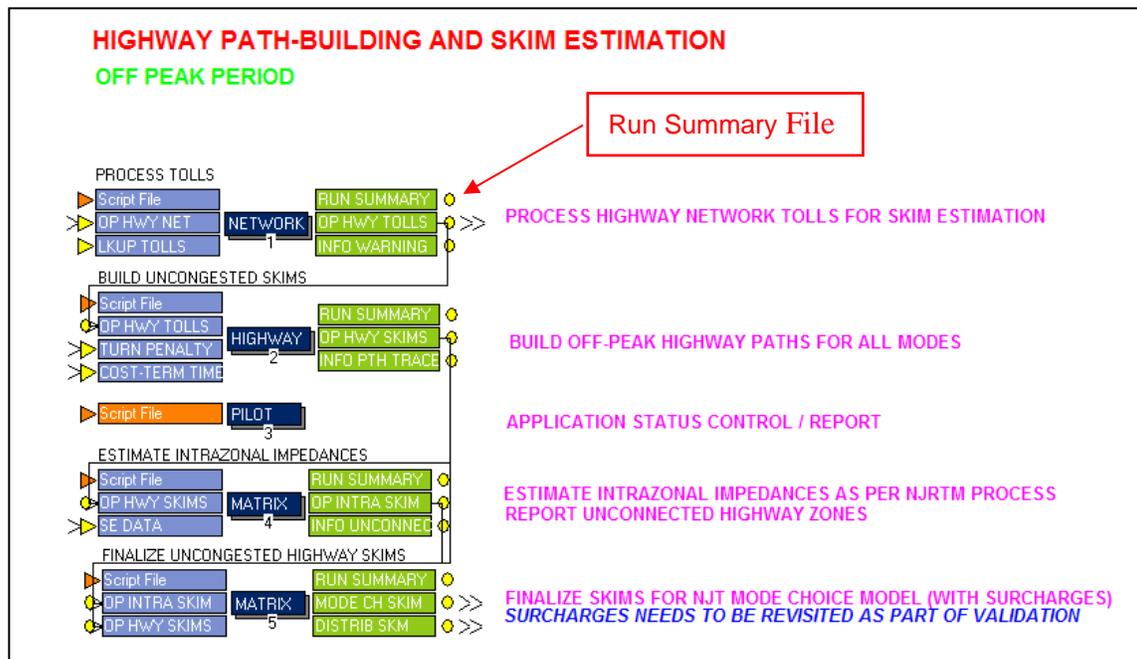
The model application report provides a series of messages of warnings and fatal conditions that were encountered in the execution of the model. The purpose of these messages is to provide an initial assessment of any significant problems encountered during the model execution. Many of these messages would be standard warning conditions with diagnostics about unusual conditions such as zones with population but no households (prisons) or minor problems (illogical turn penalties due to a network edit). These types of warnings will not cause the application to terminate, but should be investigated by the user at the conclusion of the model runs. In contrast, the customized fatal warnings developed for the model provide a mechanism to halt the model execution should any of these errors occur. These fatal messages provide a description of the problem encountered. An example of this would be the model processing a link with an invalid facility type. Note that the user can select to halt the execution if these errors are encountered or continue processing by selecting a “Scenario Key” that controls the execution processing under these conditions. The use of scenario keys is described in more detail in Section 6.3. As an example, Figure 10 provides a display of the component report feature within the highway path-building application. It is shown at the bottom of flowchart as the “APP REPORT” file.

Figure 10 – Component Report Feature



It is important to note that these messages represent conditions that can be identified prior the execution of a particular routine or function. However, there are many additional conditions that might cause CUBE to halt execution. If such conditions were to occur, then the model application will halt with a CUBE-generated message identifying the routine that failed and allowing the user to review the particular routine in detail. In these situations, the error messages are provided directly by CUBE and are located in the “RUN SUMMARY” listing file. Figure 11 provides a display of how to access these messages.

Figure 11 – Run Summary Report Feature

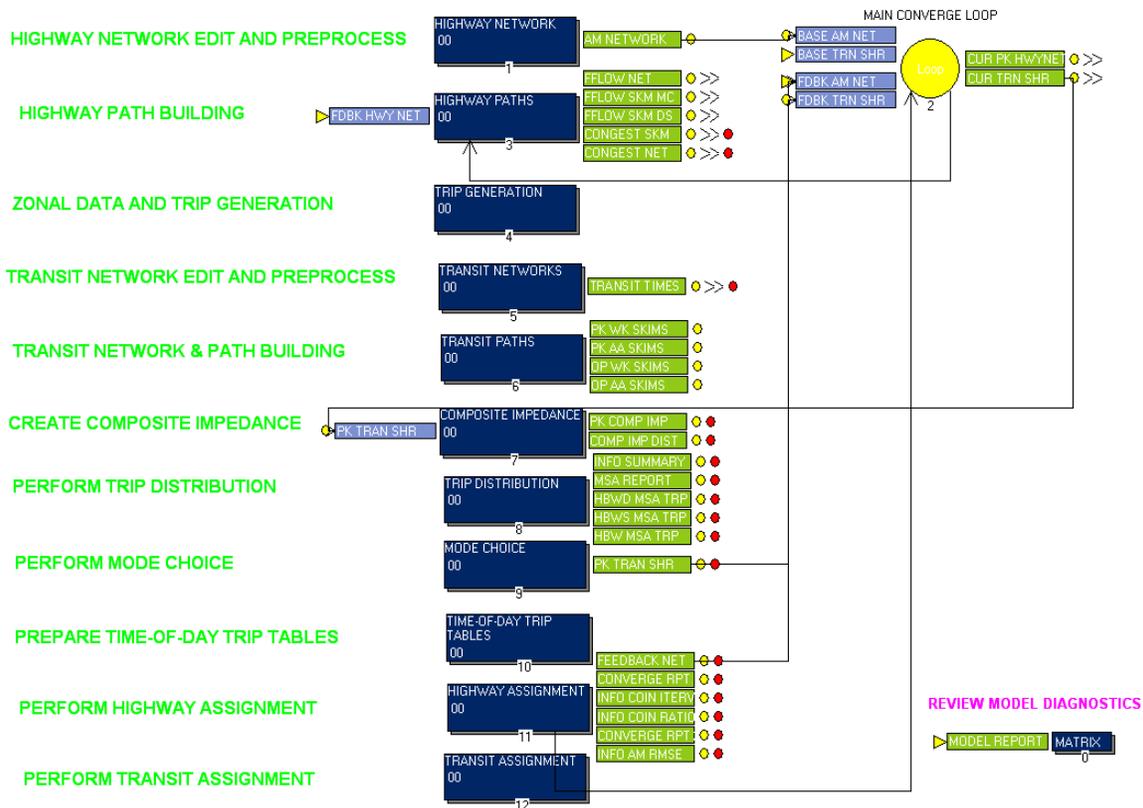


Note that a run summary file is provided for each separate routine within a model component. The user can double-click on each of these files to review a complete summary of all conditions encountered during the execution of the individual routines. Normally, these listing files would be reviewed to determine if other standard information messages or warnings require further analysis.

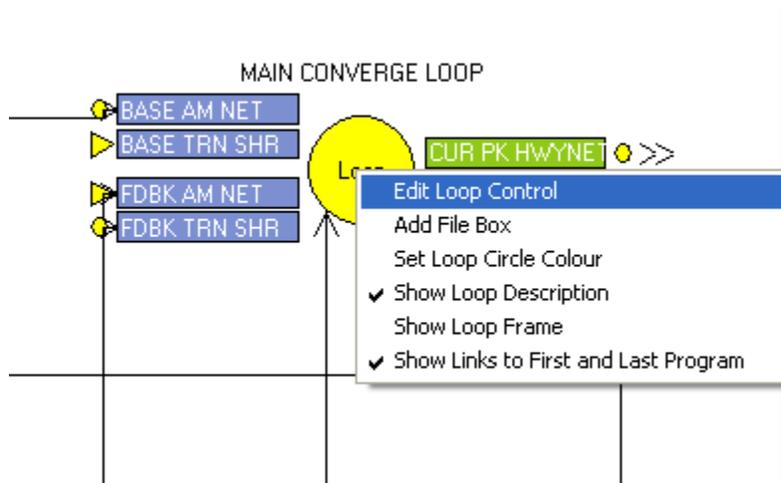
## 5.0 Model Structure Overview

The NJRTM-E (North Jersey Regional Transportation Model Enhanced) contains 12 components or “sub-applications” including a feedback loop control module as displayed in Figure 12. The model is structured as a typical four-step planning process. Component 1 contains the highway network preprocess functions that prepare the highway networks for use in the remaining model components. Component 2 (Main Converge Loop) controls the loop process and the parameters/files used during the loop phase are specified here. By right clicking the yellow Loop circle, these parameters can be viewed and modified if necessary as shown in Figure 13. Components 3 to 11 are executed within the feedback loop process controlled by Component 2. Most of the outputs from Components 3-11 are overwritten by the next iteration of model run. Only the files denoted as “Iteration Specific Files” are saved by iteration. The final component (Component 12) performs the transit assignment and is performed after the feedback process has been terminated. The Voyager MATRIX function at the right-bottom corner is a stand-alone, non-executable function enabling the user to review the complete set of model diagnostics from a full model run. The user can view the file simply by double clicking the green “Model Report” file. Messages for both warnings and fatal conditions from the entire model run by iteration can be viewed in this report.

Figure 12 – NJRTM-E Application



**Figure 13 - Loop Properties**



Note that the typical application of the NJRTM-E would not require any modifications to the main convergence loop control. The model will terminate automatically if the convergence criteria are achieved or if the model processes the maximum number of iterations permitted by the user.

The remaining sections of this discussion provide a description of the model elements in each sub-application. Note that the model elements themselves are partially documented directly by the adjacent comments in each flowchart display. Furthermore, each Voyager routine contains additional comments as part of the scripted controls. The users can obtain additional information from review of these files and CUBE Voyager documentation provided by Citilabs as well as the “help” functions provided directly in CUBE.

Note that these sections provide a general overview of the modeling process to assist the user in understanding of how to access the model data and how to execute the model. The discussion also provides a description of the various support applications that prepare general input files and perform typical output-related tasks. The user can also review additional documentation from the Model Development Report to help further understand the structure and application of the NJRTM-E.

### 5.1 Highway Network Component

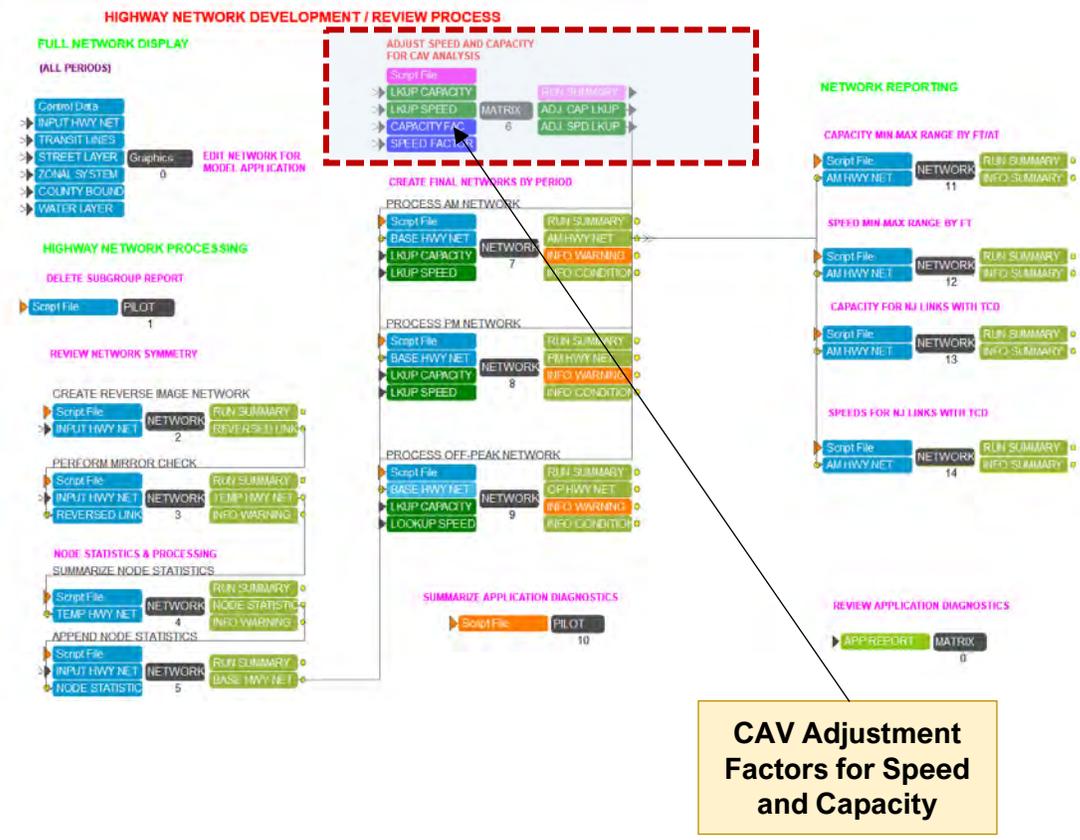
This component, as shown in Figure 14, processes the single base network and generates three input networks for the four time periods (AM, MD, PM, NT) with mid-day and night sharing a common off-peak network. Node statistics including number of approach links, number of exit links, facility type of node-related links, etc., are generated. Link statistics including speed, capacity, free flow time, traffic signal related delay, etc., are developed. System-wide summaries of speed and capacity by FT (Facility Type) and AT (Area Type) are also provided for review.

This model component precedes the full model feedback loop process, serving the purpose of highway network initialization and therefore, is executed only once. The Voyager routines denoted in the grey boxes are executed in the numerical sequence using the numbers at the bottom of each routine. Note that there are several non-executable routines (denoted by 0). These functions can only be executed manually by the user. The first is the “Graphics” box which provides a window to edit the network. The final MATRIX routine at the lower right-hand corner of the flowchart provides a mechanism to list the application report file so that a user may directly access the report

by double-clicking on the green file APP REPORT). More information about model execution is provided in Section 6 later in this document.

As previously mentioned in the Introduction Chapter, the model is equipped with the ability to make adjustments to capture known or anticipated changes in travel behavior subsequent to the model validation. In the highway submodel, the NJRTM-E includes the ability to adjust for capacity and speed which account for the supply side of the travel demand model. The model includes lookup tables allowing the user to vary the roadway performance by roadway type as well as area type. Figure 14 shows the location of these lookup tables. Figure 15 shows an example of these adjustment lookup tables for speed and capacity. The tables are currently population with values of ones “1” (no changes) but can be adjusted in the future as needed.

Figure 14 – Highway Network Development Application



**Figure 15 – Speed and Capacity Adjustment Factors**

FT	AT1	AT2	AT3	AT4	AT5	AT6
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Note:

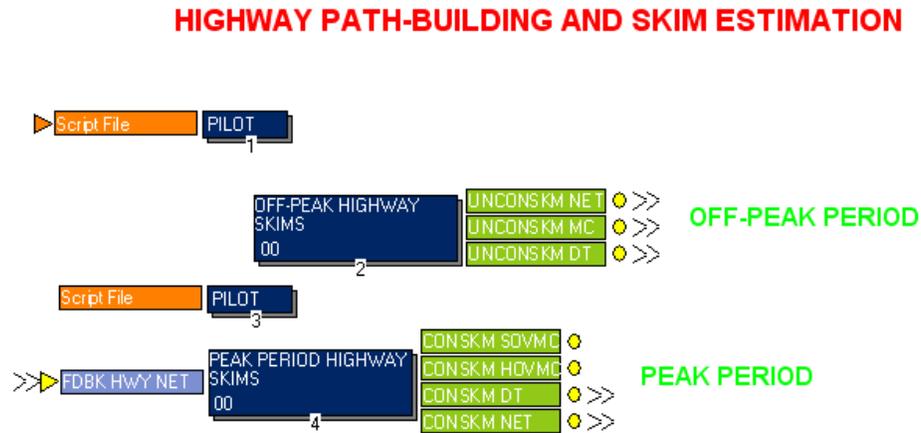
FT = Facility Type (for definition see: Model Development Manual)

AT=Area Type, only 4 area types are used in the highway network

### 5.2 Highway Path-Building Component.

This component performs the path-building and skim estimation functions for the highway network. Both peak and off-peak skims are developed here. In addition to the skims for trip distribution, a separate set of skims are specifically prepared for mode choice model as mode choice model utilizes a slightly different concept for skim. The feedback loop process only includes peak period conditions and therefore, the off-peak path building is only performed during the first iteration. Figure 16 displays the application.

**Figure 16 – Highway Path-Building and Skim Estimation Application**



Note that both off-peak and peak highway skims are generated in this sub-application. The execution order of each function denotes the order of program execution. Step 1 is a condition checking step. If the first model iteration is being processed, or if the model is being executed in a step-wise process by the user, skims will be developed for off-peak period. Otherwise the off-peak skim estimation (Routine 2) is skipped. The individual routines for peak and off-peak period skim estimation are shown on the following pages.

Figure 17 displays the sub-application for the generation of off-peak skims. Off-peak skims required for trip distribution and the adopted NJT mode choice model are estimated in this sub-application. Using a time-based minimum path-building process, path-tracing, uncongested travel time, distance, toll, parking cost and terminal time, etc. are generated for each origin-destination (or “i-j”) interchange for SOVs, HOVs and Trucks respectively. The last non-executable MATRIX step provides access to the application report.

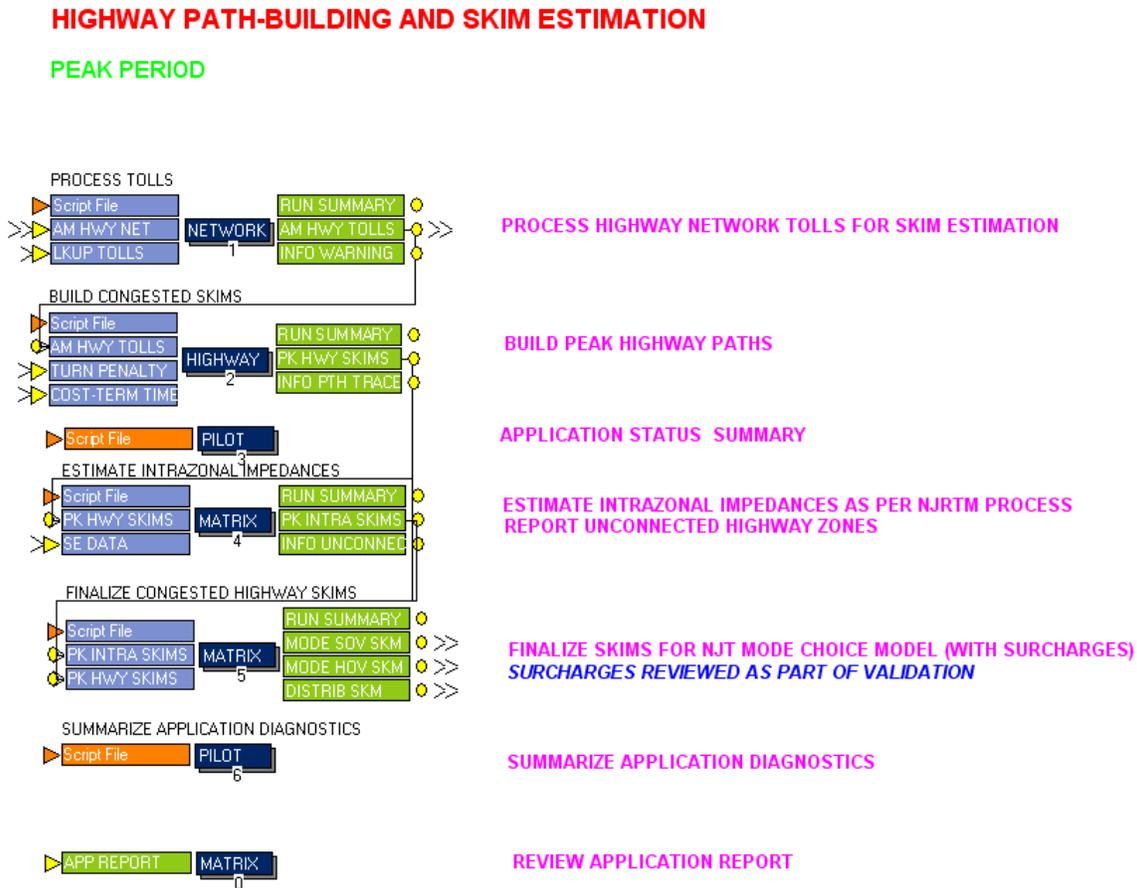
**Figure 17 – Off-Peak Highway Skim Estimation**

**HIGHWAY PATH-BUILDING AND SKIM ESTIMATION**  
**OFF PEAK PERIOD**



Figure 18 displays the sub-application for the generation of peak highway skims. Peak skims required for trip distribution and the adopted NJT mode choice model are estimated in this sub-application. Using a time-based minimum path-building process, path-tracing, congested travel time, distance, toll, parking cost and terminal time, etc. are generated for each origin-destination (or “i-j”) interchange or SOVs, HOVs and Trucks respectively.

Figure 18 – Peak Highway Skim Estimation



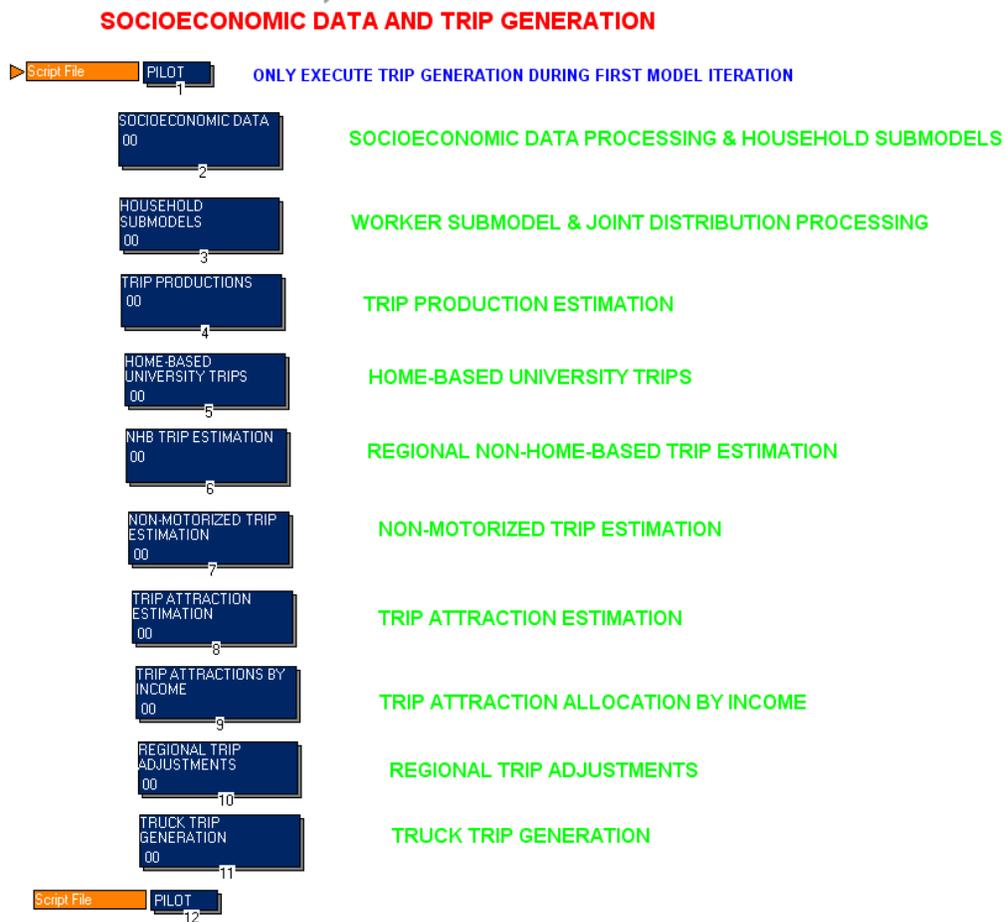
### 5.3 Trip Generation Component

Trip productions and attractions by trip purpose by income group are generated at the zonal level in this component. There are seven main trip purposes in this model:

1. HBWD (Home-based-work-direct)
2. HBWS (Home-based-work-strategic)
3. HBSH (Home-based-shop)
4. HBO (Home-based-other)
5. HBU (Home-based-university)
6. WBO (Work-based-other)
7. NHNW (Non-home-non-work)

Within this component several submodels are utilized as shown in Figure 19, including a household sub-model to stratify households by different characteristics such as number of workers, household size, household income group, and household lifecycle group. Trip production rates from household survey are applied to generate trip productions. Non-motorized trip productions are removed from the total productions. A special trip generator is designed and developed for HBU trip purpose. Trip attractions are then estimated for each purpose based on survey. As a final step in the person trip end estimation, regional trips are adjusted for the modeled area and balanced. The final model component performs the truck trip generation model which was based on the New Jersey Statewide Model truck estimation methodology.

**Figure 19 – Trip Generation Sub-Application**



As the initial step in the trip generation component, the socioeconomic data is processed as shown in Figure 20. In this sub-application, zonal socioeconomic information is automatically reviewed and any illogical conditions are identified. Households are stratified at a one-dimensional level by three key dimensions: household size, income group and life cycle group. This one-dimensional stratification of households serves as controls for the following household sub-models.

Figure 20 – Socioeconomic Data Processing

**SOCIOECONOMIC DATA PROCESSING**



Figure 21 provides a display of the Household Joint Distribution Submodel Application. In this application, households in each zone are first stratified into 90 categories by Life Cycle Group, Income Group and Household Size jointly, and then stratified into 60 categories by Life Cycle Group, Income Group and Number of Workers jointly. These two joint distributions are normalized against regional controls as well. This stratification, together with the trip production rates from the survey for each group by trip purpose, will generate trip productions for each zone. The 60-category household stratification is used to generate trip productions for home-based work purposes (Home-Based-Work-Direct and Home-Based-Work-Strategic). The 90-category household stratification is used for other trip purposes (Home-Based Shop, Home-Based University, Home-Based Other, Work-Based-Other, Non-Home-Non-Work). In Figure 22, the trip production models are applied. This includes the estimation of trips for home-based-work purposes in each of the 60 category households by zone, and trips of other trip purposes in each of the 90 category households by each zone. Trip productions are then aggregated into 15 categories (3 Life Cycles \* 5 Income Groups) by trip purpose. This application is a typical cross-classification process.

Figure 21 – Household Joint Distribution Submodel Application

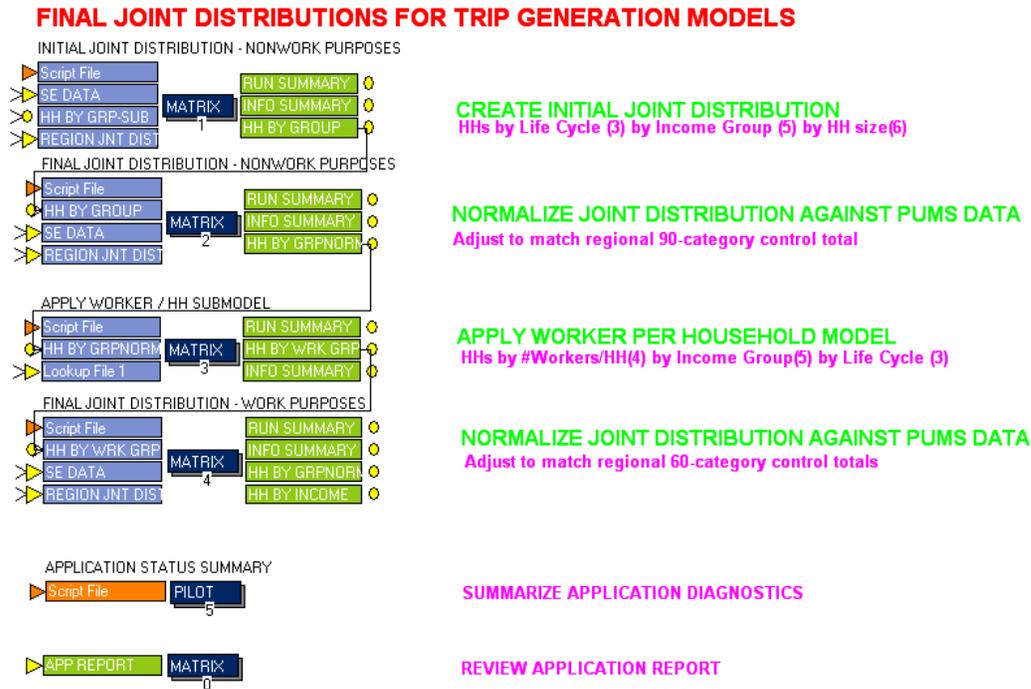


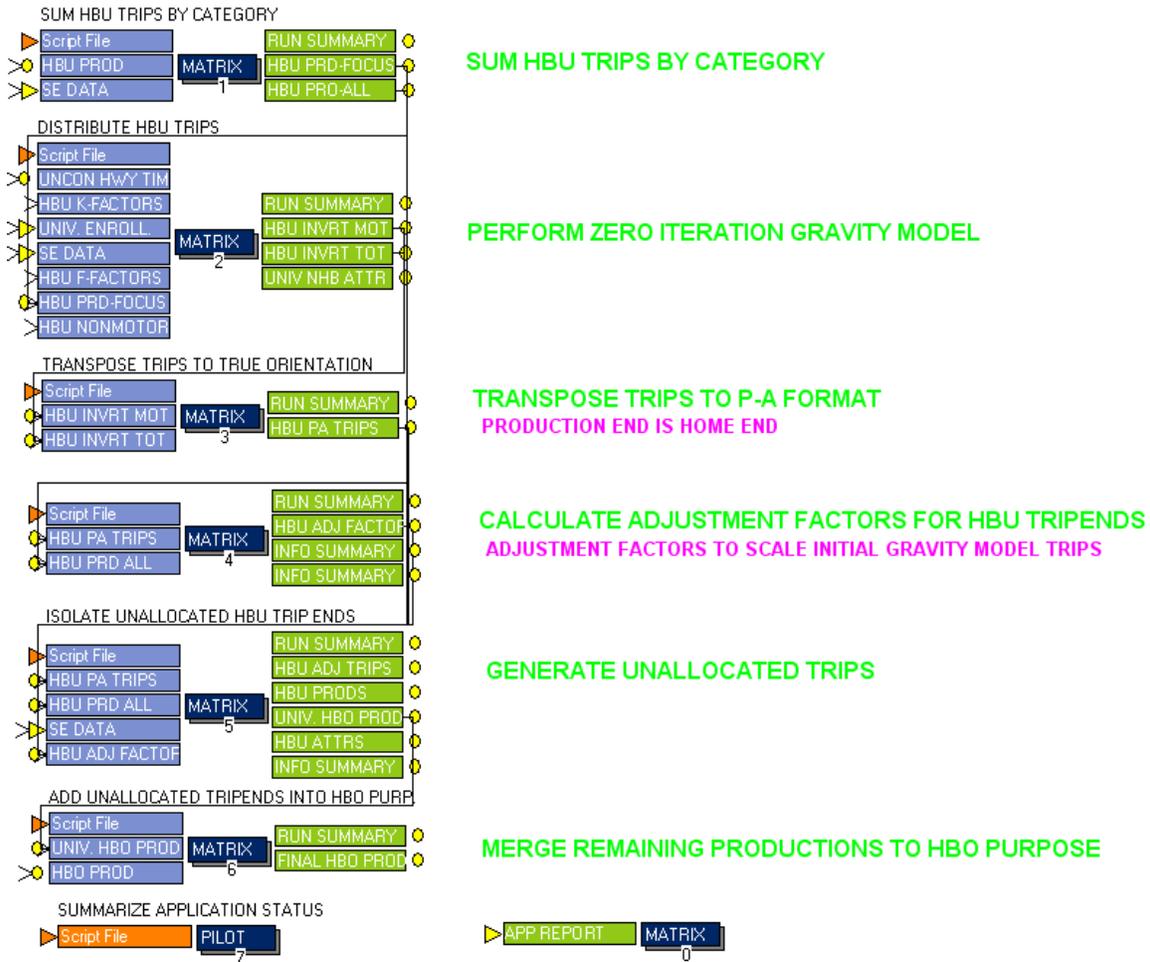
Figure 22 – Trip Production Application



Figure 23 depicts the home-based university (HBU) trip generation submodel. Due to the limited nature of observations available for the HBU trip purpose, a special trip generation process was developed for the HBU trips. University enrollment data is utilized to develop trip attractions and a zero-iteration gravity model is applied to distribute trips treating the “university” end as the production end and “home” end as the attraction end. The resulting trip table is transposed back to P-A format and adjusted based on the cross-classification HBU productions. Non-motorized trips are removed from the total trips in this process as well. Any unallocated trip productions (the remaining productions after subtracting the resulting productions from the cross-classification productions) are merged back to HBO purpose.

Figure 23 – Home-Based University Submodel Application

**HOME-BASED UNIVERSITY SUBMODEL**



The sub-applications for estimating non-home-based trip ends and non-motorized trip productions are displayed in Figure 24 and Figure 25 respectively. Since non-home-based trips are not related to the home end, trip ends at either trip origins or destinations are estimated here by regression equations related to employment and other variables.

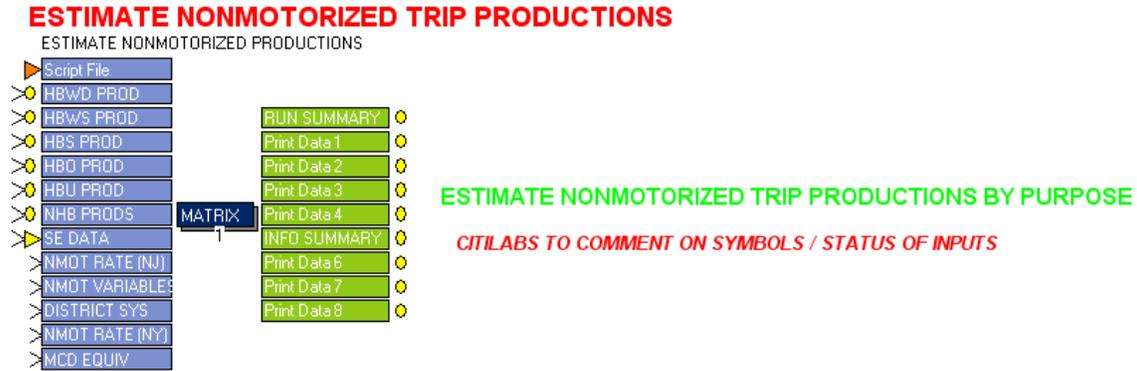
Figure 24 – Non-Home-Based Trip Estimation Application

**ESTIMATE NON-HOME-BASED TRIP ENDS BY PURPOSE**



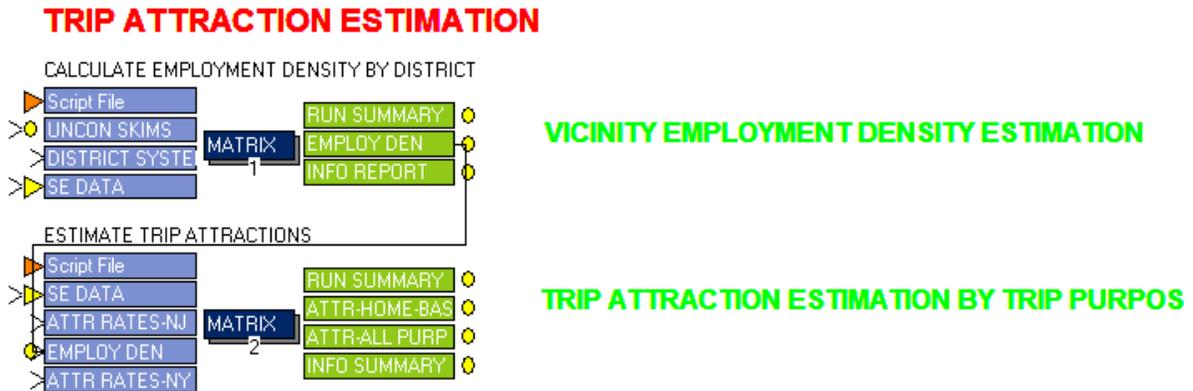
Non-motorized trip productions are estimated in this sub-application using a logit-based choice model. During the calculations, the non-motorized productions are removed from total productions, thereby providing motorized productions as the final estimates. A series of summary statistics for the NJTPA region are generated for review.

**Figure 25 – Non-Motorized Trip Estimation Application**



The sub-applications for estimating trip attractions and stratifying the attractions by income are displayed in Figure 26 and Figure 27 respectively. Employment density, which is used in the attraction estimation process, is calculated in the initial step and trip attractions for each purpose are then estimated using linear regression.

**Figure 26 – Trip Attraction Estimation Application**



Trip attractions are stratified by income group in this sub-application. For home-based-work purposes, the 2010 census distribution was used for the stratification. For home-based-shop and home-based-other purposes, a regression approach is applied utilizing production accessibility. The stratification by income group for non-home-based trip purposes is based on the distribution of attractions by income group for home-based trip purposes.

**Figure 27 – Attraction Stratification by Income Application**

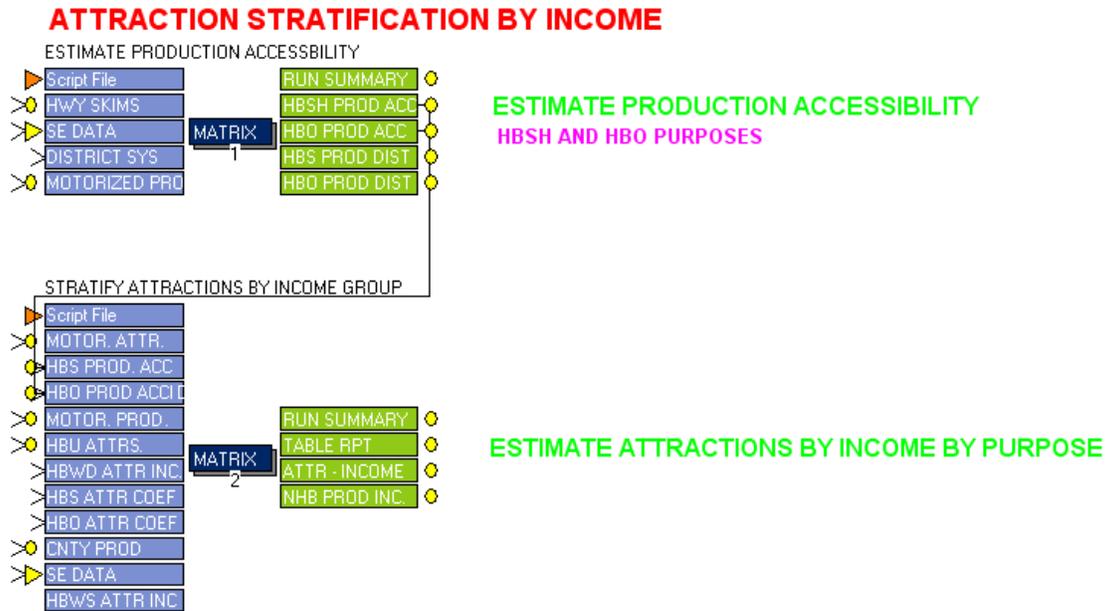


Figure 28 provides a display of the Regional Trip Control Totals Application. Since the NJRTM-E does not contain a typical externally-related trip estimation process, it is necessary to adjust the number of trips produced by and attracted to the buffer area counties surrounding the NJTPA region. Since some of the trip productions and attractions generated in this buffer region would be attracted to or produced by adjacent areas beyond the modeled region, the initial estimates are scaled here to the model area based on information gathered from LEHD (Longitudinal Employer-Household Dynamics) data and other sources. And as productions and attractions are generated separately and thus do not necessarily have the same totals by trip purpose by income group, trip attraction is also scaled so as to match trip production totals.

This application includes the ability to adjust the number of trips by purpose and income to account for any current or anticipated changes to trip-making (e.g., lower work trips due to increased work from home). Figure 29 shows the adjustment factor table in the NJRTM-E. This table is currently populated with adjustment factors equal to one (1.0000) to assume no changes to trips. These adjustment factors are included in the final step of the trip generation module prior to the balancing of trip production and trip attraction.

Figure 28 – Regional Trip Control Totals Application



**CONTROL REGIONAL PRODUCTIONS AND ATTRACTIONS FOR BOUNDARY CONDITIONS**

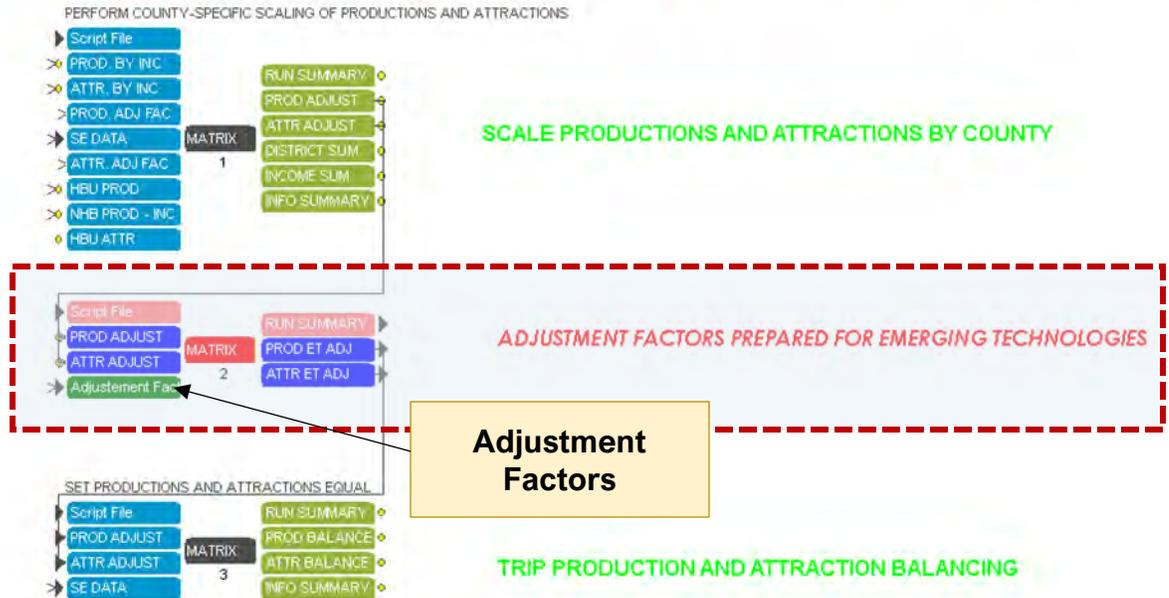


Figure 29 – Adjustment Factors for the NJRTM-E Trip Generation

PURP	INC1	INC2	INC3	INC4	INC5
1	1.0000	1.0000	1.0000	1.0000	1.0000
2	1.0000	1.0000	1.0000	1.0000	1.0000
3	1.0000	1.0000	1.0000	1.0000	1.0000
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000

**Note:**

- Purpose: 1 = HBWD                      4 = HBO  
 2 = HBWS                              5 = NHBW  
 3 = HBS                                 6 = NHBO

The truck trip generation process in the New Jersey Statewide Model was adopted for the NJRTM-E. Figure 30 provides a display of the three sub-applications developed for this process. These sub-applications control the trip generation estimation, which has been separated into an external-external component, an external-internal component, and an internal trip estimation component.

Figure 30 – Truck Trip Generation Submodel Application

**TRUCK TRIP GENERATION SUBMODEL**



External truck trip ends are estimated in the sub-application displayed in Figure 31. Total trip ends by truck type by segment (standard, terminal related, warehouse related, industrial-employment related, and special generator related) are estimated. Commercial vehicle trip ends are also estimated in this sub-application.

Figure 31 – External Truck Trip Estimation Application

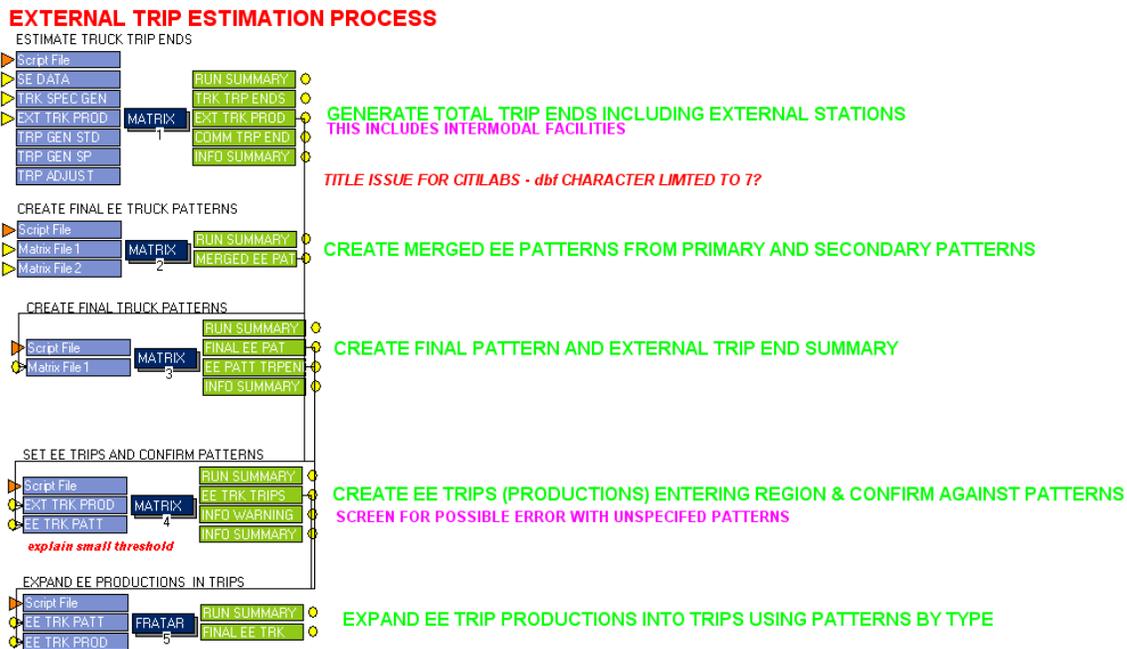
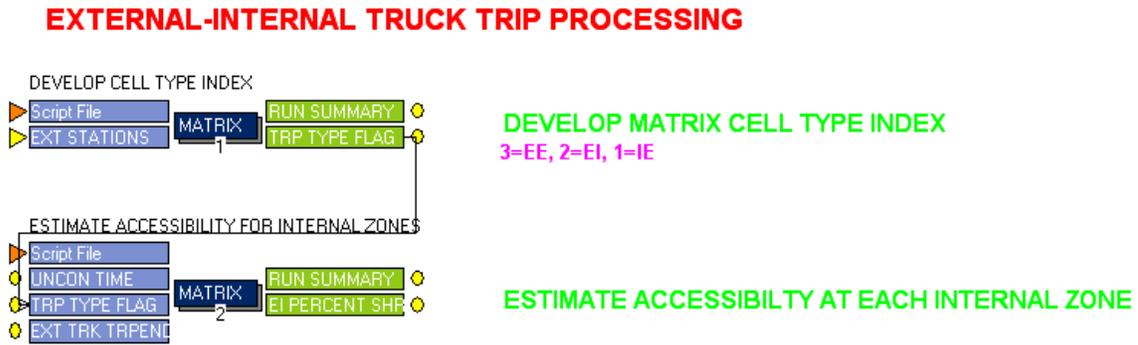


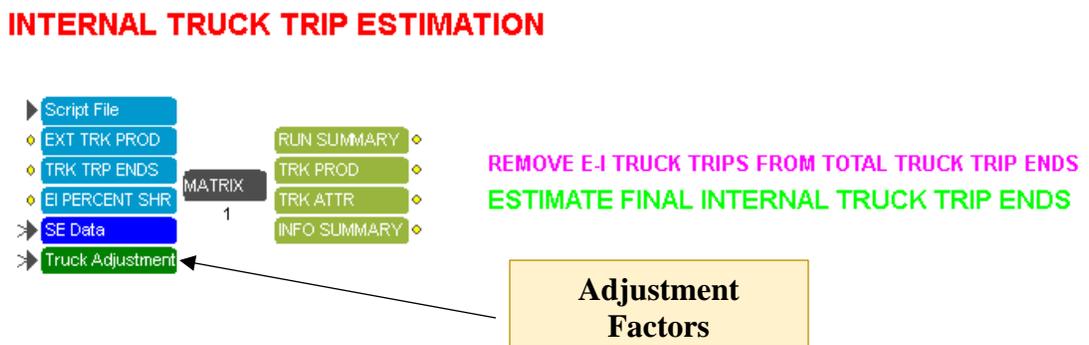
Figure 32 depicts the external-internal truck trip processing sub-application. In order to estimate the number of external-internal truck trips, this application estimates the accessibility of each internal zone to the external region “gateway zones” of the NJRTM-E. Using the accessibility at each internal zone, the number of external-internal trip truck trip ends is estimated in the following step as part of the final internal trip estimation.

**Figure 32 – External-Internal Truck Trip Processing Application**



The final internal truck trip ends are estimated the Internal Truck Trip Estimation Application, as shown in Figure 33. As part of this processing, three subcategories of external-internal truck trips (external-internal highway, external-internal intermodal and external-internal-external) are also estimated. This portion of the model also includes a lookup table containing adjustment factors by truck type (medium and heavy) and by area type. This allows the user to adjust for the number of truck trips due to current or anticipated changes to truck travel behavior (e.g., increased activity due to increased home deliveries). The same factors are applied to both truck production and attraction. Figure 34 shows the table with these adjustment factors. This lookup table is included in the final step of truck generation model component as shown in Figure 33.

**Figure 33 – Internal Truck Trip Processing Application**



**Figure 34 – Adjustment Factors for the NJRTM-E Truck Generation**

TYPE	AT1	AT2	AT3	AT4
1	1.0000	1.0000	1.0000	1.0000
2	1.0000	1.0000	1.0000	1.0000

Note:

Type 1 = Medium Truck

Type 2 = Heavy Truck

AT1 = CBD

AT2 = Urban

AT3 = Suburban

AT4 = Rural

### 5.4 Transit Network Component

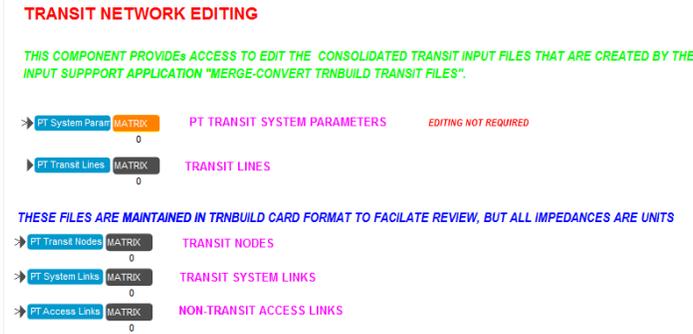
Figure 35 displays the main application that prepares input for the transit network. The first group is manually executed (if necessary) in order to update the non-transit access coding, transit links and nodes system, and transit route alignments. This sub-application provides the user with a method to access standard ASCII card decks in preparation for execution with Public Transport (PT) routine. Note that the ASCII cards are in a format similar to TRNBUILD, but the impedance terms are converted to unit values rather than hundredths. Prior to estimating transit skims, the last three sub-applications prepare the access connections and estimate transit run times for highway-based transit routes, primarily buses.

**Figure 35 – Transit Network Editing and Preparation Application**



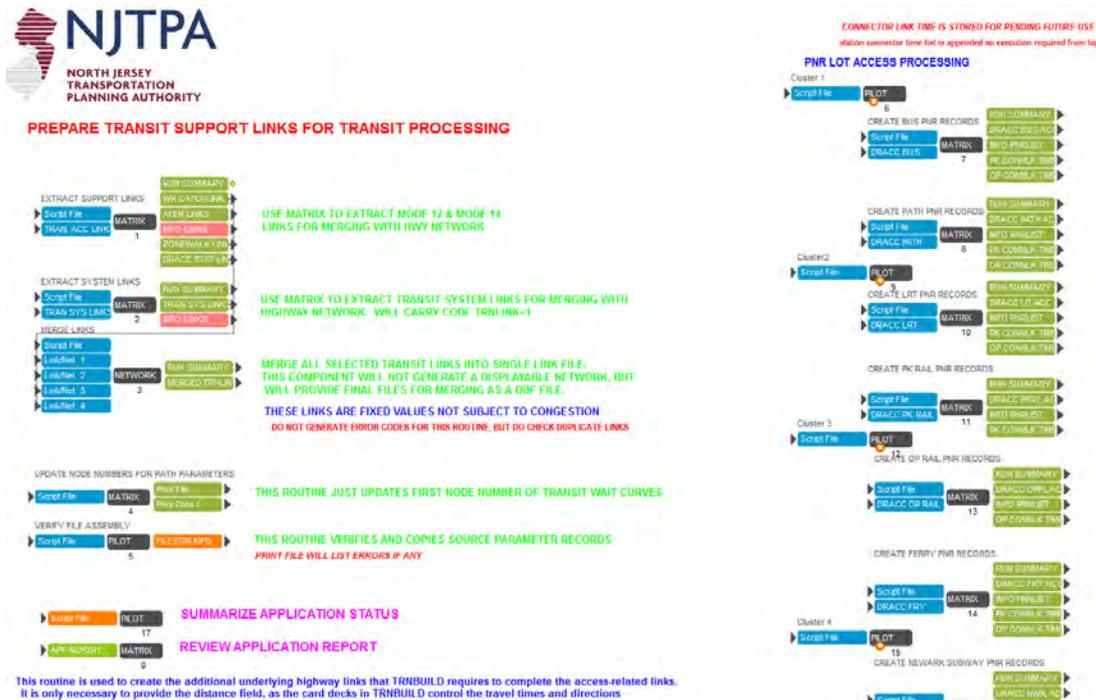
The first sub-application shown in Figure 36 permits the editing of all transit lines, transit access connections, and exclusive guideway links. This includes additional nodes and links by transit service mode used by transit lines but not included in the baseline highway network. The routine displays the non-transit access links which include walk and drive-access/transfer links and Park-and-Ride specifications.

Figure 36 – Transit Network Editing Application



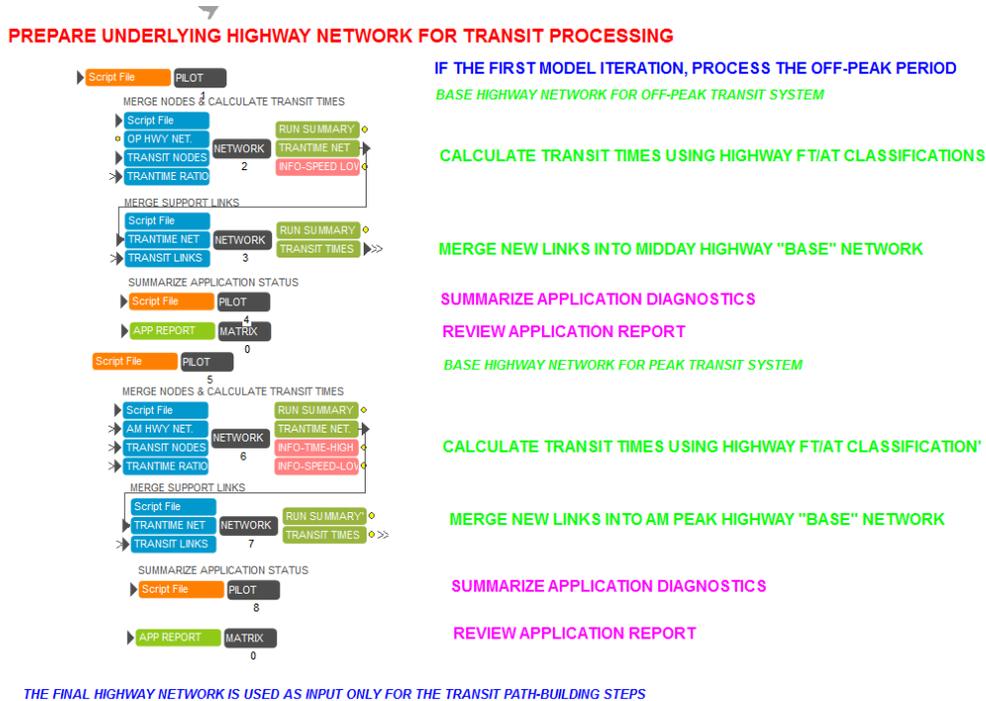
In the second sub-application, selected nodes and support links are processed prior to the creation of the final transit networks developed in the transit path building component. These links and nodes are retrieved from the node files and access/transit link files. These selected links and nodes will be merged with the baseline highway network in the final sub-application to provide a final baseline network for use as the input network for the creation of transit networks. Figure 37 displays this sub-application. PNR lot access links are also created in this step.

Figure 37 – Transit Support Links Application



The third sub-application merges the added transit nodes and links and then estimates the transit run times by factoring corresponding auto travel time by FT/AT (Facility Type / Area Type). This application is controlled by model iteration so that the off-peak period transit times are calculated only once, whereas the peak period times are calculated for each model iteration. Figure 38 provides a display of this sub-application.

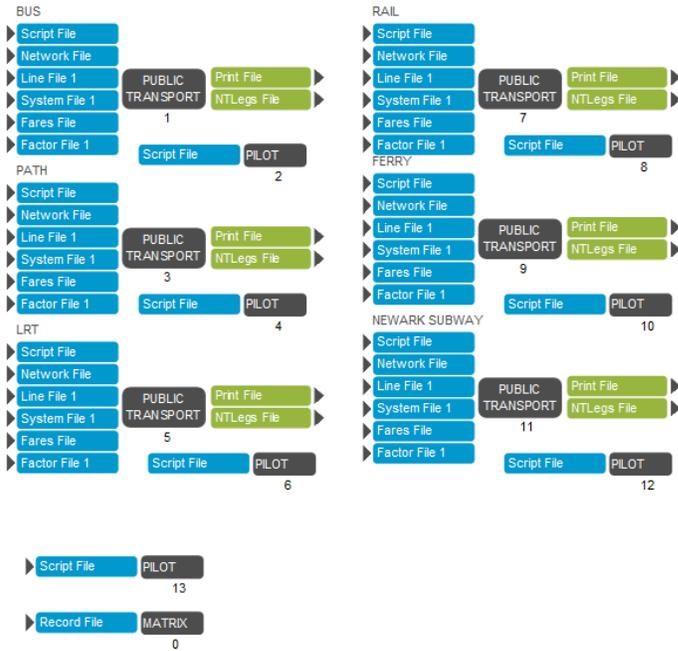
**Figure 38 – Transit Network Editing and Preparation Application**



The final two applications will generate the drive-access “legs” by transit mode for both peak and off-peak periods. The drive-access legs are used in the transit path building process and transit assignment module. Figure 39 shows the peak and off-peak applications.

**Figure 39 – Generate Drive Access Legs Application**

**PEAK PERIOD - GENERATE DRIVE ACCESS NON-TRANSIT LEGS FILES BY LINE HAUL MODE**



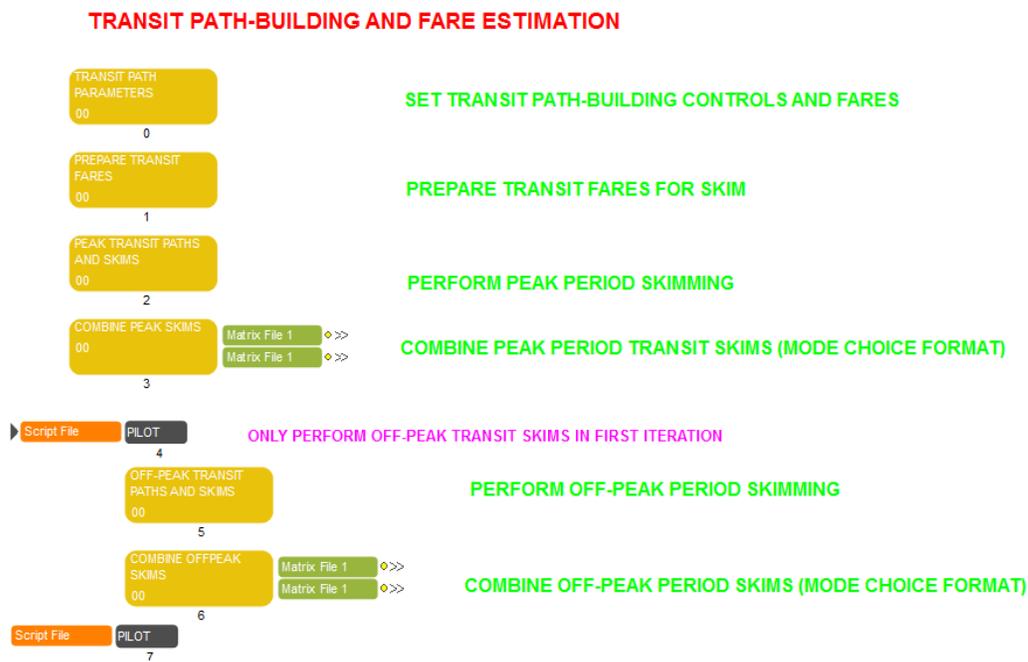
**OFF PEAK PERIOD - GENERATE DRIVE ACCESS LEGS BY LINE HAUL MODE**



## 5.5 Transit Path-Building and Skim Estimation Component

Figure 40 displays the application used to develop transit paths and fares. This application contains several sub applications that perform various elements of the process. Transit paths are built and transit fares are estimated for both peak and off-peak period for each combination of transit “line-haul” modes (Bus, Rail, PATH, LRT, Ferry, and Long Haul Ferry) and transit access sub-modes (walk access and drive access). Skims of total in-vehicle time, total wait time, walk time, in-vehicle time by transit mode, drive time, first and last station, initial wait time, transit distance, and number of transfers are estimated for all origin-destination interchanges. Users can view and specify the parameters that control the path-building process and fares as part of the first sub-application.

**Figure 40 – Transit Path-Building and Fare Estimation Application**



The first sub-application that contains transit path-building parameters and transit fares controls is displayed in Figure 41. The path-building parameters are provided for all transit modes, transit access sub-modes and time periods. These parameters include controls for generating zone walk access and park-and-ride drive access as well as other parameters for weighing various modes along the transit path and controls for transfers between modes. It should be noted that most of the parameters for path-building would not be changed during the course of typical analysis, but rather only as part of a recalibration of the model. For that reason, as shown in Figure 41a, these control files are displayed in orange boxes and include guidance indicating that they should not be modified. In contrast, the transit fare parameters listed on the right-hand side of the application are available for editing and it is assumed that these values might be adjusted as part of various scenarios. The second sub-application within the transit path-building component is displayed in Figure 41b. This application will convert fare matrix in I-J FZ DBF format into CUBE matrix, and create networks with fare zones for peak and off-peak periods.

**Figure 41 – Transit Path-Building and Fare Estimation Application**

**(b) Transit Path Parameters Application**

**TRANSIT PATH-BUILDING PARAMETERS AND FARES**

**COMMON AND MODE-SPECIFIC PARAMETERS**

*(DO NOT MODIFY)*

Common Parameters MATRIX 0

**COMMON PATH PARAMETERS**

**WALK ACCESS PARAMETERS**

Bus Parameters MATRIX 0

Rail Parameters MATRIX 0

PATH Parameters MATRIX 0

LRT Parameters MATRIX 0

Ferry Parameters MATRIX 0

LH Ferry Paramet MATRIX 0

**DRIVE ACCESS PARAMETERS**

Bus Parameters MATRIX 0

Rail Parameters MATRIX 0

PATH Parameters MATRIX 0

LRT Parameters MATRIX 0

Ferry Parameters MATRIX 0

LH Ferry Paramet MATRIX 0

**TRANSIT FARES**

Usage Fares MATRIX NJTPK SURCHARGE 0

Bus Fares MATRIX 0

Exp Bus Fares MATRIX 0

Special Fares MATRIX 0

Part-Ride Fares MATRIX PARKING COSTS (DAILY) 0

**PERIOD-SPECIFIC FARE CONTROLS BY MODE**

**PEAK PERIOD**

Rail Fares MATRIX 0

PATH Fares MATRIX 0

LRT Fares MATRIX 0

Nwk Subway Fa MATRIX 0

Ferry Fares MATRIX 0

**OFF PEAK PERIOD**

Rail Fares MATRIX 0

PATH Fares MATRIX 0

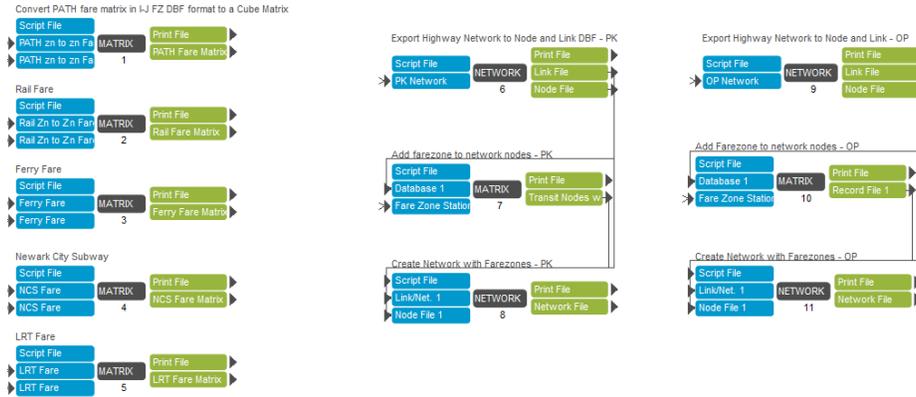
LRT Fares MATRIX 0

Nwk Subway Fa MATRIX 0

Ferry Fares MATRIX 0

(b) Prepare Transit Fares Application

**PREPARE TRANSIT FARE FOR SKIMS**



The third sub-application within the transit path-building component contains 2 specific path-building sub-applications for access submode for the peak period. Figure 42 displays the peak period path-building sub-applications.

**Figure 42 – Transit Path-Building and Fare Estimation Application**

**PEAK PERIOD TRANSIT PATHS AND SKIMS PROCESSING**

**BY LINE-HAUL AND ACCESS MODE**

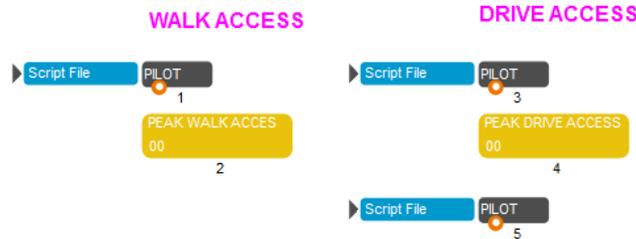


Figure 43 displays the transit path-building process using the PT routine. In this example, the paths for walk access are created and skims are estimated. The procedures for the 12 mode/access combinations are identical although the path-building parameters vary in accordance with the specific modes for which paths are being estimated. Skims of total in-vehicle time, total wait time, walk time, time in vehicle of each type of transit mode, drive time, first and last station, initial wait time, transit distance and number of transfers, etc. are generated for all origin-destination interchanges. In addition, a viewable transit network incorporating access support links are created for review and diagnostic purposes. Transit fares are estimated as well using NJFare2 program.

**Figure 43 – Peak Period Walk Access Transit Path-Building Application**

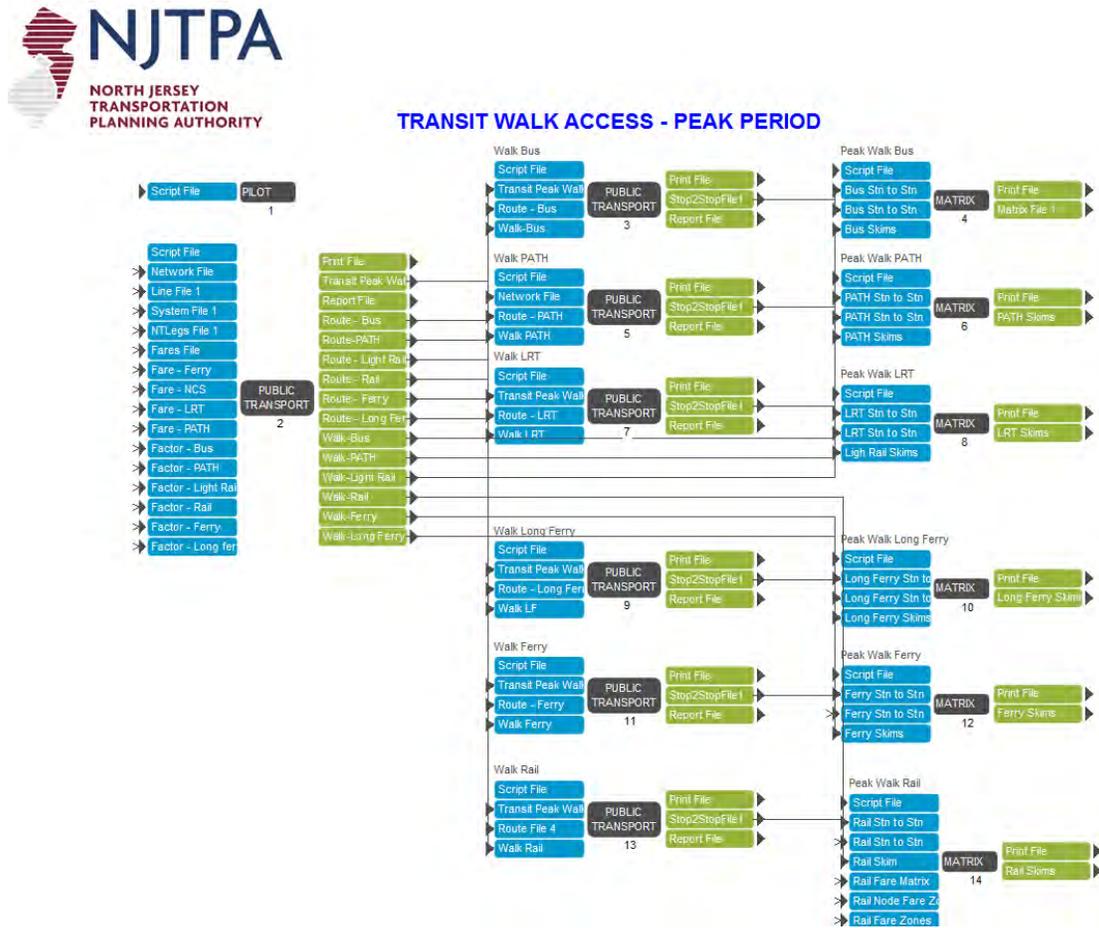


Figure 44 displays the fourth sub-application that merges the transit skims into separate files for use in the mode choice model. The first MATRIX routine combines all the transit skims with the walk-access sub-mode into a single file. Similarly, the second MATRIX routine combines all the transit skims with the auto-access sub-mode into a single file. The combined peak period skims will be used in the composite impedance routine and the mode choice model.

**Figure 44 – Peak Period Transit Skim Combination Application**



Similar to the third sub-application, the fifth sub-application within the transit path-building component contains 2 specific path-building sub-applications for each access submode during the off-peak period. Figure 45 displays these off-peak period path-building sub-applications.

Figure 45– Transit Path-Building and Fare Estimation Application

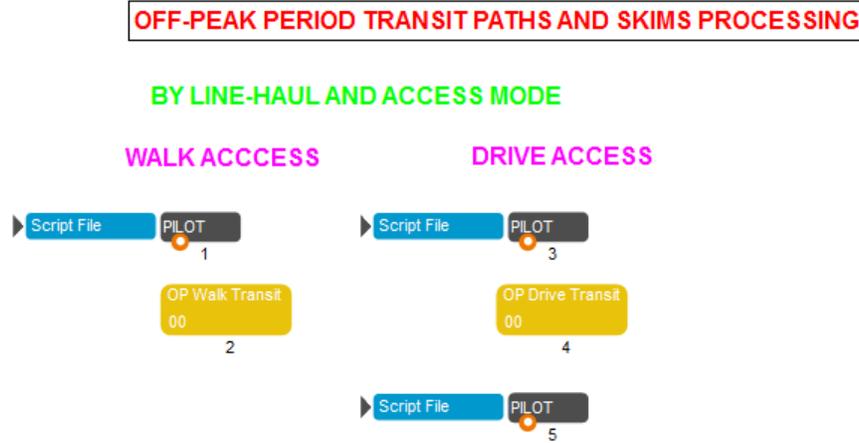


Figure 46 displays the off-peak transit path-building process. The procedures to create paths and skims for the 12 mode/access mode combinations are identical to the peak-period as shown in Figure 40.

Figure 46 – Off-Peak Period Bus-Walk Access Transit Path-Building Application

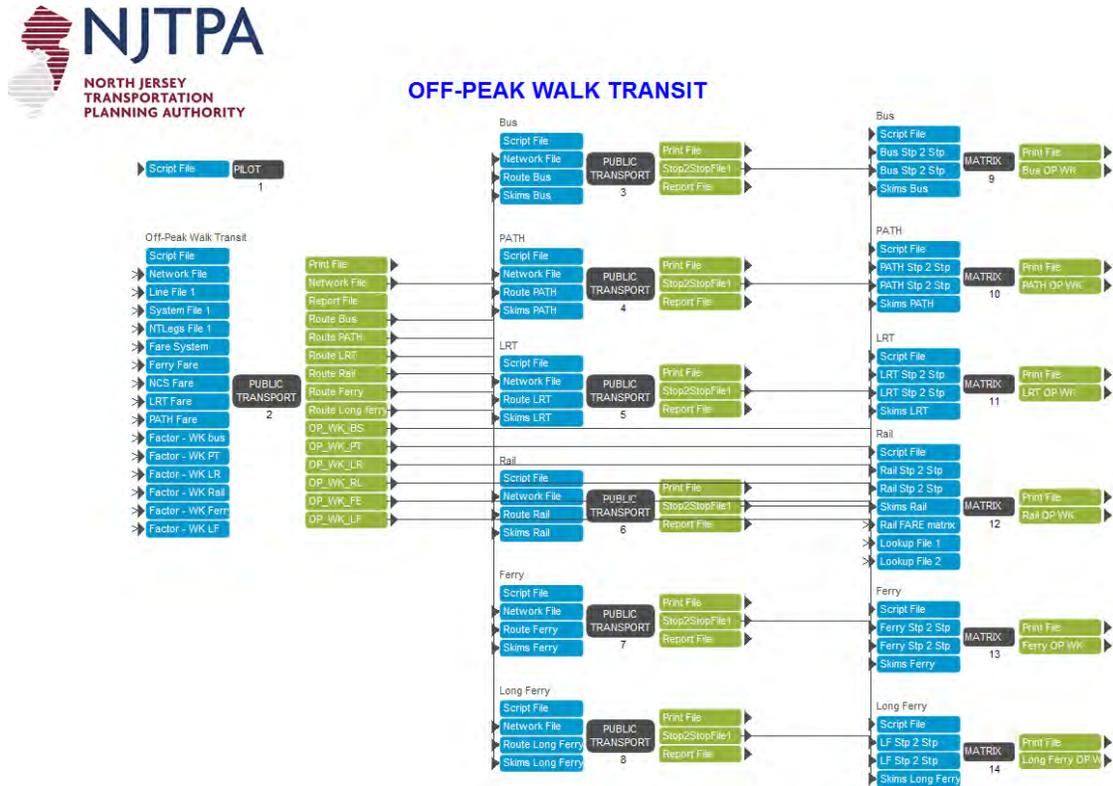


Figure 47 displays the next sub-application that merges the transit skims into separate files for use in the mode choice model. As was the case with the peak period skims in the third sub-application, the first MATRIX routine combines all the transit skims with the walk-access sub-mode into a single file. Similarly, the second MATRIX routine combines all the transit skims with the auto-access sub-mode into a single file. The combined off-peak period skims will be used in the composite impedance routine and the mode choice model.

**Figure 47 – Off Peak Period Transit Skim Combination Application**

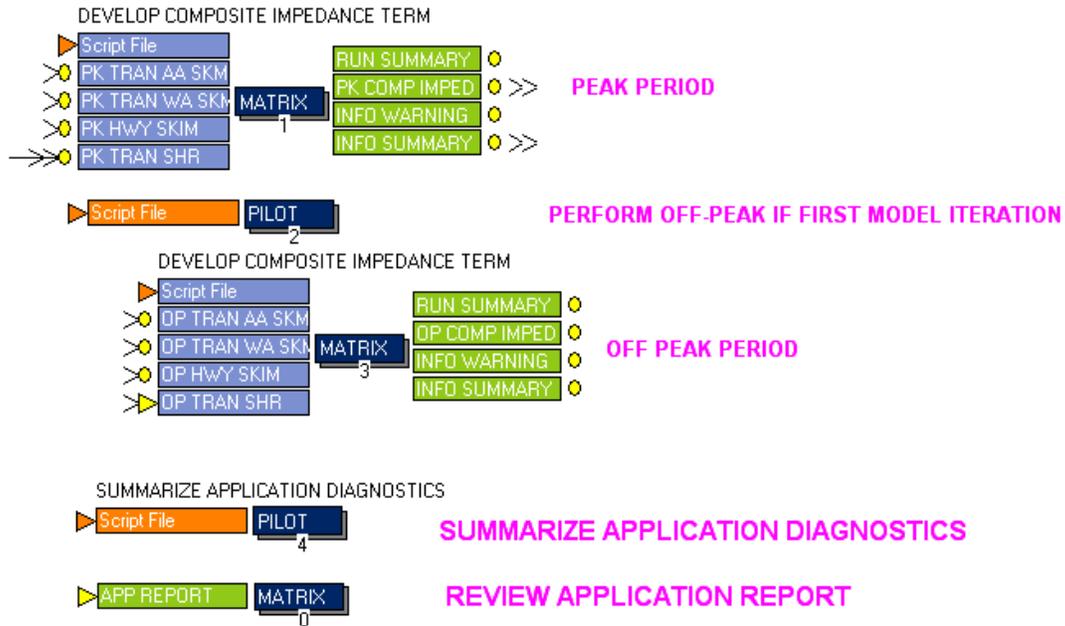


## 5.6 Composite Impedance Component

For the NJRTM-E, trip distribution utilizes a composite impedance term as a measure of spatial separation between zones. For regions with extensive transit service like NJTPA, the composite impedance term provides a better representation of multiple modes serving travel demand. As a consequence, the model is sensitive to not only the highway travel time, but rather a more complete representation of the travel choices and costs between various origin-destination zonal pairs. Note that transit skims and highway skims for both peak and off-peak periods are utilized to develop the composite impedance terms. Figure 48 provides a display of the composite impedance application.

Figure 48 – Composite Impedance Application

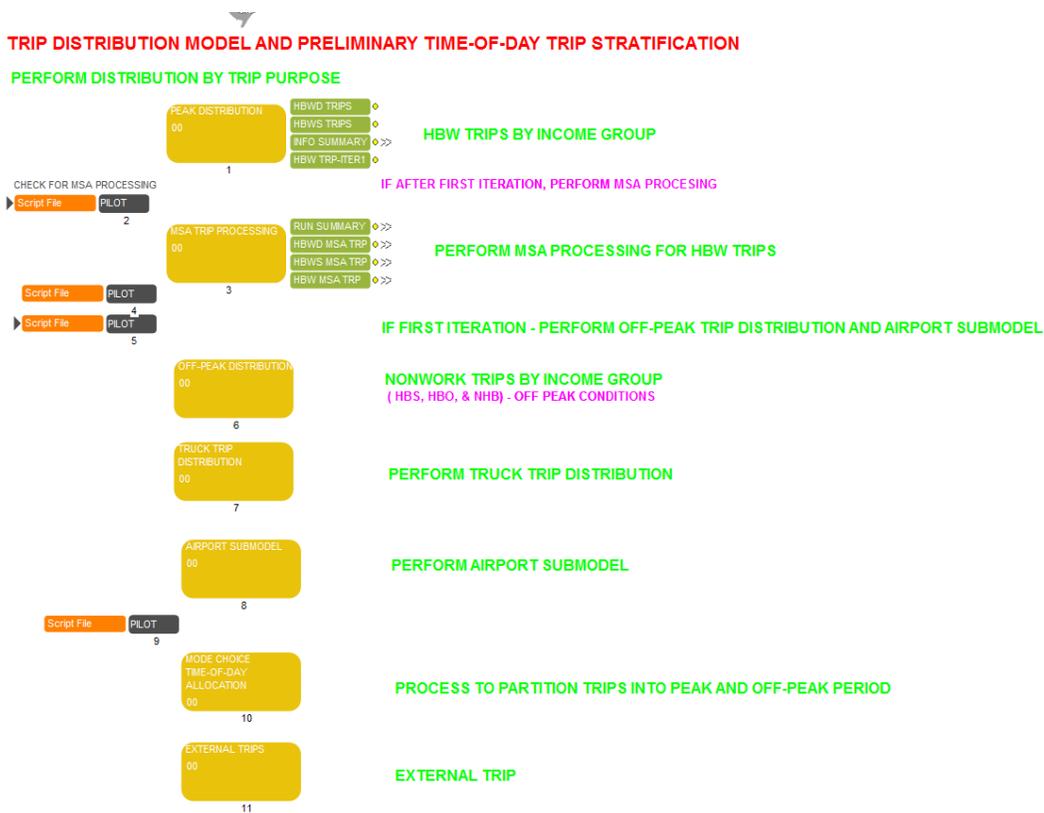
**COMPOSITE IMPEDANCE PROCESS**



## 5.7 Trip Distribution Component

Trip productions and attractions from trip generation are distributed by the application depicted in Figure 49. The distribution is performed by trip purpose and by income group. Since the composite impedance term that is based on peak period travel times is used for home-based-work purposes, the trip distribution of home-based-work purposes will be performed for each iteration. The home-based work trips are created as a weighted estimate of the current and previous iterations using the method of sequential averages (MSA). In contrast, off-peak travel times and costs are used for the distribution of other non-work trip purposes. Trip distribution for these purposes is only executed during at the first iteration. Truck trip distribution as well as airport trip generation/distribution is performed as part of this application. In the next step, trips are combined and partitioned into peak period and off-peak period for mode choice model. As the final step, the new external trip sub-application was added to the trip distribution model. The external trip application includes the external trips from three major locations: (a) the New Jersey Turnpike southern terminus (exit 3 and southward); (b) I-80 western terminus; and (c) I-78 western terminus in Pennsylvania.

Figure 49 – Trip Distribution Application



In the first sub-application of trip distribution, home-based-work trips (HBWD and HBWS) are distributed using peak composite impedance and calibrated friction-factors together with K-factors. The gravity distribution model is performed by trip purpose by income group, as shown in Figure 50. The average trip length is summarized for each trip purpose by income group after the distribution. Also trips for both purposes are combined into a single matrix during the first iteration to provide a base trip matrix for the MSA process discussed previously.

The NJRTM-E includes the ability to adjust the spread of distribution (the willingness to travel longer or shorter). As an example, commuters might be willing to experience longer work trips if autonomous vehicles become prevalent. To provide some variants to the travel spread, adjustment factors for the friction factors are provided for each trip purpose. At present, adjustment factors that follow a linear function is provided with A and B values as illustrated in Figure 51. To increase the speed (and the travel distances, the user can populate the A column with a number <1 and/or increase the B column by a number >1 (to decrease the speed/travel distance, the user work increase the A column and/or lower the B column) This function can be adjusted in the future as the observed data become available. The friction factor adjustment process for peak period, for HBWD and HBWS trip purposes, is shown in Figure 50. The adjustment factor database file contains the A and B for each trip purpose is shown in Figure 52.

Figure 50 – HBW Trip Distribution by Income Application

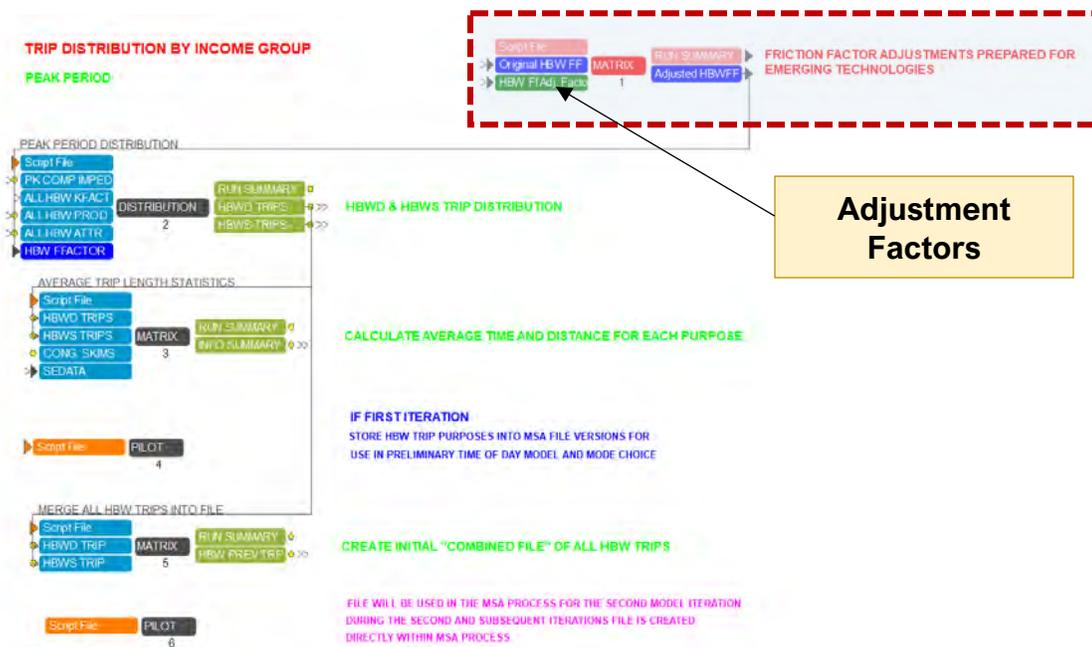


Figure 51 – Adjustment Factors for the Gravity Model’s Friction Factors

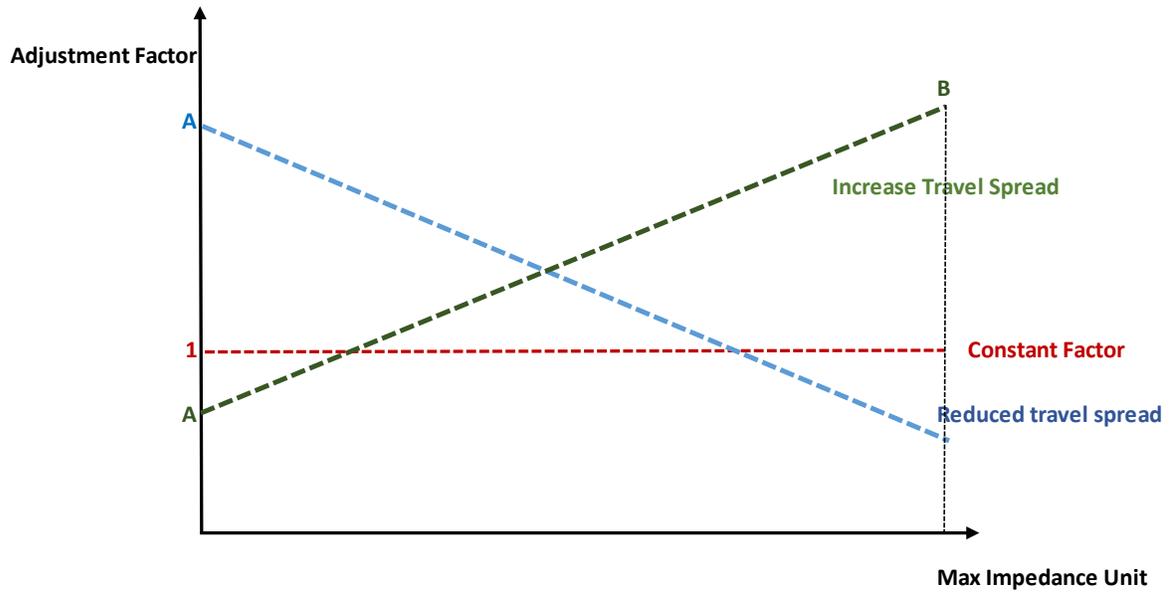


Figure 52 – Friction Factor Adjustment by Trip Purpose

PURP	A	B	DESC
1	1.0000	1.0000	HBWD
2	1.0000	1.0000	HBWS

PURP	A	B	DESC
1	1.0000	1.0000	HBS
2	1.0000	1.0000	HBO
3	1.0000	1.0000	NHBW
4	1.0000	1.0000	NHBO

The sub-application performing the MSA (method of successive averages) is shown in Figure 53. This process is used to develop a weighted matrix of trips distributed to between each origin-destination interchange for home-based-work purposes for each iteration after first iteration.

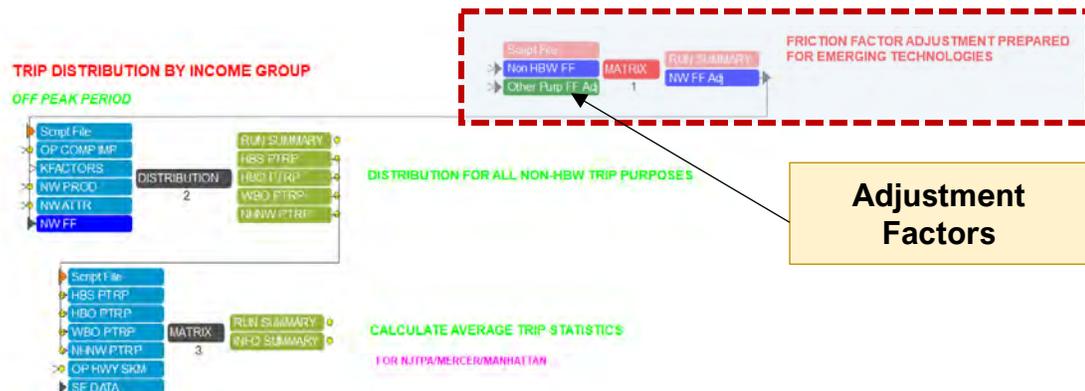
Figure 53 – Method of Sequential Averaging Application

**PERFORM METHOD OF SEQUENTIAL AVERAGING**



Non-home-based-work trips (HBSH, HBO, WBO and NHNW) are distributed using off-peak composite impedance and calibrated friction-factors together with K-factors. Figure 54 provides a display of this sub-application. The gravity distribution model is performed by purpose by income group. In the second routine, the average trip length is summarized for each trip purpose by income group after the distribution. Note that this step will only be executed during the first iteration as off-peak distribution is not subject to the congested travel times. Similar to the peak period trip distribution (see figures 51 and 52), the factor to adjust the distribution spread was also added for non-work trips as shown in Figure 54..

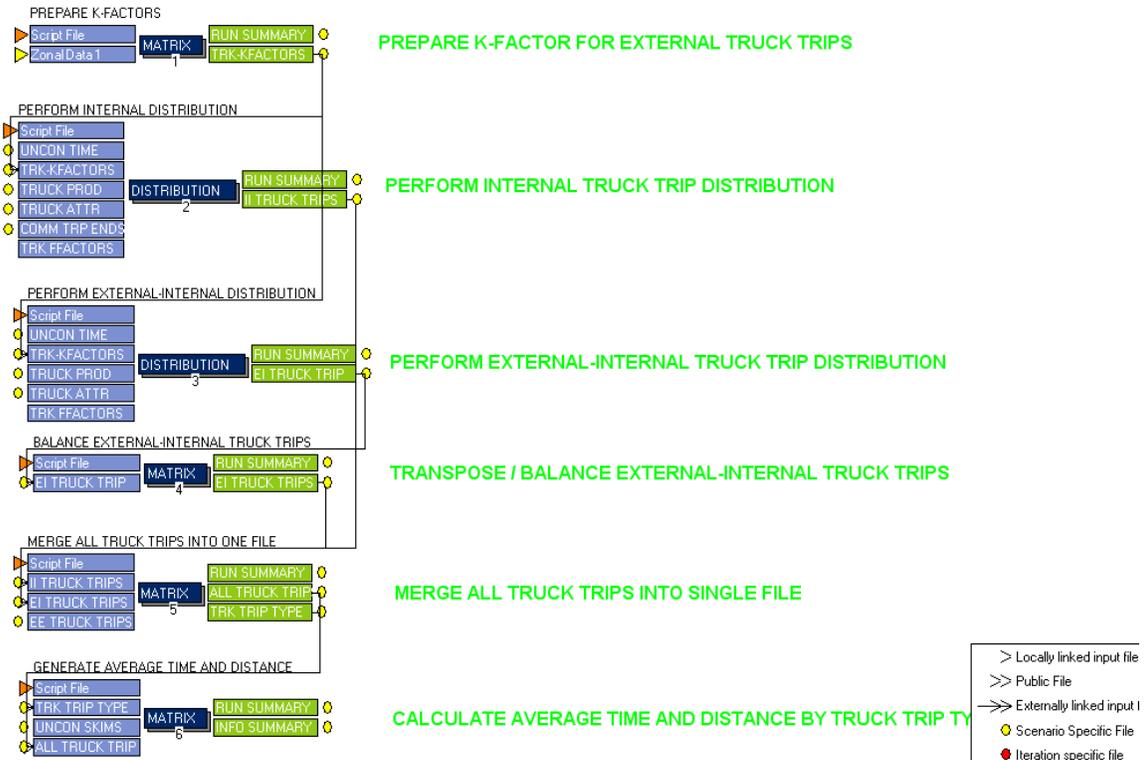
Figure 54 – Non-Work Trip Distribution by Income Application



Truck trip productions and attractions are distributed in the sub-application shown in Figure 55. This process is performed by truck type (median truck, heavy truck and commercial vehicles) and by trip type (internal-internal, external-internal). All trips are merged then into a single file for use by the time of day processing component prior to highway assignment. The final MATRIX routine is used to calculate average trip length and travel times for each trip type.

**Figure 55 – Truck Trip Distribution Application**

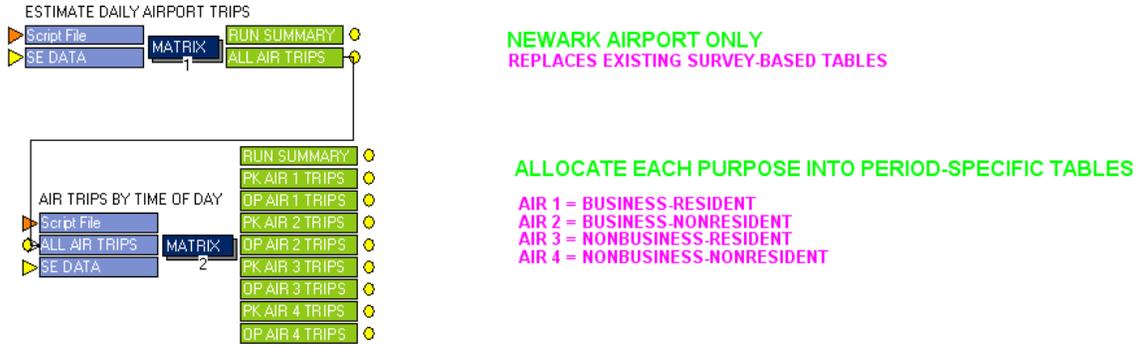
**PERFORM TRUCK AND COMMERCIAL TRIP DISTRIBUTION**



As shown in Figure 56, trips related to Newark airport are generated utilizing a combined generation-distribution process with separate functions by trip type (Business-Resident, Business-NonResident, NonBusiness-Resident, NonBusiness-NonResident). The second routine allocates these trips by time of day for use in the mode choice model.

Figure 56 – Airport Trip Estimation Application

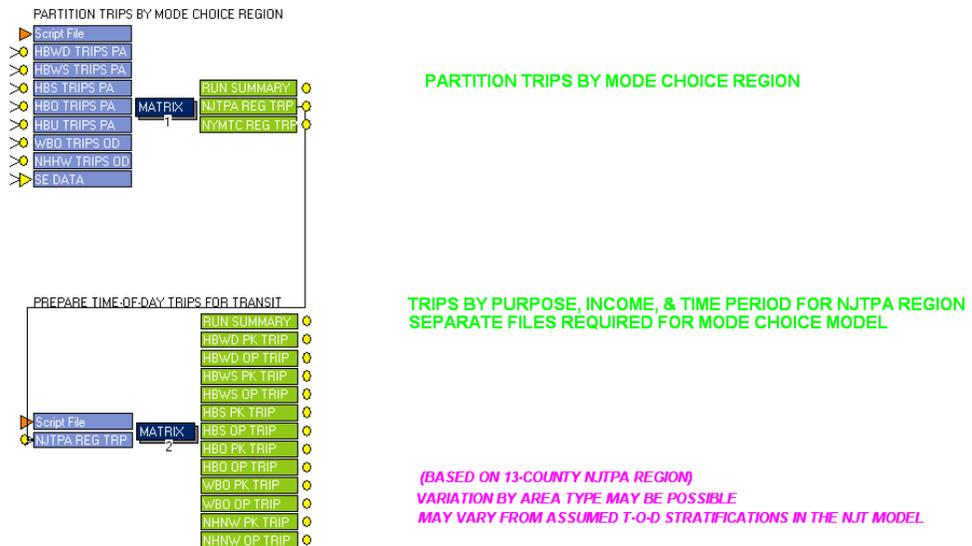
**AIRPORT TRIP ESTIMATION PROCESS**



The next sub-application in trip distribution, all trip tables are combined and partitioned by mode choice region. The modeled area is divided into two regions for mode choice model purposes designated as the NJTPA-controlled region and NYMTC-controlled region. Trips produced west of Hudson River (New Jersey, New York (Orange/Rockland/Sullivan), Pennsylvania), and trips from Manhattan westward across the Hudson River are have model choice performed by NJT model adopted within the NJRTM-E. The remaining trip flows are governed by NYMTC model where mode share from NYMTC BPM model is adopted to derive trips by mode. Those trips controlled by the NJT mode choice model are then partitioned by time of day as required by NJT mode choice model. Figure 57 displays this sub-application.

Figure 57 – Trip Distribution Application

**PRELIMINARY TIME OF DAY PROCESSING FOR MODE CHOICE**

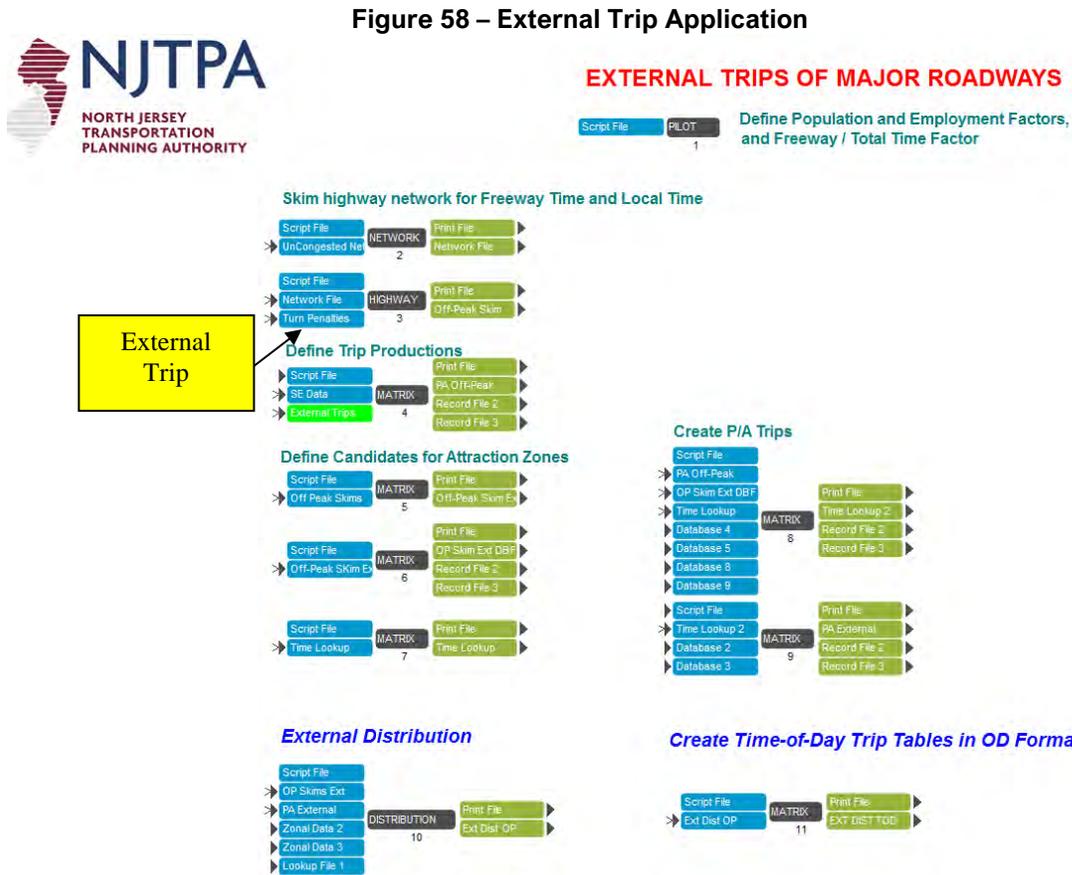


As the final sub-application, the external trips were added for three major external points that include:

1. The southern terminus of the New Jersey Turnpike (exit 3 and south)
2. The western terminus of I-80 in Pennsylvania, and

- The western terminus of I-78 also in Pennsylvania.

Figure 58 displays this sub-application.



It should be noted that the analyst is responsible to update the external trips at the three external locations. The external trips are stored in the “External.DBF” file in the network-related input folder (for example, modeldata\14VAN folder). The data can be provided by updating the DBF file using any database program, or opening the file directly from the external trip application by double-clicking the “external.dbf” box as shown in Figure 58. The external.DBF consists of three fields: Zone, Name, and Trips as shown in Figure 59. The analyst only needs to update the values in the “Trips” column. The trips are the total two-directional trips from the traffic counts or estimated future traffic. For example, the 47,000 daily traffic for the NJ Turnpike represents 23,500 NB, and 23,500 SB.

**Figure 59 – External Trip Data File**

	ZONE	NAME	TRIPS
▶	367	NJTPK	78000
	873	I78	32350
	2071	I80	33450

## 5.8 Mode Choice Component

This application performs the mode choice model component for separate regions within the modeled area by time of day. As discussed previously, the NJT mode choice model is used to perform mode choice within the NJTPA and Manhattan areas, while shares from the NYMTC BPM model are used to allocate trips by mode for the remaining areas east of the Hudson River. This application also prepares transit shares by model iteration for use in subsequent composite impedance calculations. The application is displayed in Figure 60.

**Figure 60 – Mode Choice Application**

### MODE CHOICE PROCESS BY TIME PERIOD



Figure 61 displays the sub-application that performs peak period mode choice within the NJTPA-controlled region. The process essentially prepares final controls and then launches a series of DOS applications that call the C-based NJT mode choice model. It also includes a manually-executed summary routine that provides a market segment report consistent with NJ Transit reporting process. Detailed reports of the mode choice model runs are provided as a separate sub-application shown in Figure 62.

Figure 61 – NJTPA Region Peak Period Mode Choice Application

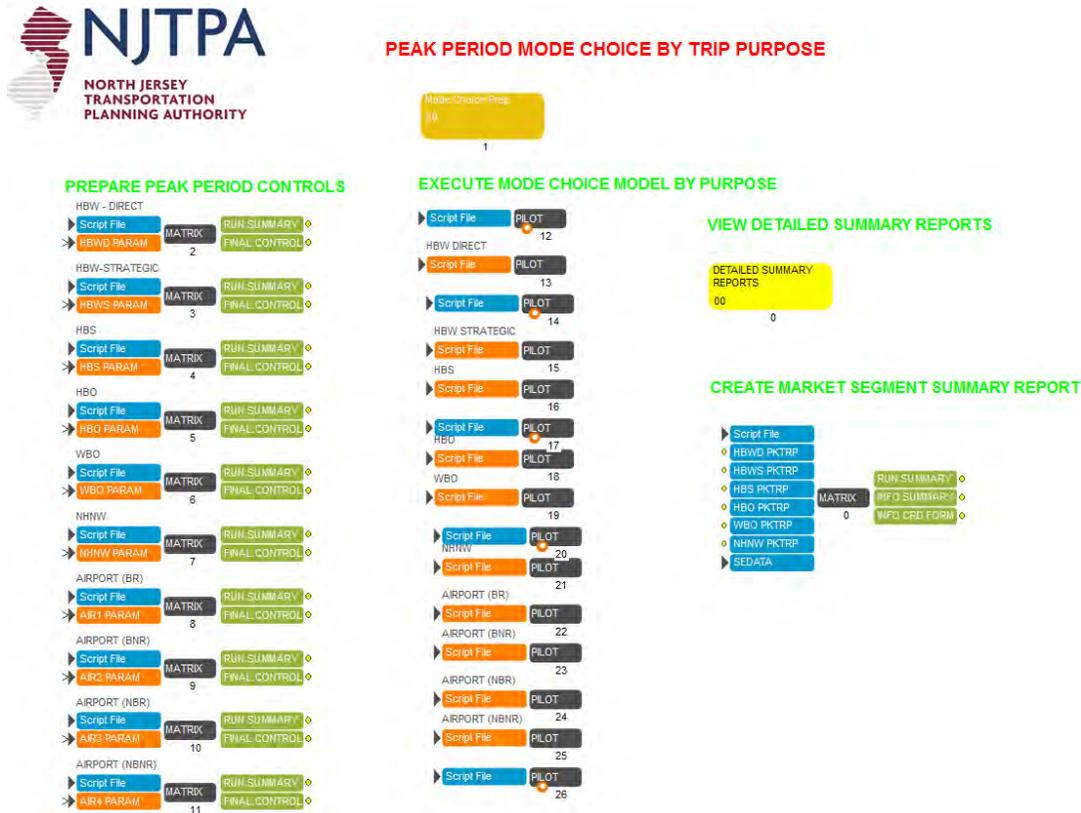


Figure 62 – Peak Period Detailed Summary Application

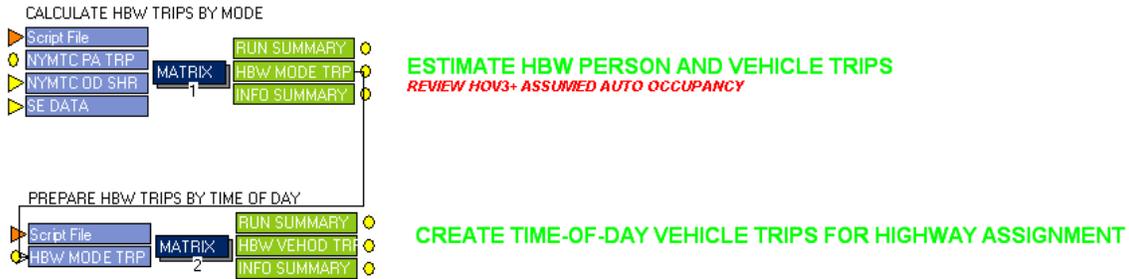
**DETAILED SUMMARY OF PEAK PERIOD MODE CHOICE MODEL RESULTS**



In this sub-application shown in Figure 63, mode shares from NYMTC BPM model is applied to derive trips by mode for HBW purposes within the NYMTC-controlled region. And as HBW purposes are subject to trip distribution during each model iteration, the NYMTC-controlled HBW trips may change resulting in change of trips by mode. Therefore, this routine is executed during each iteration. The time-of-day allocation process and conversion from person trips to vehicle trips for the auto modes are also performed in this application.

Figure 63 – NYMTC Peak Period Mode Choice Application

**NYMTC-HBW MODE CHOICE ESTIMATION**

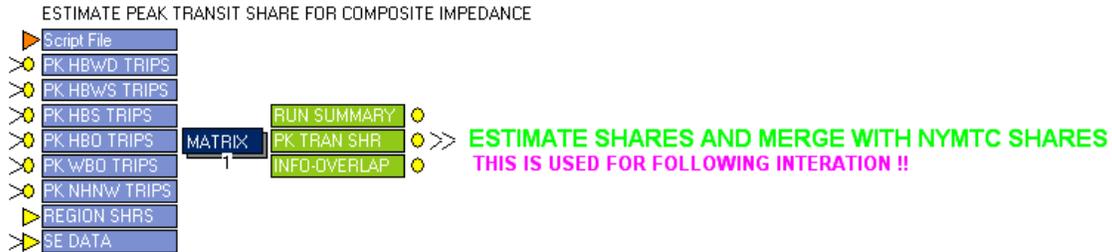


*NOTE THAT THE HBW PURPOSES ARE SUBJECT TO DISTRIBUTION DURING EACH MODEL ITERATION SO NYMTC-CONTROLLED REGION HBW TRIPS MAY CHANGE AND TRIPS BY MODE NEED TO REVISED*

Peak transit share after mode choice model are calculated here and prepared for the computation of composite impedance in the next model iteration. Figure 64 provides a display of this sub-application.

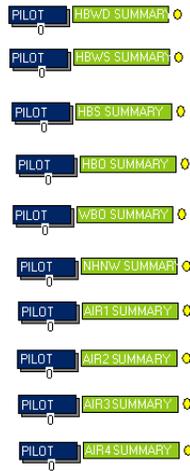
Figure 64 – Transit Shares Preparation Application

**ESTIMATE PEAK PERIOD TRANSIT SHARES FOR COMPOSITE IMPEDANCE**





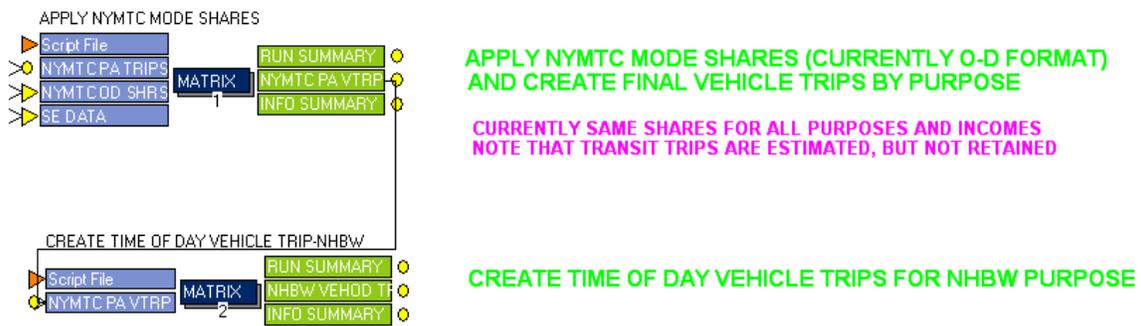
**Figure 66 – Off-Peak Detailed Summary Application**  
**DETAILED SUMMARY OF OFF-PEAK MODE CHOICE MODEL RESULTS**



In this sub-application shown in Figure 67, mode shares from NYMTC BPM model is applied to derive trips by mode for HBW purposes within the NYMTC-controlled region. Off peak mode choice is performed only during the first iteration since off peak travel times are not included in the feedback model iterations. The time-of-day allocation process and conversion from person trips to vehicle trips for the auto modes are performed in this application.

**Figure 67 – NYMTC Off-Peak Period Mode Choice Application**

**APPLY MODE CHOICE SHARES FOR NYMTC REGION**



## 5.9 Time-of-Day Trip Matrix Preparation

Time-of-day split is performed for auto-related trips in this application. Figure 68 displays the application and its sub-application. Trips are converted from production-attraction format into origin-destination format while being allocated to four “time of day” periods. Person trips are also converted to vehicle trips as well. Airport trips are partitioned by time-of-day in the first MATRIX routine and second MATRIX routine converts the person trips by mode from the NJTPA-controlled region into various time-of-day periods. As part of this second routine, the vehicle trips from NYMTC controlled area, along with truck trips and the above derived airport-related vehicle trips are combined into the final trip tables by time of day.

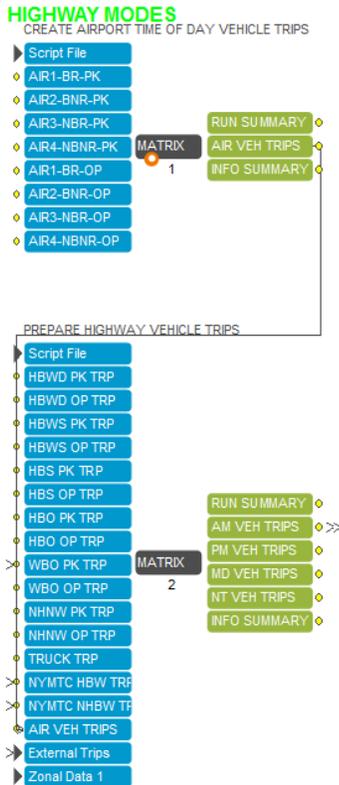
Figure 68 – Time of Day Trip Matrix Preparation Application

### PREPARE TIME OF DAY TRIP TABLES BY FOR HIGHWAY ASSIGNMENT



PREPARE AUTO TRIPS BY MODE AND TIME PERIOD  
(SOV, HOV FOR AM PEAK, PM PEAK, MIDDAY, NIGHT)

### TIME-OF-DAY TRIP MATRIX PREPARATION

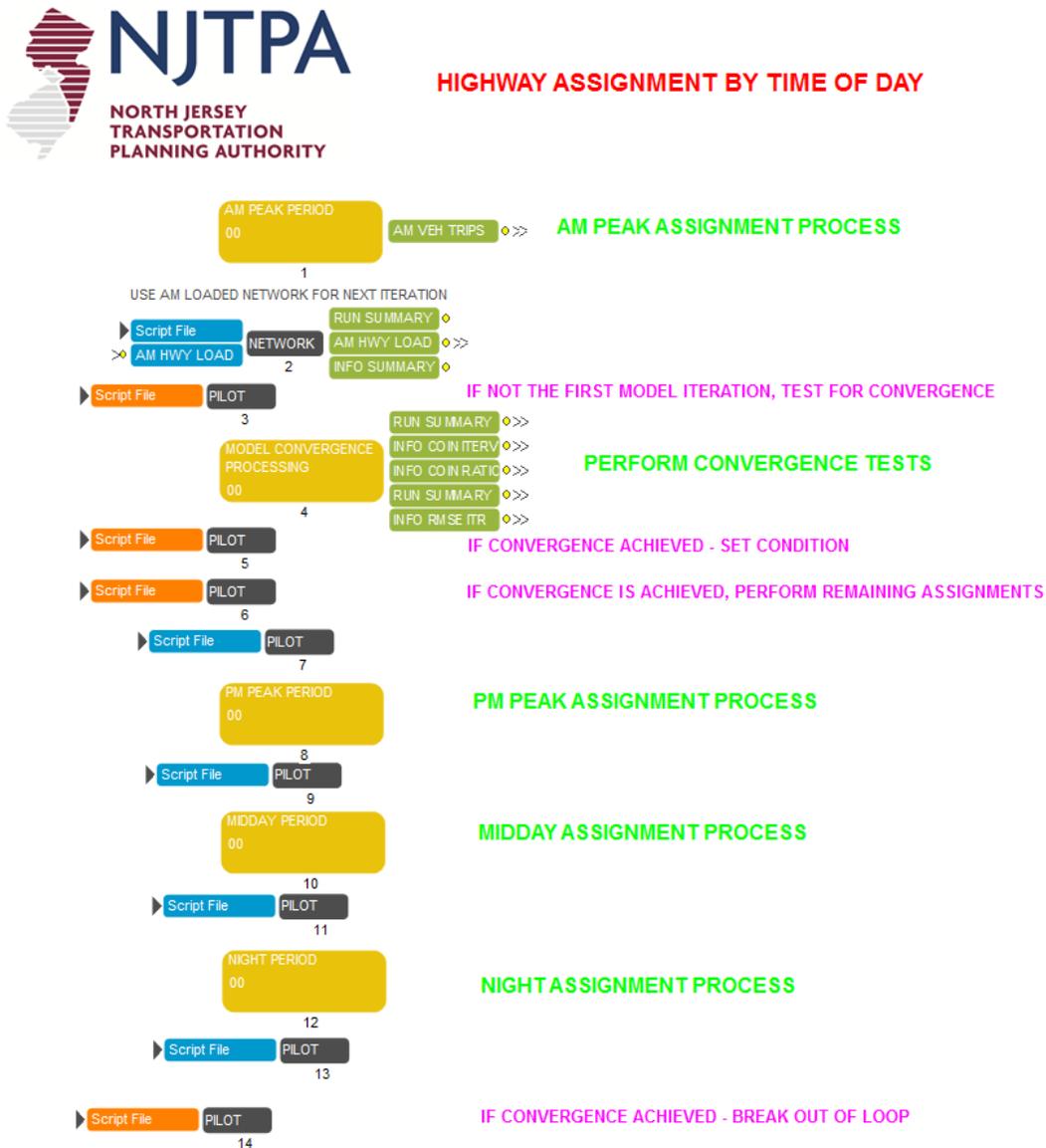


CREATE PERIOD-SPECIFIC TRIP TABLES FOR EACH PERIOD  
(EACH PERIOD HAS SOV, HOV & TRUCKS)

### 5.10 Highway Assignment Component

This application performs highway assignment for the four time-of-day periods. Note that highway assignment is performed for the AM peak period during each iteration. Starting at the second iteration, model convergence is analyzed following the conclusion of the AM peak assignment. The analysis includes analysis of Root Mean Square Error (RMSE) values between the loaded networks and coincidence ratios for the AM peak trip tables for the current and previous model iterations. If the convergence is achieved, the model will terminate the iterative model loop and perform highway assignment for other time periods. This application is displayed in Figure 69.

Figure 69 – Highway Assignment Application



AM peak highway assignment is performed in this sub-application shown in Figure 70. After regrouping vehicle trips in the order required for the toll diversion model and preparing capacities and tolls for the network, AM peak highway assignment with a toll diversion model is performed. Note that the user has the option of running a universal select-link analysis via setting the scenario key {Pathfile} to 1. Note that the resulting output path file is more than 15 gigabytes, so the user should confirm that space is available for this option.

Figure 70 – AM Peak Highway Assignment Application

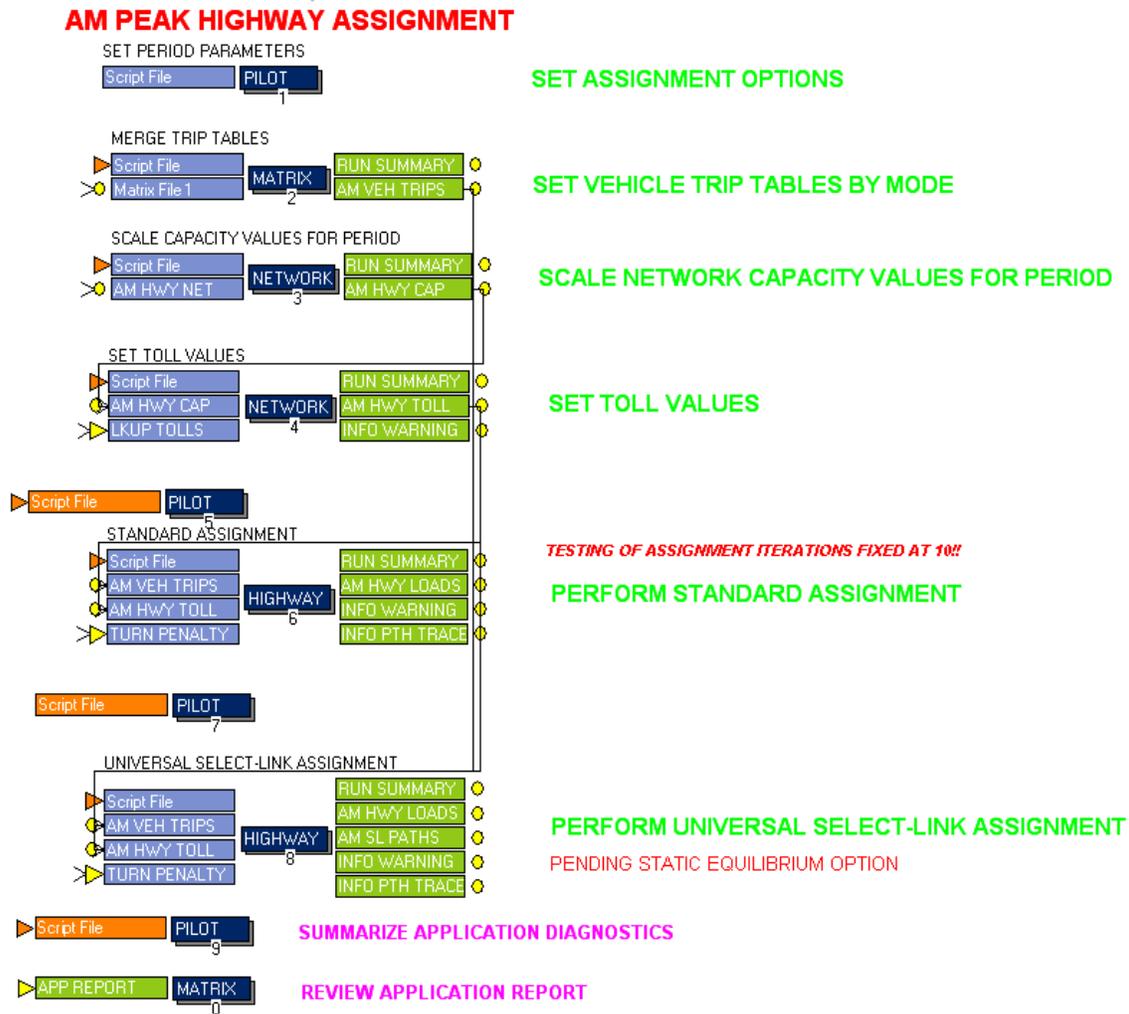
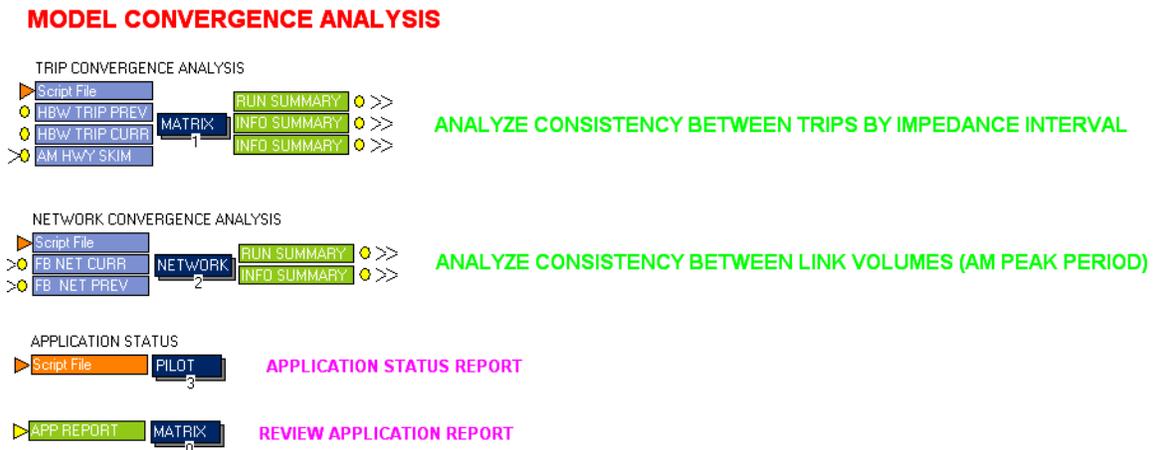


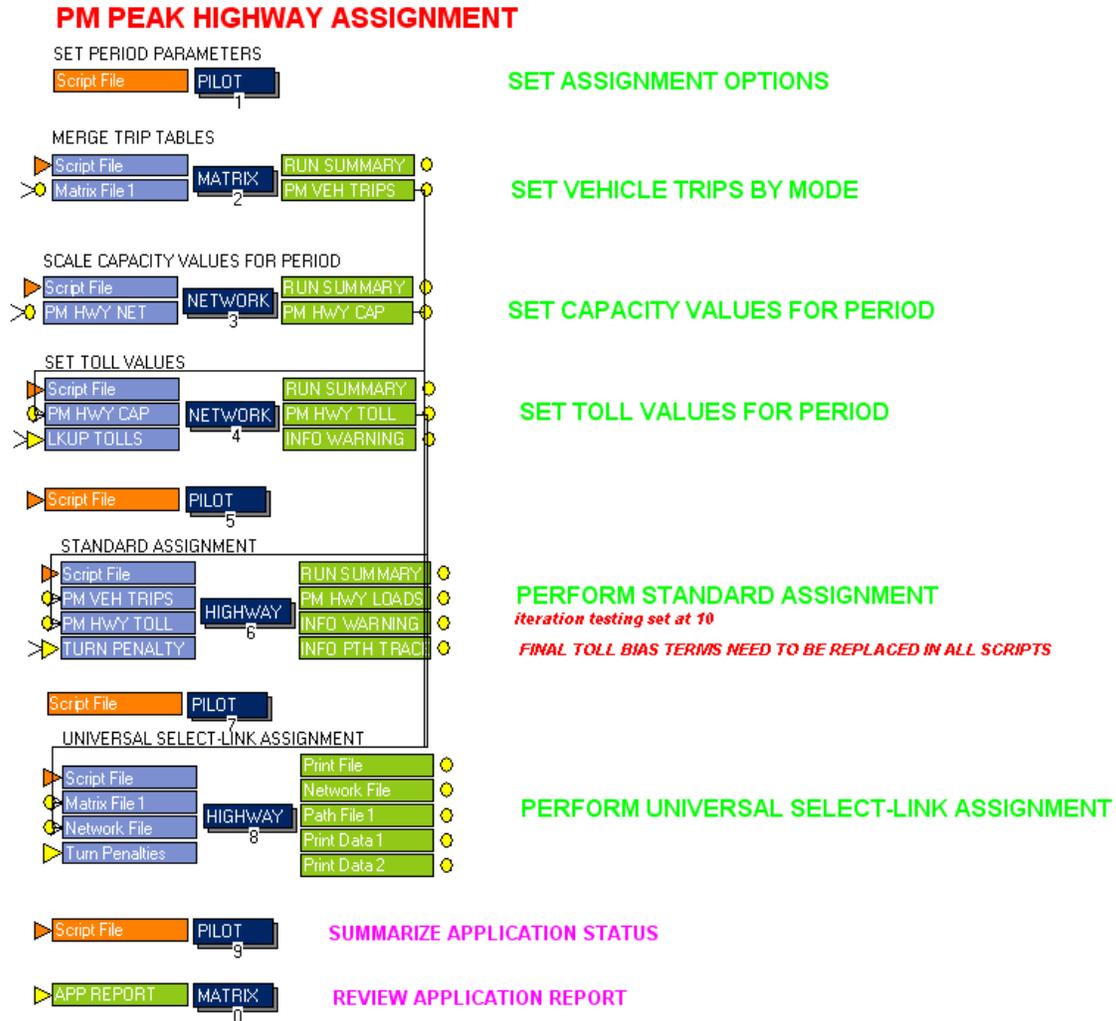
Figure 71 shows the Model Convergence Analysis Sub-Application. The convergence of the model is checked in this sub-application for every iteration after the first iteration. Two criteria are used for convergence analysis: the coincidence ratio and RMSE. Coincidence ratio reflects the similarity of trip tables between consecutive model iterations. The RMSE reflects the difference in loaded link volumes between consecutive model iterations. As the coincidence ratio approaches 1.0 and the RMSE approaches 0.0 percent, the model approaches true convergence. If coincidence ratio is greater than 0.95 and RMSE is less than 5 percent, or the maximum iteration has been reached, the model will exit the iterative model loop and proceed to highway assignment for other time periods. Otherwise, the loop control will initiate the next iteration of model.

**Figure 71 – Model Convergence Analysis Application**



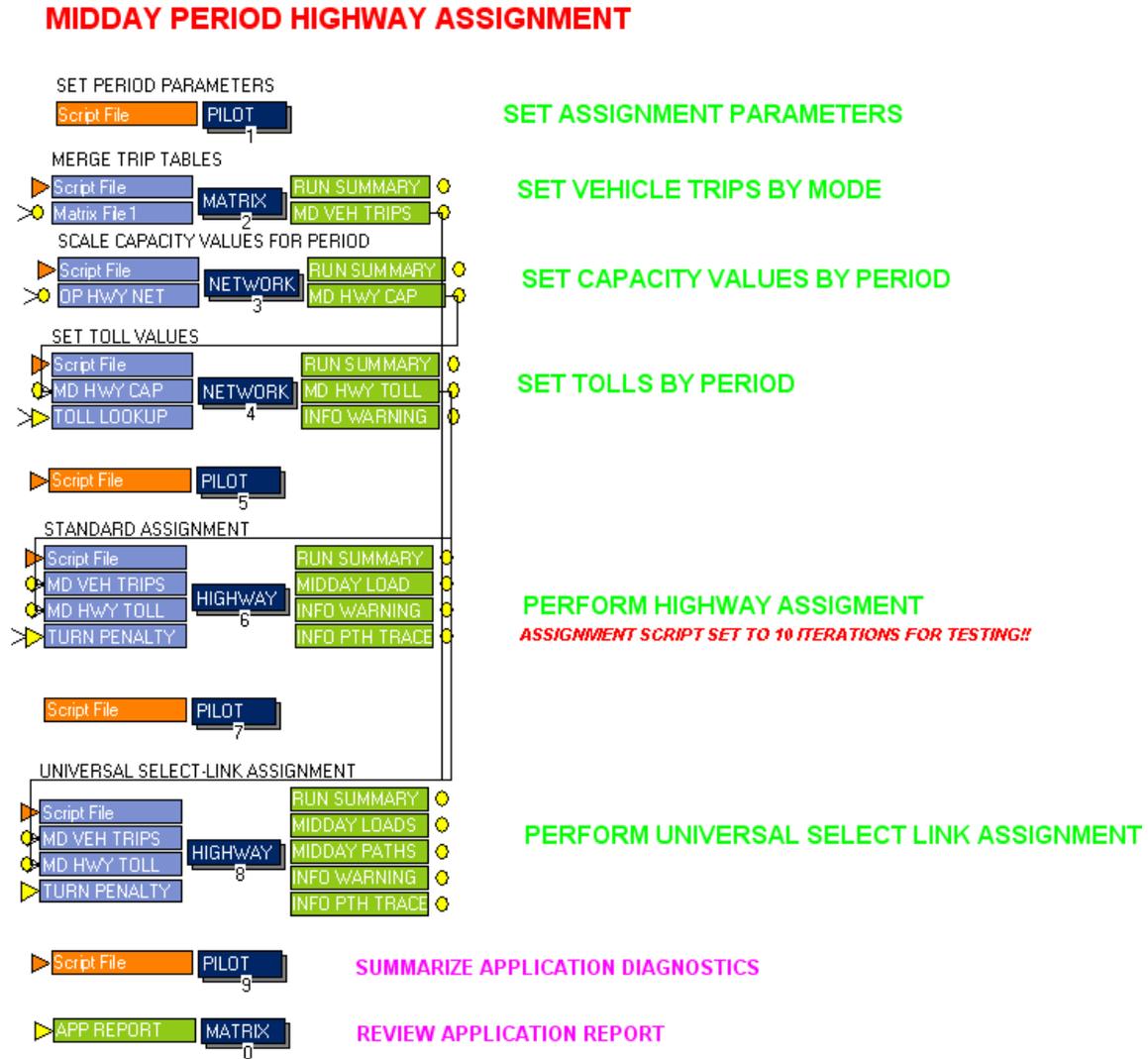
PM peak highway assignment is performed in this sub-application shown in Figure 72. After regrouping vehicle trips in the order required for the toll diversion model and preparing capacities and tolls for the network, PM peak highway assignment with a toll diversion model is performed. Similar to discussion of the AM peak period, the user has the option of running a universal select-link analysis. Again, note that the resulting output path file is more than 15 gigabytes so the user should confirm that space is available for this option.

Figure 72 – PM Peak Highway Assignment Application



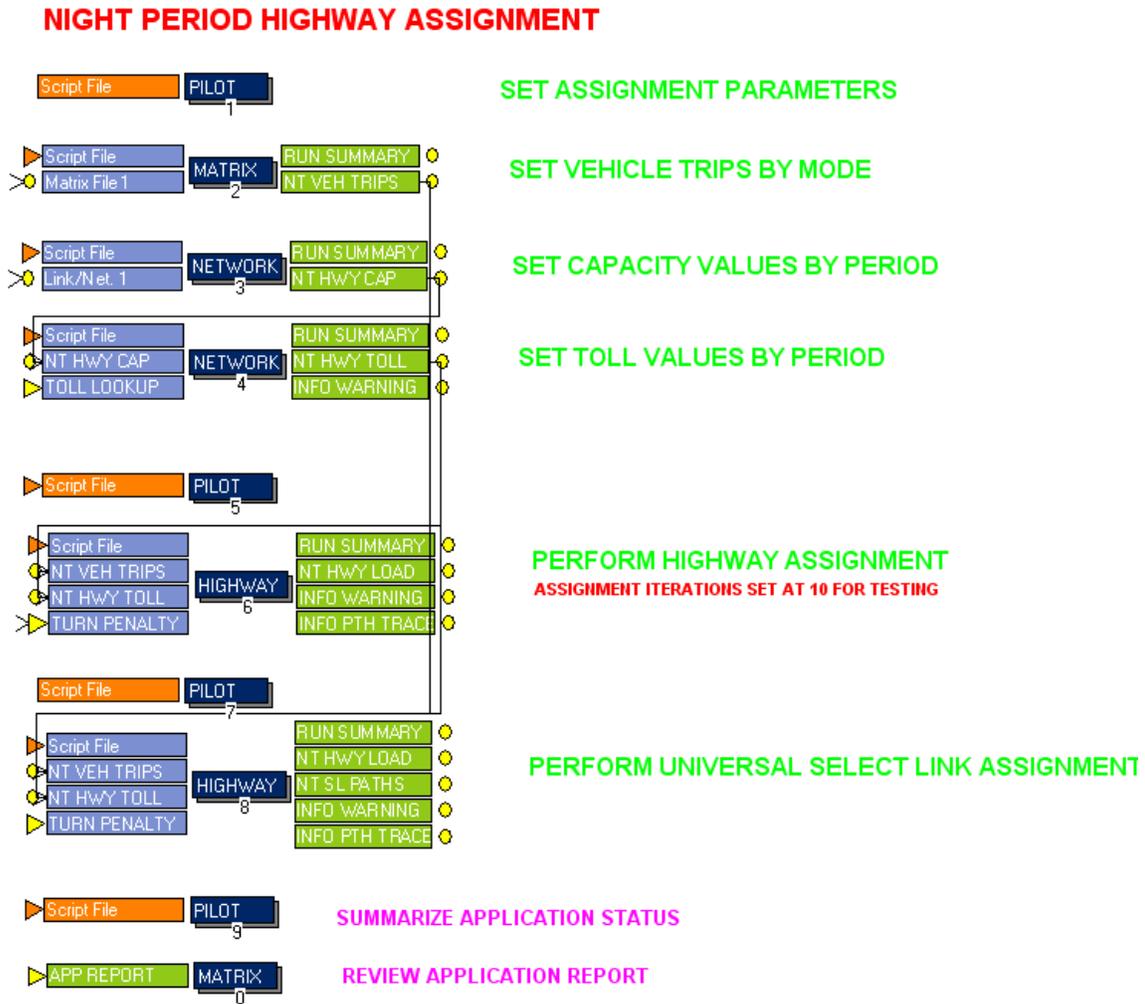
The midday period highway assignment is performed in this sub-application shown in Figure 73. After regrouping vehicle trips in the order required for the toll diversion model and preparing capacities and tolls for the network, midday period highway assignment with a toll diversion model is performed. Similar to discussion of the AM peak period, the user has the option of running a universal select-link analysis. Again, note that the resulting output path file is more than 15 gigabytes so the user should confirm that space is available for this option.

Figure 73 – Midday Period Highway Assignment Application



The night period highway assignment is performed in this sub-application shown in Figure 74. After regrouping vehicle trips in the order required for the toll diversion model and preparing capacities and tolls for the network, Night period highway assignment with a toll diversion model is performed. Similar to discussion of the AM peak period, the user has the option of running a universal select-link analysis. Again, note that the resulting output path file is more than 15 gigabytes, so the user should confirm that space is available for this option.

Figure 74 – Night Period Highway Assignment Application



### 5.11 Transit Assignment Component

Figure 75 displays the transit assignment component. In the initial sub-application, transit trips are combined into peak and off-peak periods. Following this step, the transit trips are assigned by the PT routine for each time period. The summaries of ridership and boardings are generated at the last sub-application using the NJT programs that summarize line ridership and station activity. Figure 76 displays the first sub-application that aggregates the trips by time period and access submode.

Figure 75 – Transit Assignment Application

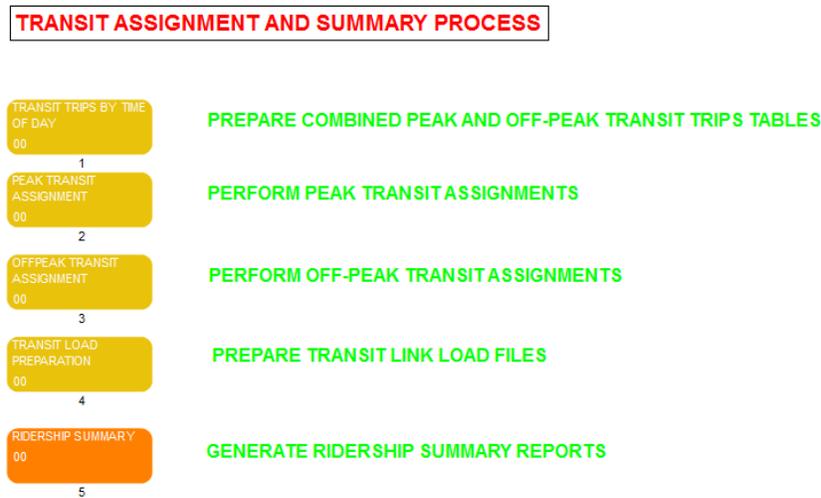
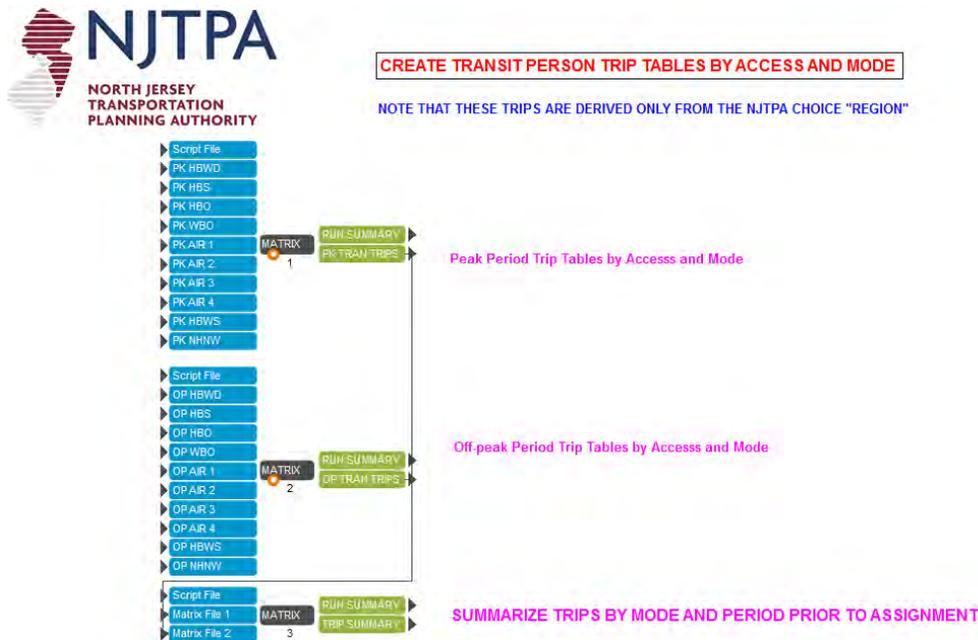


Figure 76 – Transit Time of Day Trip Matrix Application



Peak period and off-peak period transit assignment are performed in the sub-application shown in Figure 77 and Figure 78, respectively. This process is performed separately by transit mode and access sub-mode.

Figure 77 – Peak Period Transit Assignment Application

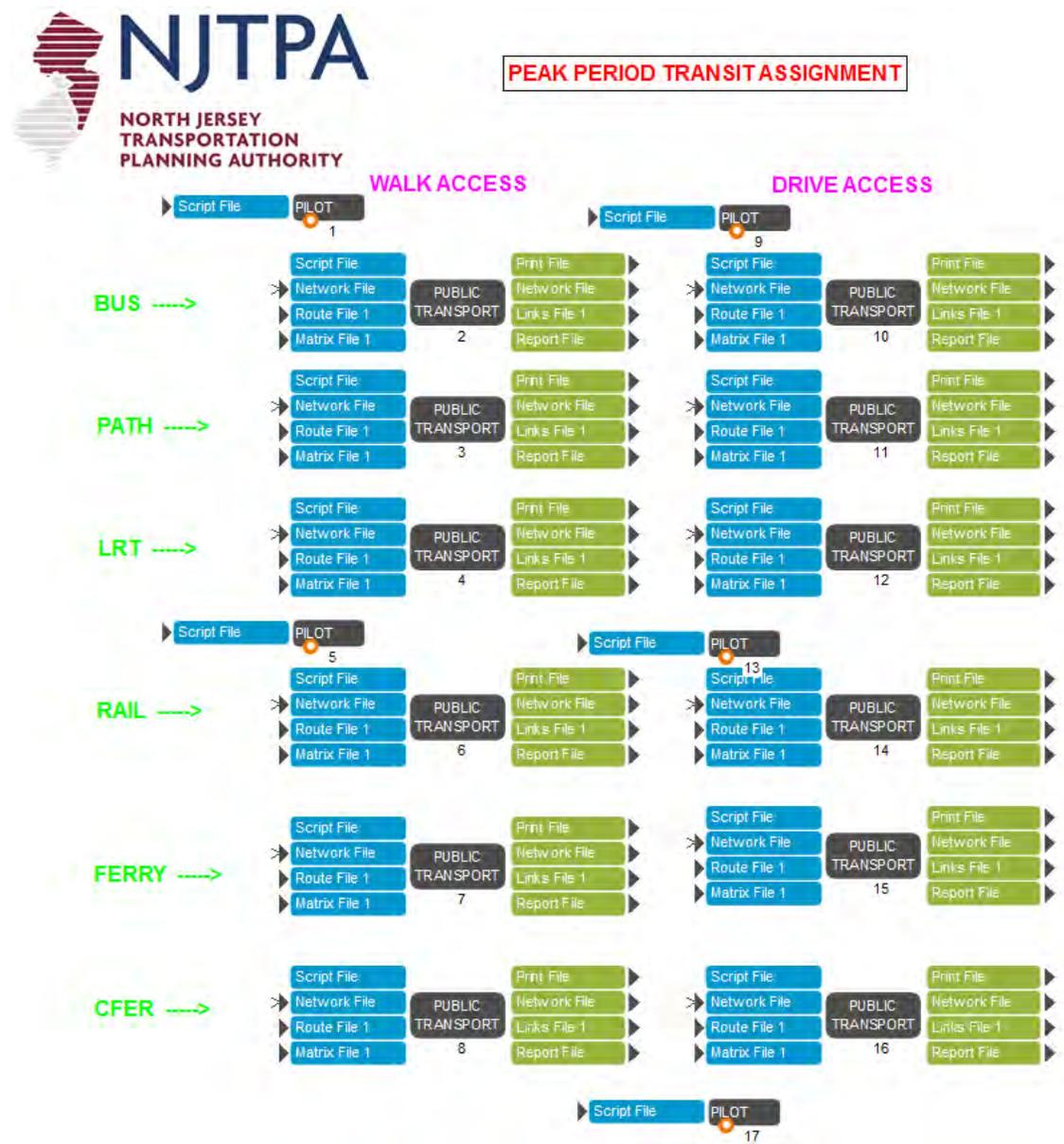


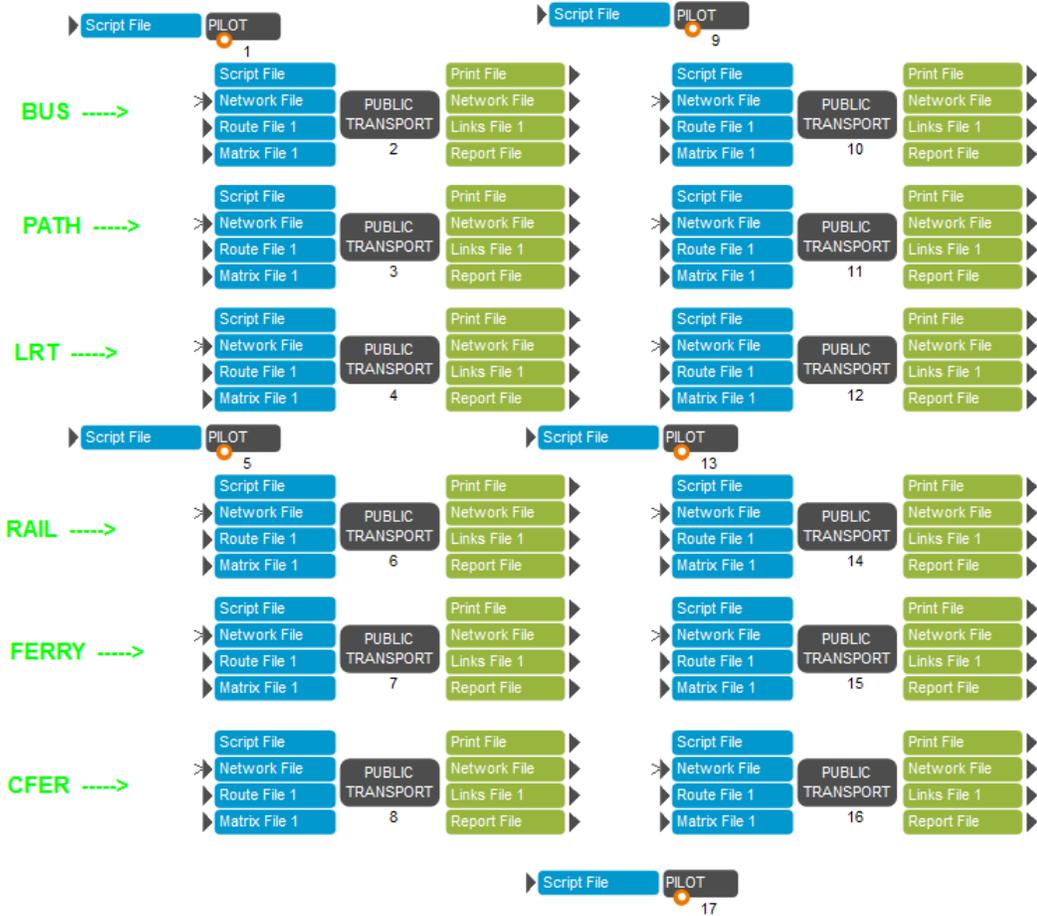
Figure 78 – Off-Peak Period Transit Assignment Application



**OFF-PEAK PERIOD TRANSIT ASSIGNMENT**

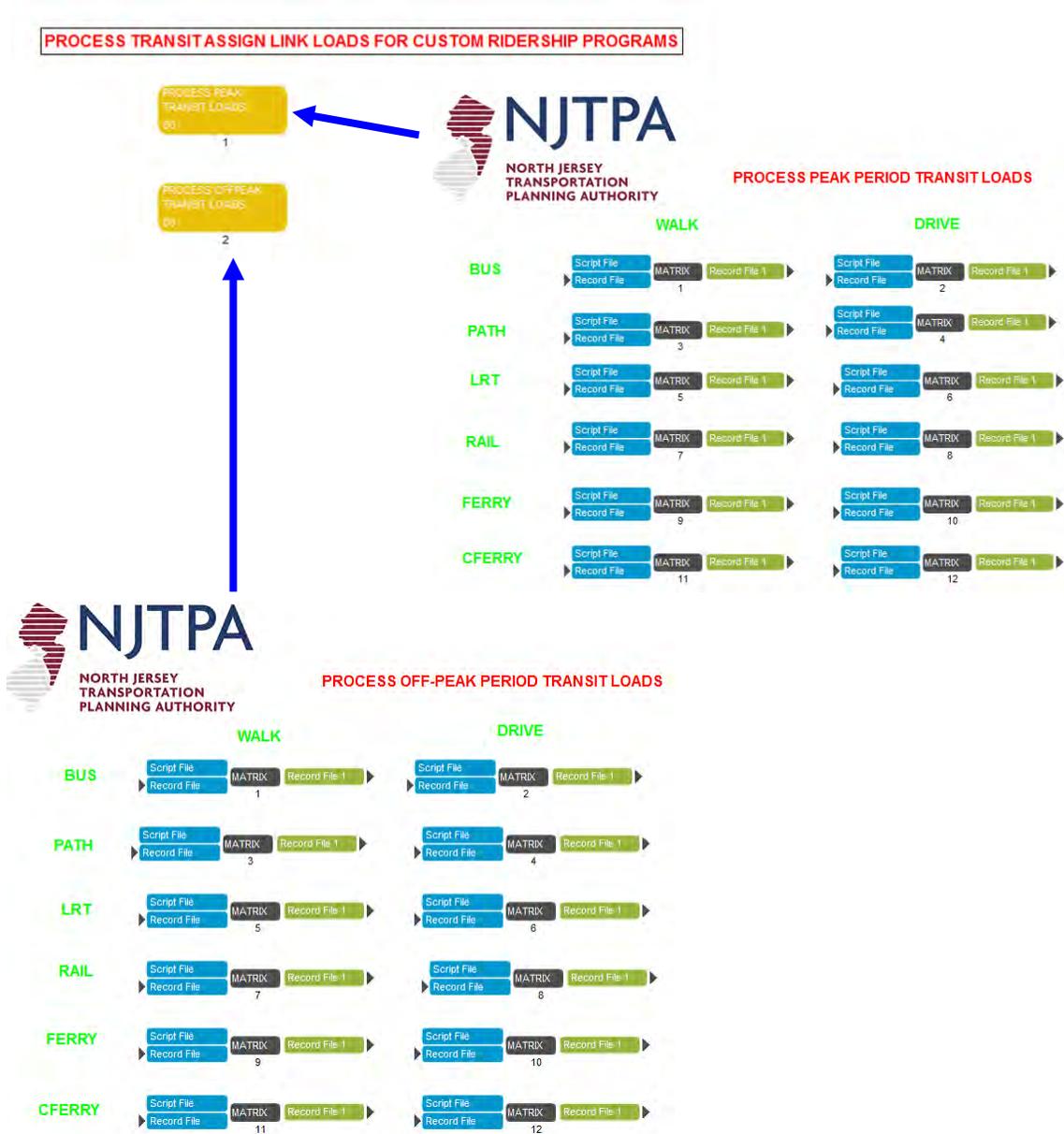
**WALK ACCESS**

**DRIVE ACCESS**



The next sub-application is to process the results of the transit assignment, and prepare the outputs in a format ready for a custom ridership program. Figure 79 shows the sub-application. The final sub-application in this group, shown in Figure 80 is used to generate the standard ridership and station activity summarizes as defined by the NJ Transit Model. The summary report process is performed by a series of C-Based programs (DLL files) developed for NJ Transit’s specific needs. These programs currently summarize ridership for the major transit corridors and station activity at major transit stations. Note that the controls can be revised by the user to add new stations or other ridership reports.

Figure 79 –Process Transit Link Loads Application

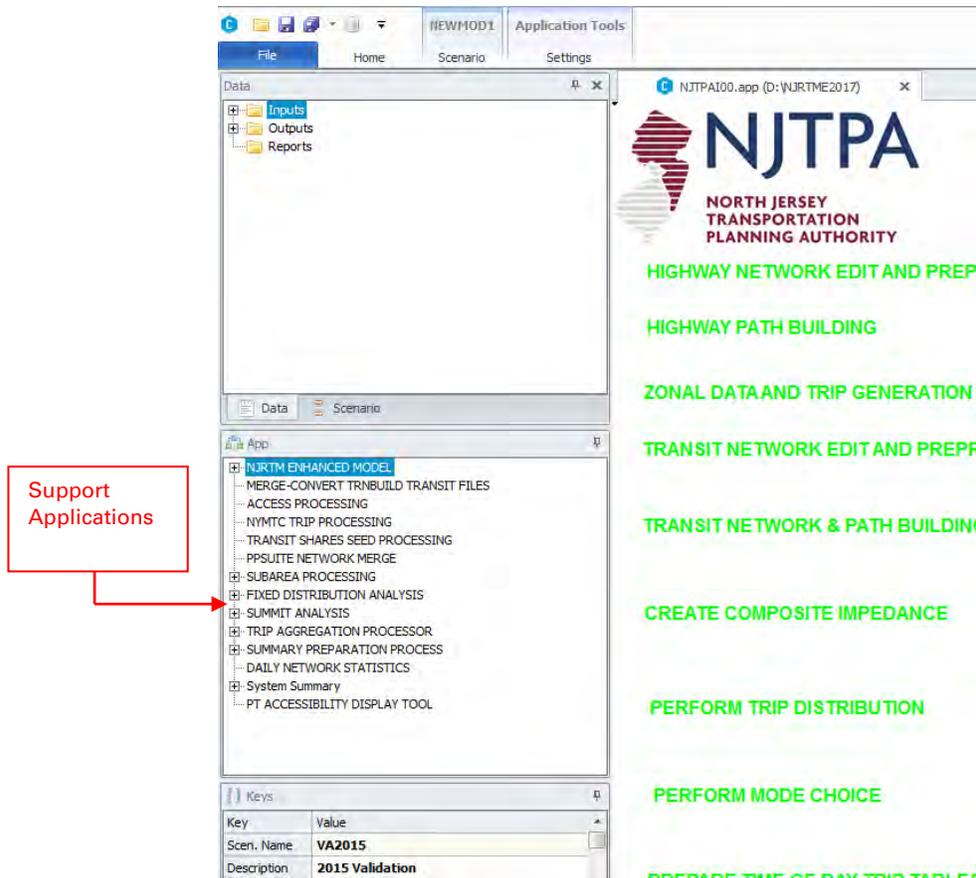




### 5.12 Support Applications

In addition to the Main NJRTM-E Application, a series of support applications were developed to facilitate the model processing. These support applications have been grouped into two general categories designated as “input support” or “output support”. Figure 81 shows the listing of these applications below the NJRTM Enhanced Model in CUBE application manager.

Figure 81 – Support Application Display

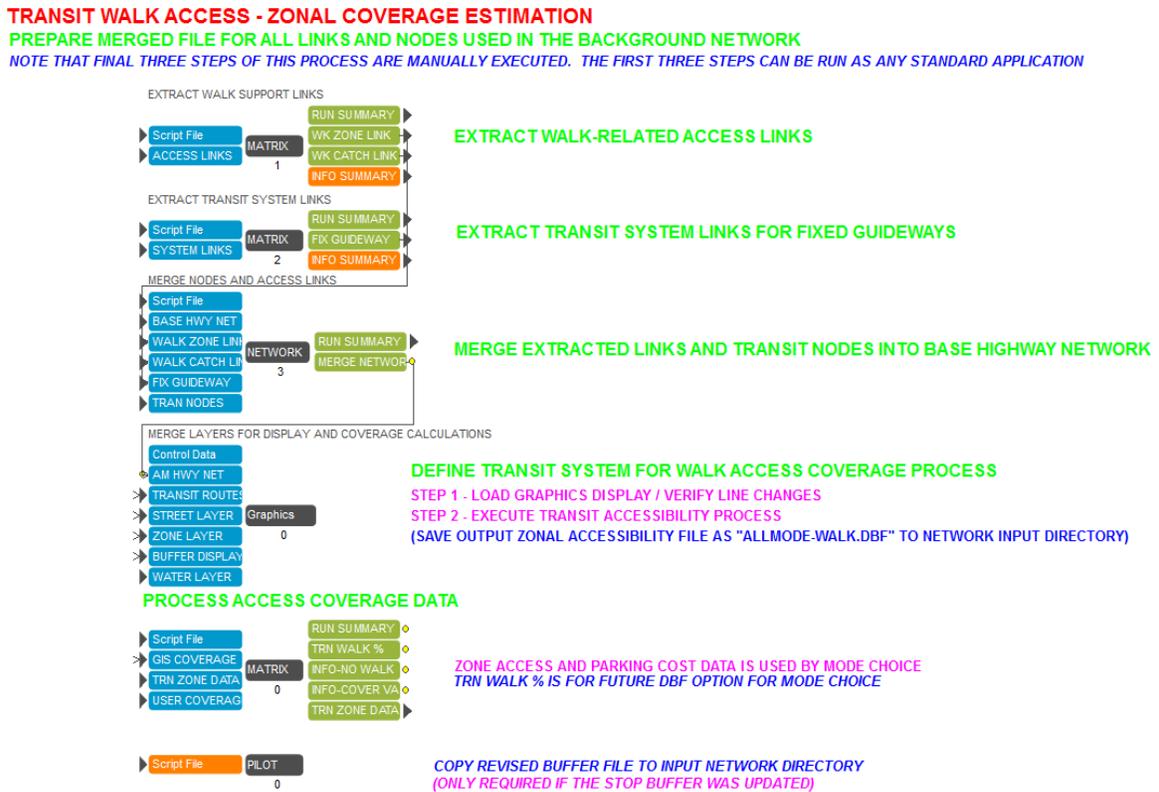


The first three support applications are input-related and provide data related to walk access coverage in each zone as well as mode choice and transit share data used in the initial iteration of the NJRTM-E. The remaining five support applications are output-related. These applications provide some basic summary data from the highway assignment as well as support for subarea extractions and the FTA SUMMIT program. The final support application named “Fixed Distribution Analysis” provides a mechanism to analyze alternative network scenarios while holding person-trip distribution constant. Each of these support applications is discussed in further detail in the following sections.

### 5.13 Transit Walk Access Coverage Application

The percentage of each zone within transit walk-access zonal coverage is estimated below in Figure 82. This data is required for the mode choice model component and should be estimated when significant changes to the transit network are implemented. As an example, the walk coverage should be re-estimated if a scenario extends (or truncates) a transit route, or if new stations and boarding points are added. In preparation for this estimation, the background highway layer is merged with additional data from the transit input card files. The user then needs to execute the transit accessibility process in the CUBE environment. Finally, access coverage data is processed, and zonal coverage is updated. Note that the execution of this particular application is performed manually by the user. Note that this process does require that ARCMAP or ARCVIEW be installed on the computer.

**Figure 82 – Transit Walk Access – Zonal Coverage Estimation**

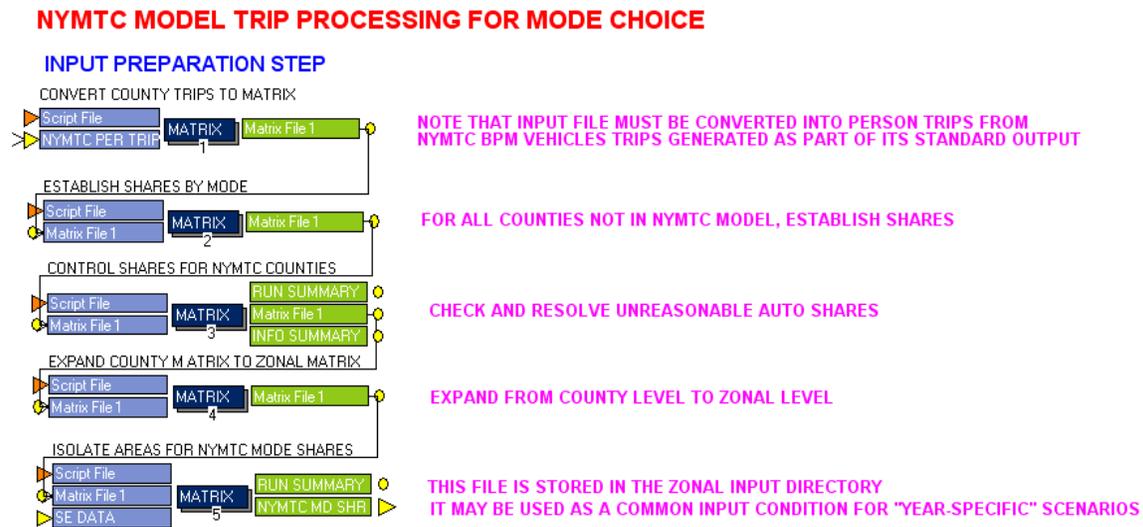


Note that the final output file used by the mode choice model is stored within the zonal input directory. This provision enables the model to automatically use previously estimated coverage data from another scenario that has the identical transit network.

### 5.14 NYMTC Trip Processing Application

Person trips by mode from NYMTC BPM model are utilized in the support application displayed in Figure 83 to generate mode shares for the NYMTC-controlled region. A file in DBF format of county-level person trips by mode from NYMTC BPM model is initially converted to Voyager matrix format and mode shares are then calculated for each mode. Unreasonable auto shares are checked and resolved in a subsequent routine. Finally, county-level mode shares are expanded to zonal level and mode shares in the NJT controlled area are set to be zeros.

Figure 83 – NYMTC Model Trip Processing for Mode Choice



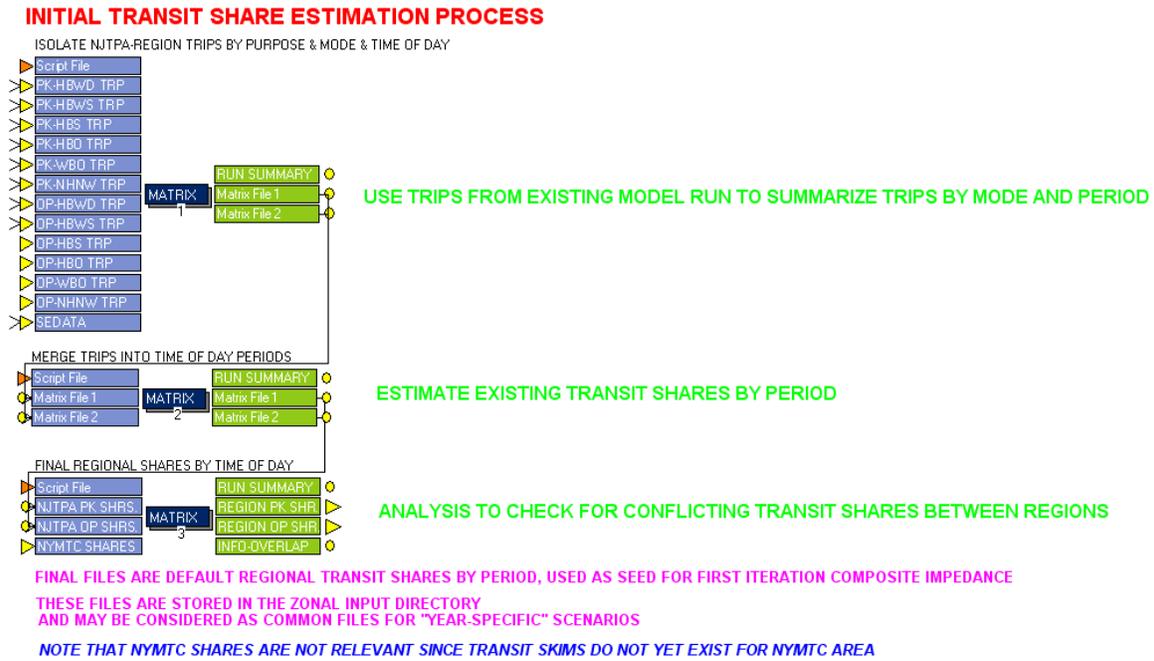
Note that this support application would normally be executed in situations where the mode choice estimates from the NYMTC-controlled region are being updated. Ideally, these shares would also vary by horizon year. However, it is important to note that the shares are estimated at county level and therefore minor changes to the transportation system in NYMTC region would most likely not alter the county-level mode shares.

Note that the final output file used by the mode choice model is stored within the zonal input directory. This provision enables the model to automatically use previously estimated mode shares from another scenario that has the identical assumption of mode share for the NYMTC region.

### 5.15 Transit Shares Seed Processing Application

In order to generate the composite impedance term for the first model iteration, it is necessary to obtain initial transit shares. This support application generates those shares for the NJTPA-controlled region, as shown in Figure 84. The shares are generated using trips from an existing model run. Note that since transit skims for the NYMTC-controlled region are not estimated, the transit shares for the NYMTC-controlled region are not used as part of the composite impedance terms. However the NYMTC file is provided for potential future use if the transit networks are extended further into the eastern side of the NYMTC region.

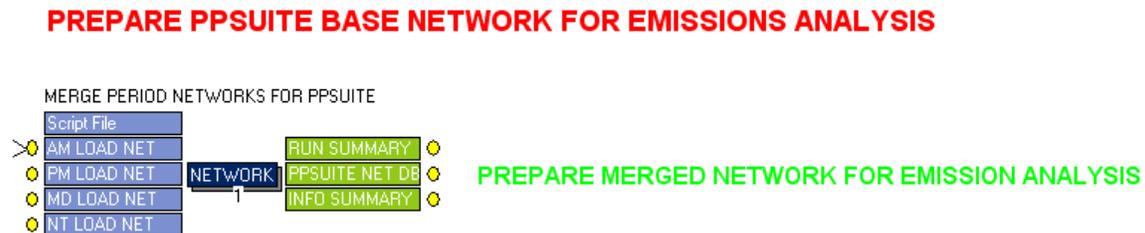
Figure 84 – Initial Transit Share Estimation Process



### PPSuite Network Preparation Application

This support application is used to merge and prepare the loaded highway network assignments for the PPSUITE post-processor. Currently, this merged network is used for air quality analysis, but the processed network could be used for other summary analysis provided by PPSUITE. Figure 85 displays the structure of this application.

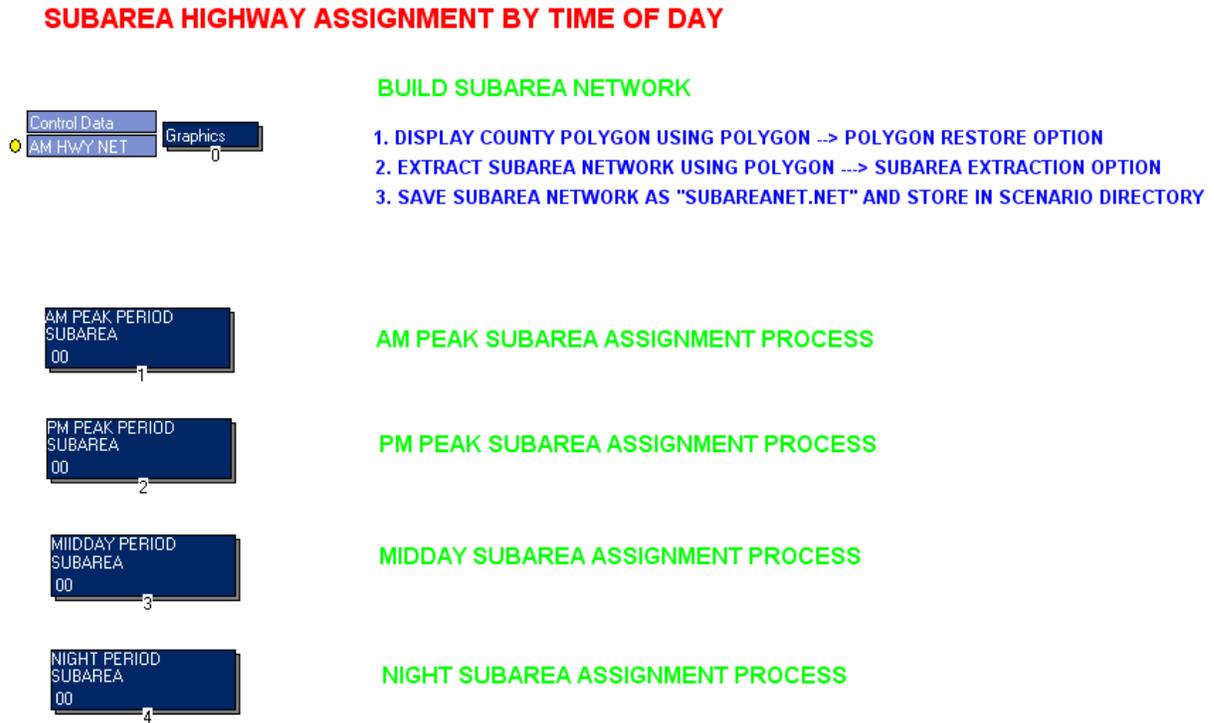
Figure 85 - Initial Transit Share Estimation Process



### 5.16 SubArea Processing Application

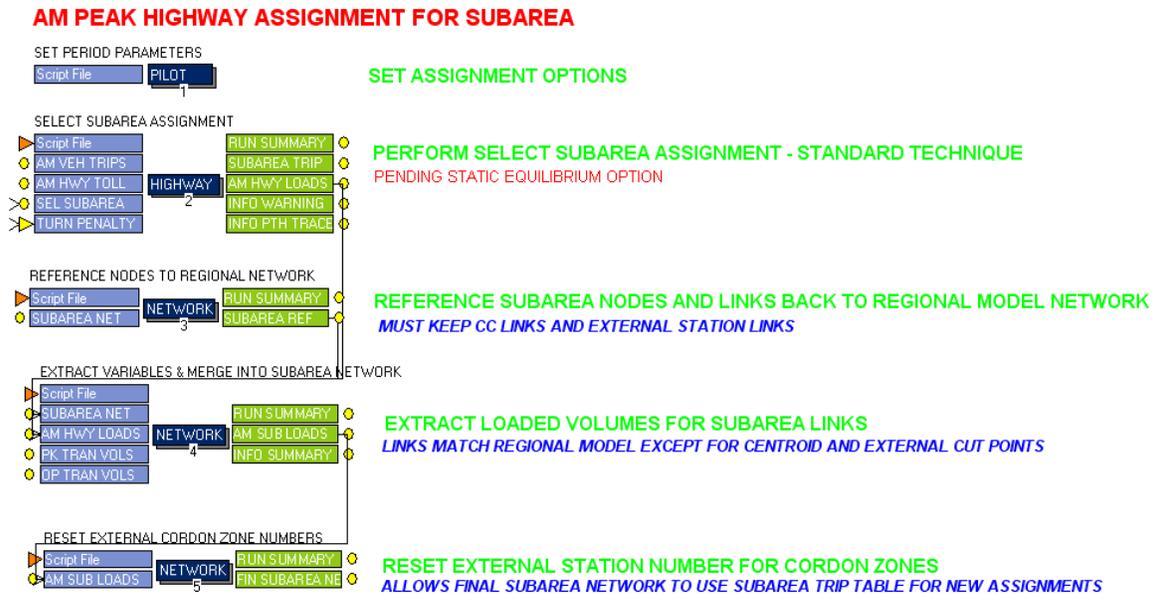
A customized subarea extraction process is also provided as standard output support application. This application is shown in Figure 86. The user can extract a subarea network and trip tables within one of the 15 designated NJTPA subregions and or a customized subregion using the CUBE environment. After generating the subarea network in the initial sub-application, highway assignment steps in the following four sub-applications can be executed to extract subarea- related trips as well as loaded subarea networks.

Figure 86 - Subarea Highway Assignment by Time of Day



A subarea trip table and loaded subarea network for the AM peak period are produced in Figure 87. The initial highway assignment loads traffic regionally and simultaneously extracts the subarea trip table and loaded subarea network. Highway-based transit link volumes are then merged in the network via node number renumbering technique. The user can add and perform new assignments on the subarea network using the extracted subarea network and trip table as desired. Note that the link transit volumes used in the merging routine must be created in the “Daily Network Statistics” support application prior execution the subarea extraction application.

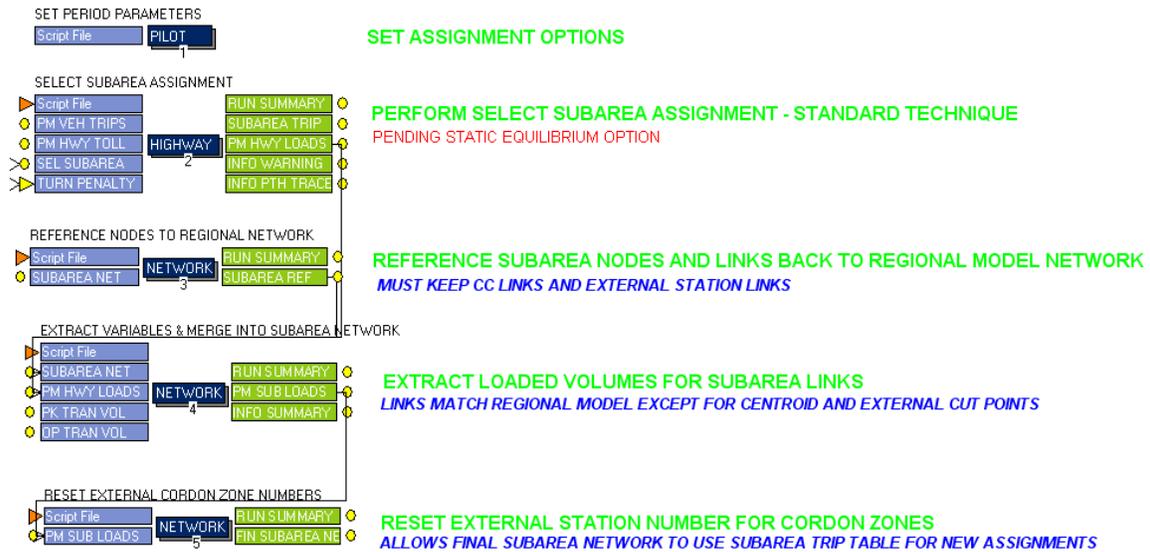
Figure 87 - AM Peak Highway Assignment for Subarea



A subarea trip table and loaded subarea network for the PM peak period are produced in Figure 88. The initial highway assignment loads traffic regionally and simultaneously extracts the subarea trip table and loaded subarea network. Highway-based transit link volumes are then merged in the network via node number renumbering technique. The user can add and perform new assignments on the subarea network using the extracted subarea network and trip table as desired. Note that the link transit volumes used in the merging routine must be created in the “Daily Network Statistics” support application prior execution the subarea extraction application.

Figure 88 - PM Peak Highway Assignment for Subarea

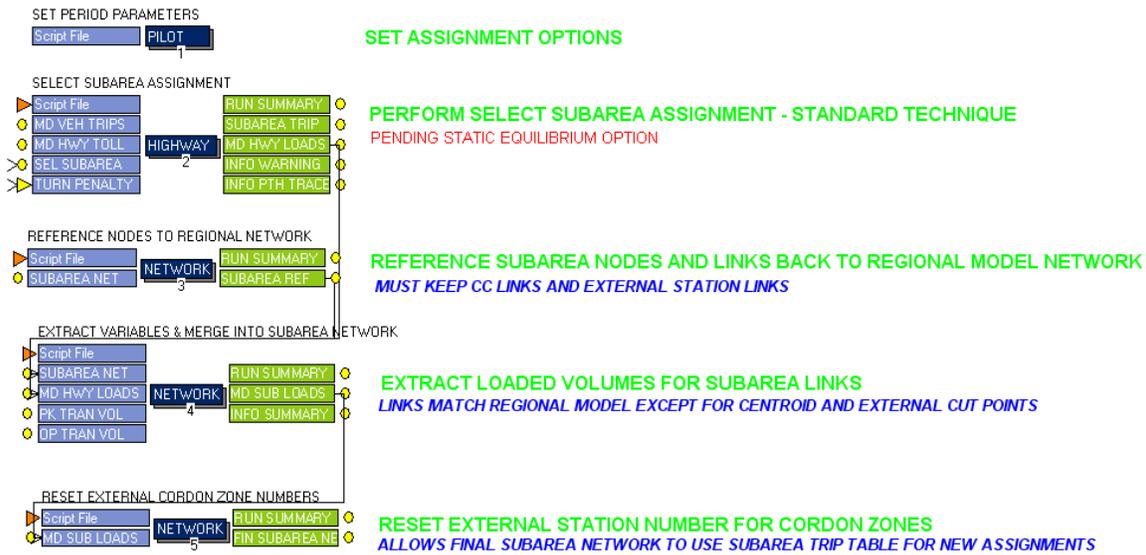
**PM PEAK HIGHWAY ASSIGNMENT FOR SUBAREA**



A subarea trip table and loaded subarea network for the midday period are produced in Figure 89. The initial highway assignment loads traffic regionally and simultaneously extracts the subarea trip table and loaded subarea network. Highway-based transit link volumes are then merged in the network via node number renumbering technique. The user can add and perform new assignments on the subarea network using the extracted subarea network and trip table as desired. Note that the link transit volumes used in the merging routine must be created in the “Daily Network Statistics” support application prior execution the subarea extraction application.

**Figure 89 – Midday Highway Assignment for Subarea**

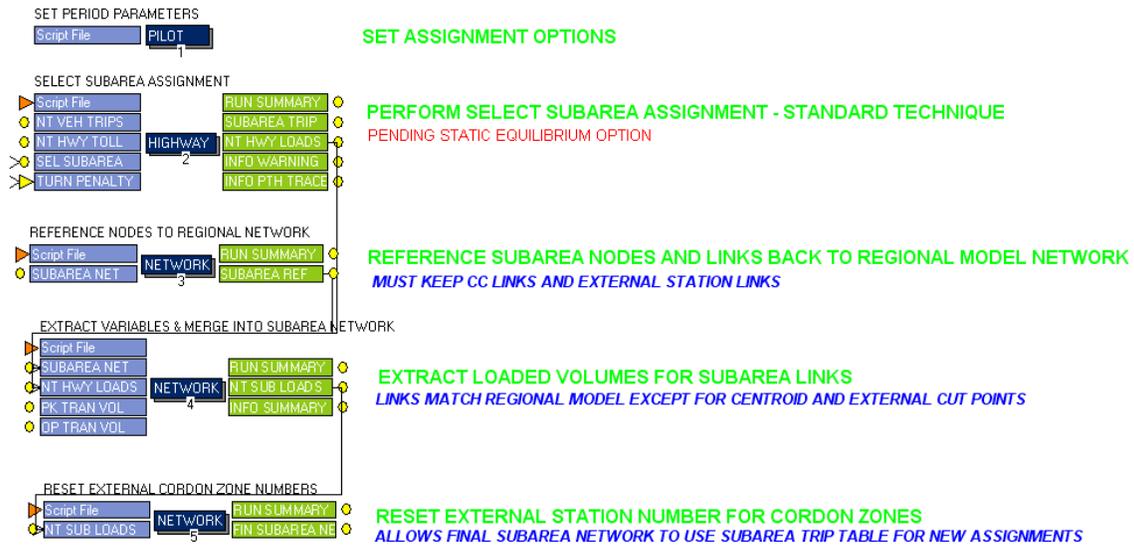
**MIDDAY HIGHWAY ASSIGNMENT FOR SUBAREA**



A subarea trip table and loaded subarea network for the night period are produced in Figure 90. The initial highway assignment loads traffic regionally and simultaneously extracts the subarea trip table and loaded subarea network. Highway-based transit link volumes are then merged in the network via node number renumbering technique. The user can add and perform new assignments on the subarea network using the extracted subarea network and trip table as desired. Note that the link transit volumes used in the merging routine must be created in the “Daily Network Statistics” support application prior execution the subarea extraction application.

**Figure 90 – Night Highway Assignment for Subarea**

**NIGHT HIGHWAY ASSIGNMENT FOR SUBAREA**

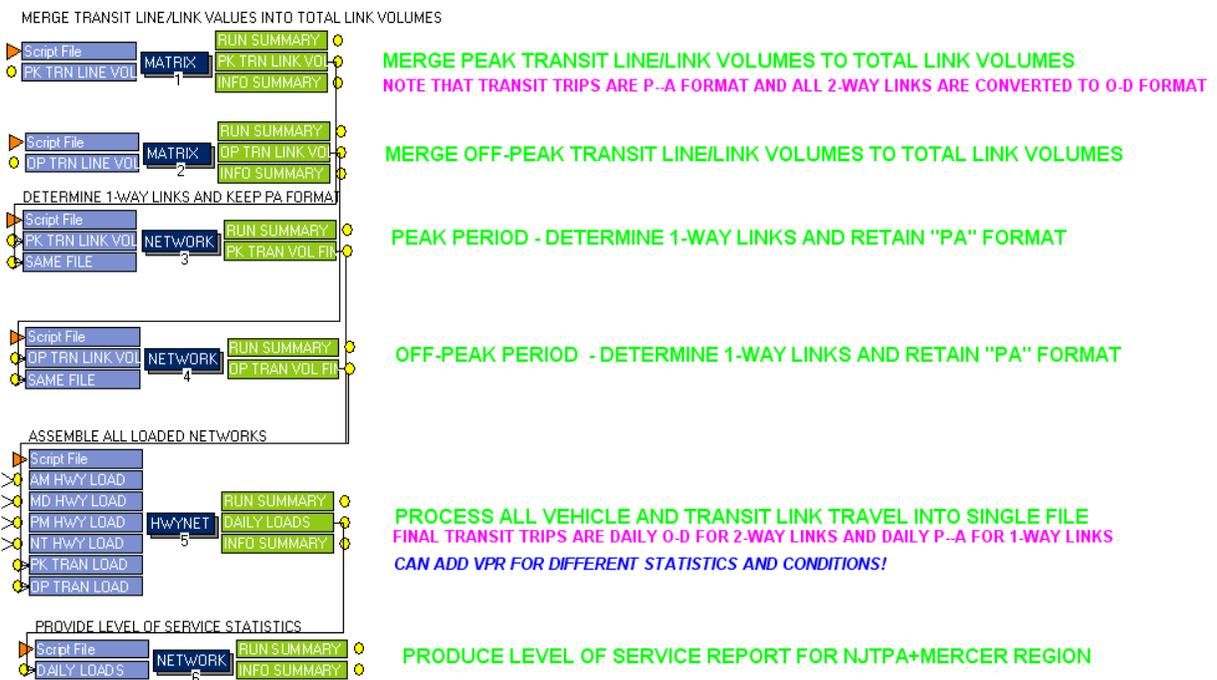


### 5.17 Daily Network Statistics Application

A daily loaded network and corresponding summary statistics are generated by this application, as shown in Figure 91. Transit link volumes are merged to the loaded network as well so that the transit travel pattern can be viewed visually in CUBE environment. Note that production-attraction formatted transit volumes are converted to origin-destination volumes for all two-way links in order to be consistent with format used for vehicles trips loaded to the network. For one-way links, transit trips are retained in the production-attraction format as it is not possible to reference the reverse direction links. Summary statistics including vehicle-miles of travel (VMT) and vehicle-hours of travel (VHT) are produced in the last routine.

Figure 91 – Summary of All Vehicle and Person Trip Network Statistics

#### SUMMARIZE ALL VEHICLE AND PERSON TRIP NETWORK STATISTICS



### 5.18 SUMMIT Preparation Application

This support application is basically an extension of the NJRTM-E mode choice model with options to generate output files used by the FTA SUMMIT program to evaluate potential transit alternatives. The two sub-applications are the peak and off-peak period mode choice models for the NJTPA-controlled region. A series of additional file calls are appended to the controls to generate the additional data required by the SUMMIT program. This application is displayed in Figure 92. Figure 93 and Figure 94 are the sub-applications for each time period.

Figure 92 – Generate Summit Files

## NJTPA MODE CHOICE PROCESS - GENERATE SUMMIT FILES

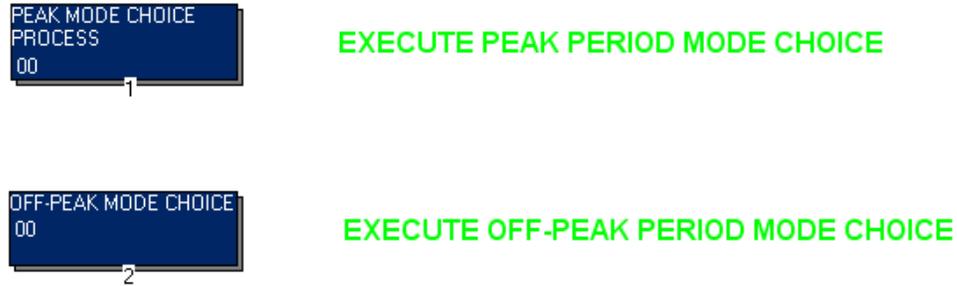


Figure 93 – Peak Period Mode Choice for Summit Analysis

### PEAK PERIOD MODE CHOICE FOR SUMMIT ANALYSIS

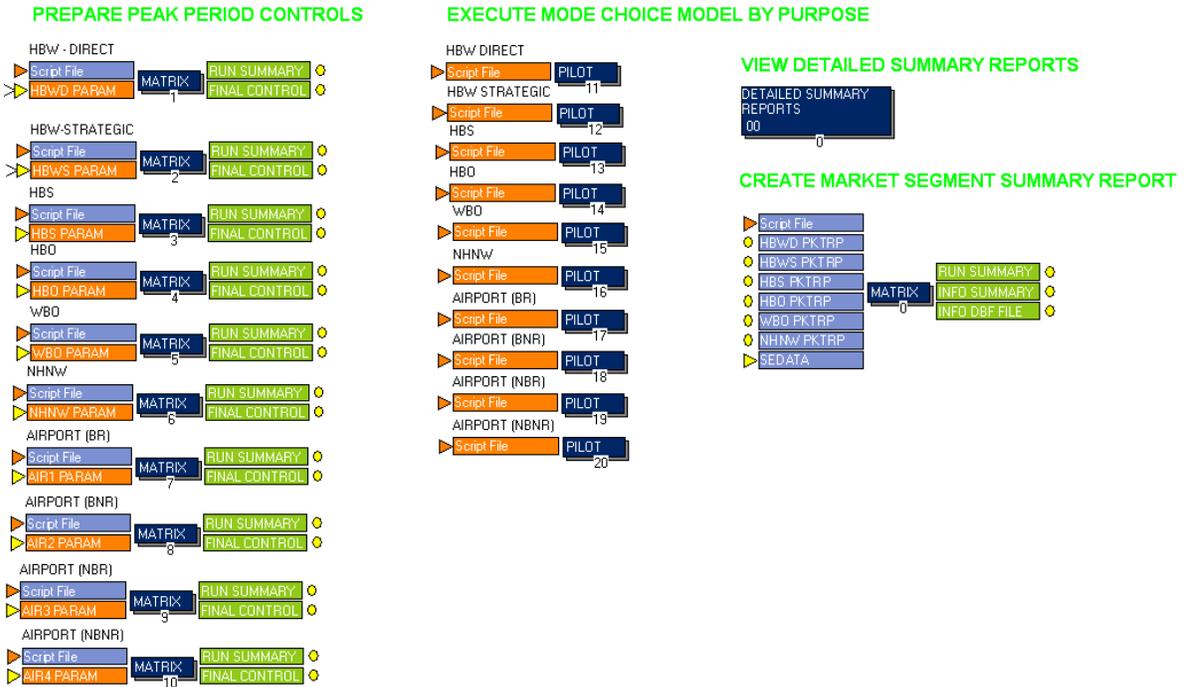
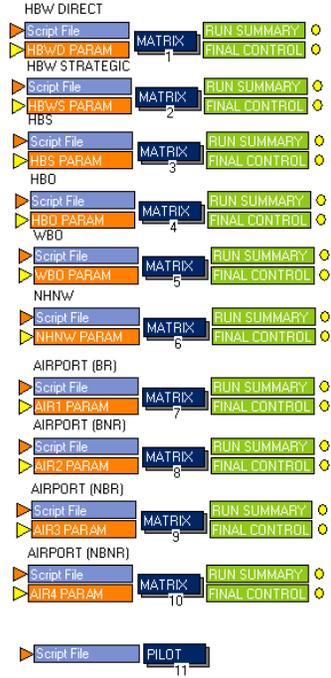


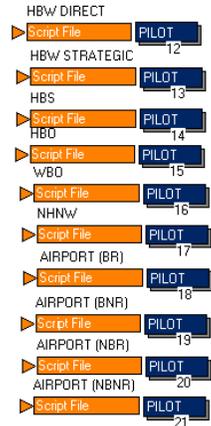
Figure 94 – Off Peak Period Mode Choice for Summit Analysis

**OFF PEAK PERIOD MODE CHOICE FOR SUMMIT ANALYSIS**

**PREPARE OFF-PEAK PERIOD CONTROLS**



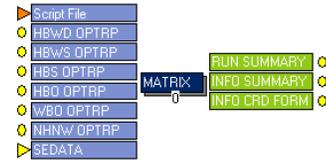
**EXECUTE MODE CHOICE BY PURPOSE**



**VIEW DETAILED SUMMARY REPORTS**



**CREATE MARKET SEGMENT SUMMARY REPORT**



## 5.19 Fixed Distribution Analysis Application

During the course of the model development it was recognized that there would be scenarios where it would be necessary to retain a common or “Fixed” distribution of person trips, particularly in response to FTA requirements of for New Starts analysis. The fixed distribution analysis application, as shown in Figure 95, was developed to satisfy this requirement. Note that this support application is assumed to be performed following the full processing of a standard model run, say a horizon year scenario (2030 nobuild). To prepare for this analysis, the user would copy the specific scenario output directory from the selected scenario into a new directory. As with all new scenarios, the user would also copy the input sub-directories in order to provide as separate version of the inputs for their modification.

To provide the maximum amount of flexibility, the user is permitted to control the specific model components that will be executed for each scenario. This will enable the user to perform only those elements of the model that are deemed necessary for the type and level of analysis desired, thereby minimizing execution time. As an example, if a user was investigating a scenario that featured a widening of a minor roadway that did not provide transit service, the user might wish to avoid executing the transit model components and the mode choice component. In contrast, if a major new transit facility was being developed, the user may wish to see the full impact of this project and therefore would execute both the highway and transit components of the model.

Three scenario keys are used to control this application. The model execution key {moddev} must be enabled (or set to 1) and the user can specify the fixed distribution highway key {fdhwy} and the fixed distribution transit key {fdtransit}. Note that if either of these keys is enabled, the mode choice model will be executed. Enabling both of these keys will execute all highway and transit components. To perform analysis for only the highway side of the model, the user would enable the keys as follows:

Highway Components Only -- {fdhwy}=1, {fdtransit}=0

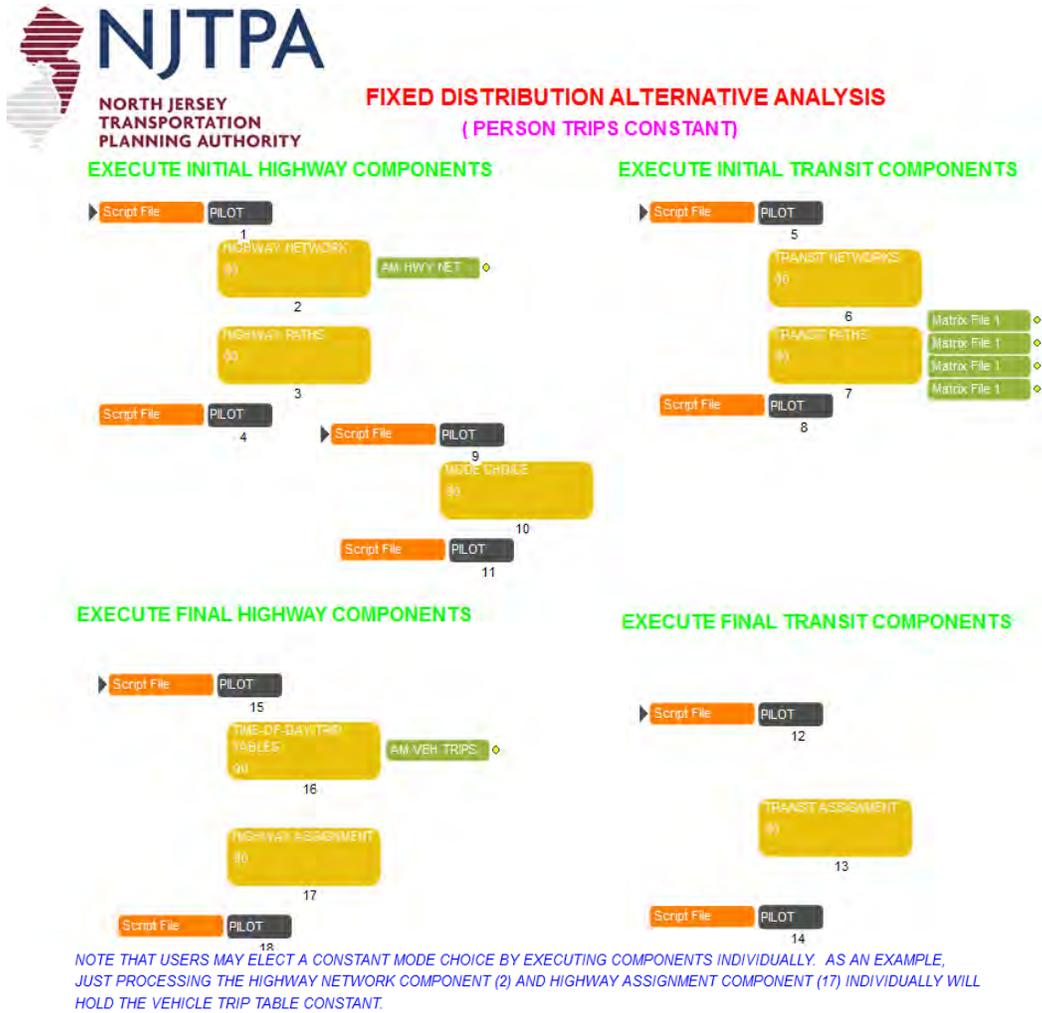
For transit analysis the user would enable the keys as follows:

Transit Components Only -- {fdhwy}=0, {fdtransit}=1

If the user chooses “Highway Components Only” option, only steps 1-4, 9 and 13-16 will be actually executed. If the user chooses “Transit Components Only” option, only steps 5-8, 9, and 10-12 will be actually executed.

Note also that the sub-applications can also be executed independently, similar to the main NJRTM-E model. In a case where the user did not wish to execute mode choice component (say for a minor rural road widening), the user could sequentially execute only the Highway Network Component and the Highway Assignment Component. In this case, the vehicle trip table is held constant and the additional time required to execute the Highway Path-Building Component and mode choice is avoided.

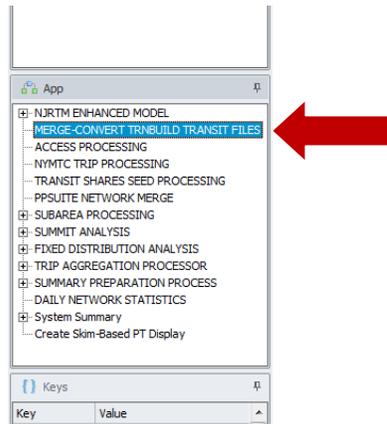
Figure 95 – Fixed Distribution Analysis Application



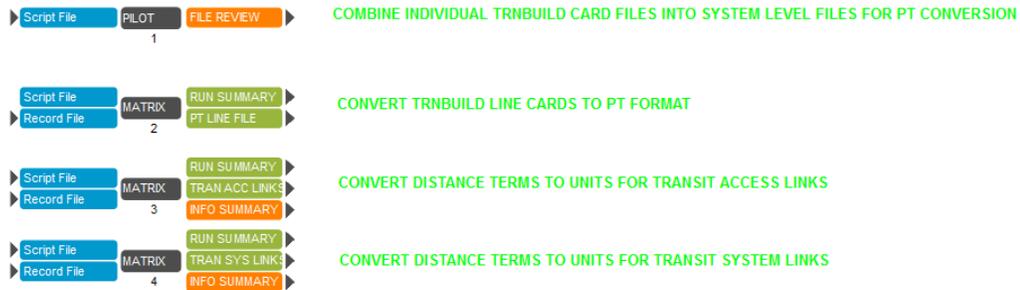
## 5.20 Merge-Convert TRNBUILD Transit Files

In order to facilitate the processing of existing NJT transit networks from earlier models that have been maintained as multiple, partitioned files in TRNBUILD format, this support application will merge the relevant files into a series of individual, unified files representing transit lines, transit access links, and transit system links in preparation for use in the Voyager Public Transport (PT) routine. As shown in Figure 96, the first step of this application merges the individual file types into three separate unified files using the following source files as shown in Figure 97.

**Figure 96 – Fixed Distribution Analysis Application**



**MERGING & INITIAL CONVERSION OF TRNBUILD TRANSIT NETWORK FILES TO PT**



**Figure 97 – Merged Transit Files for PT Module**

UNIFIED FILES		
<i>LINE.TB</i>	<i>ACCESS_TRANSIT_SRC.TB</i>	<i>LINK_TRANSIT_SRC.TB</i>
LINE BUS.TB	ACCESS BUS.TB	LINK BUS XBL.TB
LINE RAIL.TB	ACCESS COMMUTER RAIL.TB	LINK FERRY.TB
LINE FERRY.TB	ACCESS FERRY.TB	LINK LRT.TB
LINE NY SUBWAY.TB	ACCESS LRT.TB	LINK NY SUBWAY.TB
LINE LRT.TB	ACCESS NWK SUBWAY.TB	LINK RAIL.TB
LINE ARTHUR.TB	ACCESS PATH.TB	
	LINK BUS OTHER.TB	
	LINK BUS PNR.TB	

The step also provides a listing of any missing files (displayed in the orange file review output file so that the user can confirm that all files were provided. These input files are assumed to existing in the input network data directory defined by the {NETID} key field and the unified files are retained in this same input directory. Note that the transit node file is already a merged file as part of the standard TRNBUILD networks, so there is not an equivalent merging step for the transit nodes.

The second step of this application converts the merged line file from TRNBUILD format to PT format, thus creating the 'PT Line File'. The remaining two files convert the distance fields from hundredths as required by TRNBUILD into unit values required by PT, while retaining the general formatting appearance familiar to analysts that have developed transit networks using TRNBUILD. Following these conversion steps, the reformatted input files are ready for use in the main NJRTM-E application and can be further edited as part of the main model's transit network component.

**5.21 PT Accessibility Display Tool**

This application was built to prepare a series of shape files for transit accessibility-related display. The main program was developed in Java, and incorporated into the NJRTM-E Model stream as a Cube Voyager Application called "PT ACCESSIBILITY DISPLAY TOOL" as shown in Figure 98. The application is executed by double-clicking "PILOT" box in the application window to bring a new input window as shown in Figure 99.

The analyst need to enter the following information to the input window:

1. Scenario Folder – the scenario that will be processed, including its path. For example, C:\NJRTM-E2013\BASE\C2014 indicates that Scenario C2014 located in "C:\NJRTM-E2013\BASE" folder is selected.
2. Attraction TAZs – the accessibility to these attraction zones will be processed and displayed. The TAZs can be a single TAZ or a series of TAZs. For example, 500 (a single TAZ), 500-510 (a series of TAZ from 500 to 510 are selected).

3. Out-of-Vehicle Travel Time (OVTT) weight – the default value is set at 2.5. The user can update this value if needed.

Figure 98 – PT Accessibility Display Tool Application

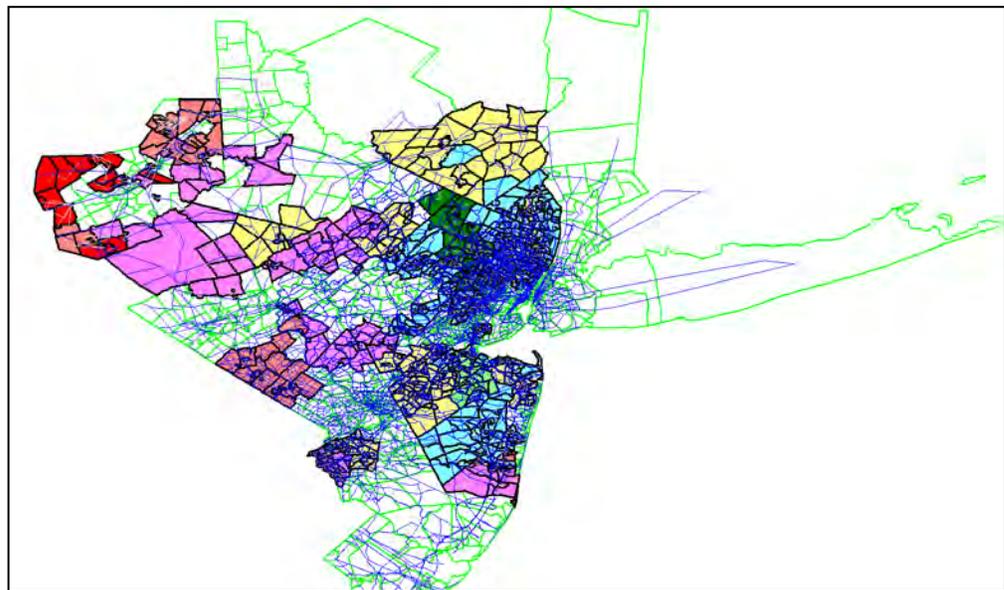
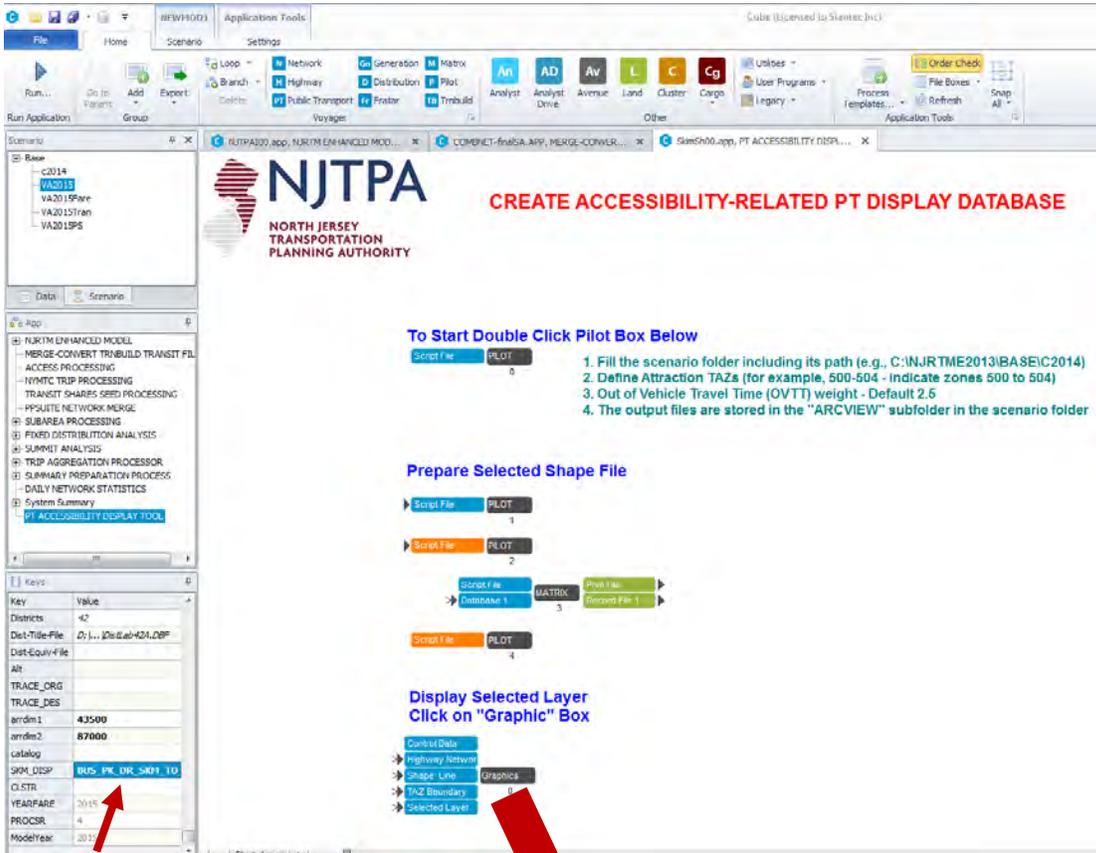


Figure 99 – Accessibility Input Window

Version: 1.06 - 05.22.2015

**AECOM NJRTME Skim Shape File Creator**

Scenario Folder:

Attraction TAZs:

OVTT Weight:

2.5

Only create Best Mode Shape Files

Aggregate Best Mode Shape File By Average

Run

There are two check boxes in the bottom of the input window:

- Only Create Best Mode Shape Files – This property disables the creation of the shape files for each Mode and Attraction TAZ. If it is selected, only the Best Mode Shape File will be created.
- Average Best Mode Shape File by Average - If this checkbox is not selected, different Best Mode Shape Files will be created for each attraction TAZ.

The output shape files will be stored in the “ARCVIEW” subfolder of the Scenario Folder. For example, C:\NJRTM-E2013\BASE\C2014\ARCVIEW.

Upon the completion of the shape file creation, the users can select the shape file that will be displayed, by providing the name of the shape file (without extension) to the SKM\_DISP key variable as shown in Figure 93. After running the application, the selected shape file can be open by double-clicking the “graphic” box. The color shows in the display indicate the values of the In-Vehicle Time (IVTT). The red shows the highest value, while green the lowest.

## 6.0 Model Use and Execution

The execution process for the NJRTM-E was structured in a manner to provide a significant amount of flexibility in terms of developing scenarios. In the development of this approach, a decision was made to integrate all the input data files into separate input directories that contain specific elements of the model inputs. With this approach, a scenario is created simply by selecting a series of input folders. This approach was developed specifically to facilitate the use and understanding of each scenario developed as well as to streamline the process used to archive a completed scenario. A complete “scenario” therefore includes two separate input data sets in specific directories and an output scenario directory that contains all the output files and listing files. Therefore, to archive a model run, the user needs only to identify the two input directories and the scenario’s output directory.

Note that this approach to data storage represents a balance between minimizing input data storage and simplifying the archiving of completed scenarios. An alternative approach would be to store all input files (networks and zonal files) in a single directory for general use. This approach would minimize input data storage on the hard drive since common files for a given network or socioeconomic growth assumption would exist at single location in a general data directory. However, using one directory for all input files could make identifying and storing the correct input files associated with a given scenario confusing, therefore, the model uses separate input directories for each scenario.

### 6.1 Input Directory Structure

As discussed as part of the model installation process, the model has several associated subdirectories including a data directory called “modeldata”. The modeldata directory contains many input directories, each representing either a network condition or a socioeconomic condition for a given model year. As noted above, the user would select one network and one socioeconomic condition (subdirectories) as part of creating a scenario. A description of all files in the input directories is provided in Appendix D.

Two basic input “data sets” are required for each scenario. Each of these data sets is stored in a unique directory. The first set of data describes the transportation network and is located in a “network” directory. Each network directory includes all transportation network attributes and parameters for both the highway and transit systems. Note that all the data files in a given directory are related to a single network condition and that the various elements (highway and transit elements) are fully integrated. As an example, the user can create a directory called “2015NB” for the no-build network in the year 2015. In this example, the user could simply copy the 2010 network directory into the 2015NB directory, assuming that the 2015 “no-build” network would be same as the 2010 network.

The second data set contains all zonal data and parameters related to the zonal system. This data is stored in a “socioeconomic data” directory. Similar to the network directory, all of the files in a given socioeconomic data directory represent a unique condition of forecasted demographic assumptions and values for a particular horizon year. As an example, the directory containing the NJTPA-approved socioeconomic forecasts for the year 2020 could be named “2020MPO”. The data in each of these directories includes typical variables such as population and employment, as well as other variables that are directly or largely related to the zonal system. For example, parking cost is treated as a zonal variable, even though it might be influenced by an existing transportation

network element (say, a transit station) or altered due to a planned transportation improvement project.

Note that the data for each network and socioeconomic directory must be prepared prior to execution of a scenario. A basic approach to creating the necessary data for each directory would be to copy an existing directory and then alter the specific elements within CUBE that are to be included in a new scenario. As example, if a scenario included the widening of an existing roadway in the year 2010, the analyst could simply copy the existing 2010 base network directory and alter the necessary links within CUBE prior to executing the scenario. Similarly, if a scenario assumed a revised set of growth assumptions for a given municipality in the year 2010, the analyst could copy the 2010 MPO socioeconomic data directory and then alter the zones associated with the municipality directly within CUBE.

## 6.2 Scenario Selection

Prior to executing the model, the analyst has either to select an existing scenario or create a new scenario. By selecting a scenario, it will define the scenario properties, select input data, and create a folder in which all output files will be stored. The list of existing scenarios is displayed in the Scenario Window on the upper left section of the screen as shown in Figure 100.

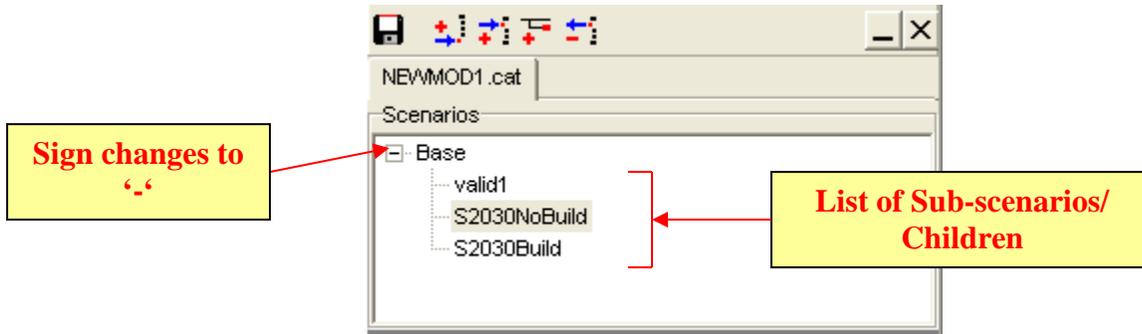
Figure 100 – Scenario Window



The name shown in the scenario window (“Base”) indicates a directory or folder name in which all the scenarios will be stored. The “+” sign in front of the folder name indicates that the folder contains several scenarios. To display all scenarios, the user can click the “+” sign with the left-button on

the mouse. The sign then will change to “-“and the scenarios contained in this folder will be displayed. A sample of full list of scenarios is shown in Figure 101.

**Figure 101 – Display of Scenario List**

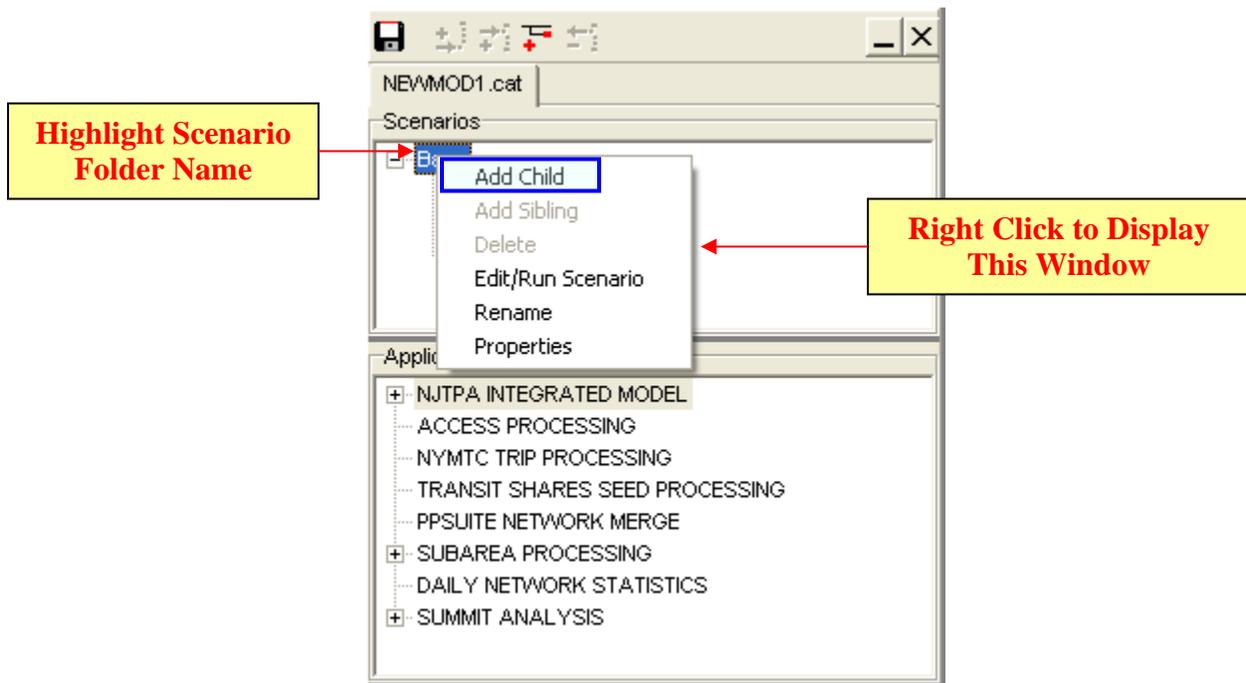


The analyst can highlight a scenario from the scenario list to select an existing scenario. In addition to executing an existing scenario, the analyst can also create a new scenario. There are two ways to create a new scenario, the first technique is:

- highlight the folder name (“Base” in our sample)
- right click and then select “Add Child”

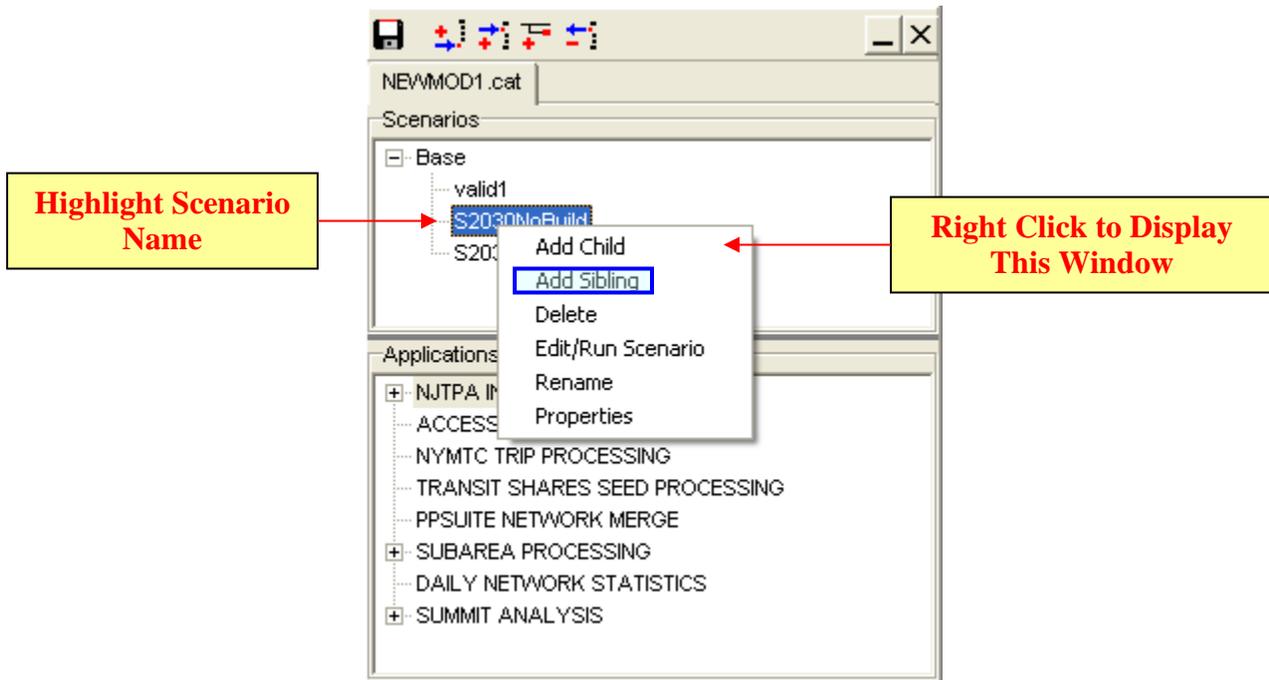
This technique is shown in Figure 102.

**Figure 102 – Create a New Scenario from Folder Name**



The second technique is to highlight a scenario name, right click on the name, and then select “Add Sibling” as shown in Figure 103.

**Figure 103 – Create a New Scenario from an Existing Scenario**



### 6.3 Scenario Keys and Properties

When a new scenario is created, the analyst is prompted to fill scenario properties, such as “Code”, and “Description”. The analyst can use these fields to provide descriptive phrases to identify the scenario. Note that the code field should be unique for each scenario being created. Figure 104 shows the scenario properties window. Following the scenario properties window, the analyst will be prompted to fill or updates a set of parameters specific to the scenario. Figure 105 shows the list of parameters included in the scenario keys window. For an existing scenario, the analyst can display scenario properties window by double right-clicking the scenario name. The same window (Figure 105) will be shown and revisions can be performed by changing the parameters values.

Figure 104 - Scenario Properties Window

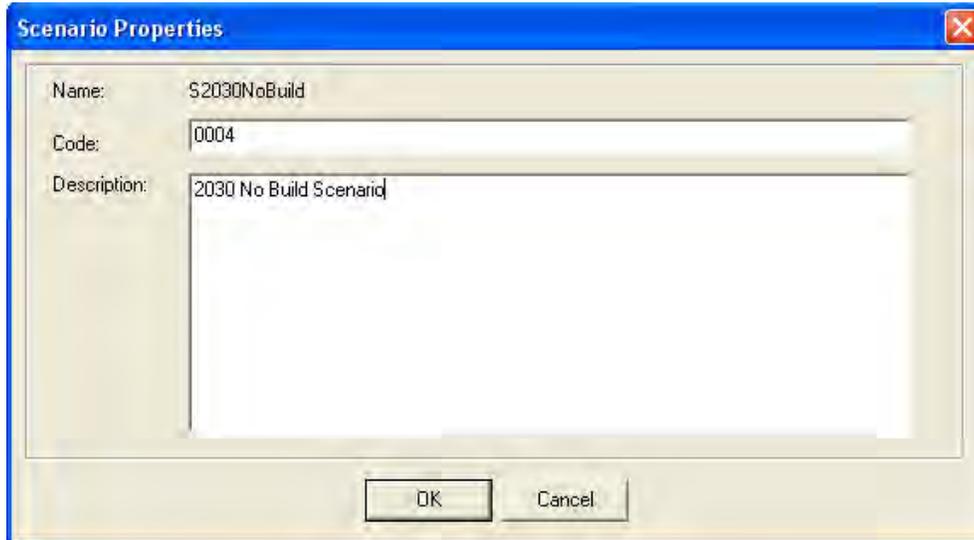
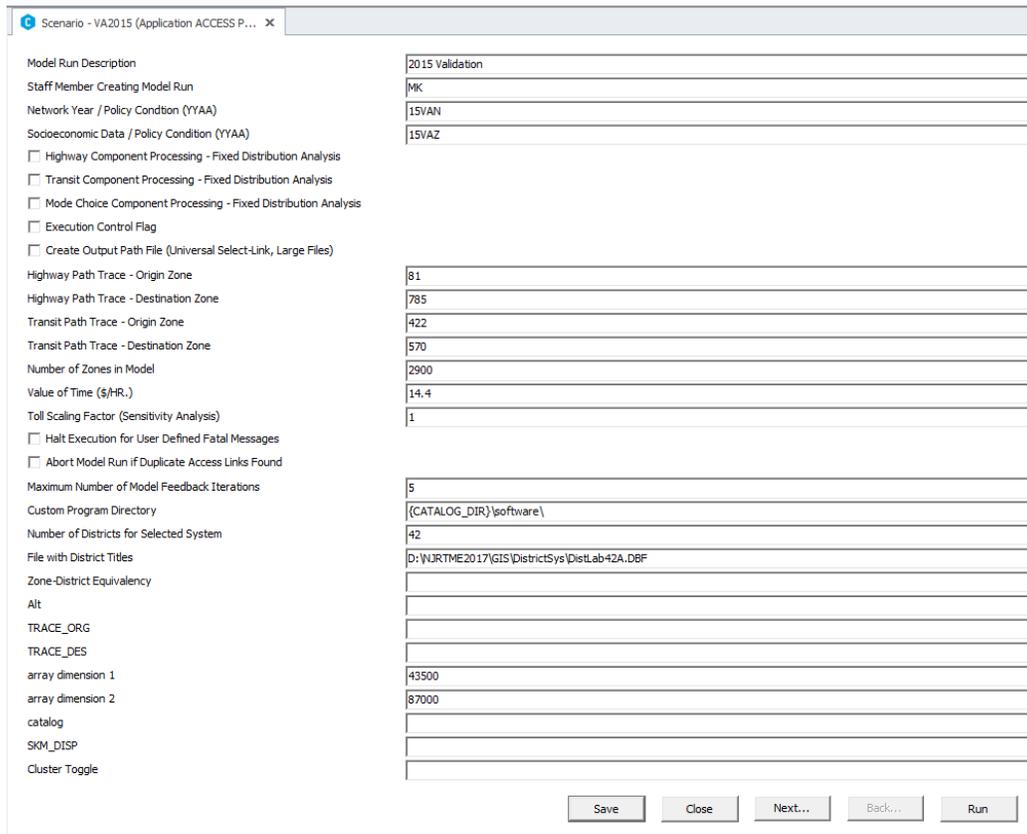


Figure 105 – Scenario Keys Window



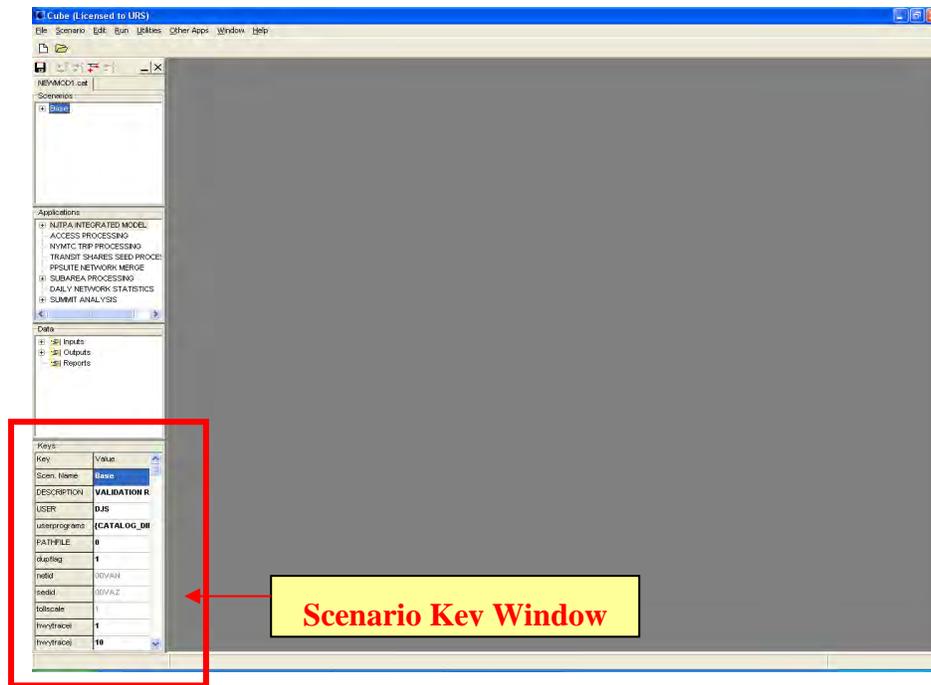
The scenario keys included in the scenario keys window, along with the individual the key names in brackets {}, are described as follows:

- Model Run Description {description} – Option for users to insert a brief description about the scenario.
- Staff Member Creating Model Run {User} – Option to identify User/Agency that developed the scenario.
- Network Year/Policy Condition {netid} – identifies the sub-directory where all of the network data and other related network parameters are stored. This subdirectory is located within the “modeldata” directory and a valid subdirectory must be used for each scenario.
- Socioeconomic Year/Policy Condition {sedid} – identifies the sub-directory where all of the socioeconomic data and other zonal data are stored. This subdirectory is located within the “modeldata” directory and a valid subdirectory must be used for each scenario.
- Highway Component Processing - Fixed Distribution Analysis {fdhwy} – This parameter controls the selection highway components for fixed trip distribution analysis.
- Transit Component Processing - Fixed Distribution Analysis {fdtransit} – This parameter controls the selection transit components for fixed trip distribution analysis.
- Model Execution Control Flag {moddev} – This parameter controls the general execution of the model. The default value of zero is used for full multi-iteration model runs. The value of 1 is used if the analyst is executing only selected model elements in a sequential manner.
- Create Output Path File {Pathfile} – This key enables the universal select-link option. Checking the box (or a value of 1 in the key display) will create the loaded path files for each time period of the highway assignment. Note that each of these files is very large and that these files are useful only if graphical displays of select-link data are required. The value zero (default) will prevent these files from being generated.
- Origin Zone for Highway Path Trace {hwytracei} – This is the origin zone (i) number for to be used generate a detailed listing of nodes and impedances for tracing highway paths. A value of zero will suppress the path tracing.
- Destination Zone for Highway Path Trace {hwytracej} – This is the destination zone (j) number for to be used generate a detailed listing of nodes and impedances for tracing highway paths. A value of zero will suppress the path tracing.
- Origin Zone for Transit Path Trace {trantracei} – This is the origin zone (i) number for to be used generate a detailed listing of nodes and impedances for tracing transit paths. A value of zero will suppress the path tracing
- Destination Zone for Transit Path Trace {trantracej} – This is the destination zone (j) number for to be used generate a detailed listing of nodes and impedances for tracing transit paths. A value of zero will suppress the path tracing.
- Number of zones in Model {zones} – This parameter indicates the number of zones in the model. In a future model version, it will be used to automatically adjust the number of zones to be processed by the model.
- Value of time {vot} – This parameters indicates the value of time used in the model for development of the composite impedance term for trip distribution. This parameter should not be changed for most model applications.
- Factor for Scaling Tolls {tollscale} – This parameter is valuable for toll sensitivity testing but would not be altered for most model applications.
- Halt Execution for User-Defined Fatal Messages {abortflag} - Abort Model Run if model identified conditions that users have defined as fatal conditions. These errors are conditions that should be corrected to address minor errors in the model run. As an example, improperly coded turn penalties. There has been limited testing of this parameter during the model development process.

- Abort Model if Duplicate Access Links Found {dupflag} – This option was created to identify if duplicate access links are created. The default value is zero and it is not anticipated that this parameter would change as part of normal executions.
- Maximum number of model feedback iterations {maxiters} – This parameter can be used to define the number of feedback iterations desired by an analyst. The default value of 7 should be sufficient for most horizon years.
- Directory with user programs {userprograms} – Indicates directory where customized software is stored. This key should not be modified.
- Array1 Dimension {arrdim1} – This Array is used within trip generation and the value is the number of zones \* 15. This value should not be changed unless the number of zones is increased
- Array2 Dimension {arrdim2} – This Array is used within trip generation and the value is the number of zones \* 30. This value should not be changed unless the number of zones is increased.

For an existing scenario there is another way to revise or update scenario keys. In the lower portion of the screen, there is a display of “Scenario Key Window” as shown in Figure 106.

**Figure 106 – Scenario Keys Window**



The updates or revisions can be performed directly by changing parameters values in this window. Figure 107 shows an enlarged display of this window. Note that Cube Cluster is an add-on to the Cube package that distributes modeling processes across multiple computer cores, which significantly reduces the running time. CUBE Cluster can be enabled or disabled by using two additional key variables called “PROCSR” and “CLSTR”. To disable the Cluster processing feature, a semicolon (;) should be input into the CLSTR (or Cluster Toggle Field) as shown in Figure Figure 107 and Figure 108, and to enable the Cluster processing feature, a space should be input into this variable. The value entered in the ‘PROCSR’ field indicates the number of processors that will be

used for the model run. This number can vary based on the user’s computer processor (e.g. quad-core processors can use 4 processors).

**Figure 107 – Scenario Keys Window**

Key	Value
hwytracei	81
hwytracej	785
trantracei	422
trantracej	570
zones	2900
vot	14.4
tollscale	1
abortflag	0
dupflag	0
maxmoditr	1
Userprograms	{CATALOG_DIR}\software
Districts	42
Dist-Title-File	D:\... \DistrictSys\DistLab42A.DBF
Dist-Equiv-File	
Alt	
TRACE_ORG	
TRACE_DES	
arrdim1	43500
arrdim2	87000
catalog	
SKM_DISP	
CLSTR	;
YEARFARE	2015
PROCSR	4
ModelYear	2015

**Figure 108 – Scenario Keys Window**

The screenshot shows a software interface with a left-hand menu listing various model components and a main area with corresponding input fields. A red box highlights the bottom of the input fields area.

Model Run Description	2015 Inulation
Start/End User - Creating Model Run	96
Network Year / Policy Condition (YFAA)	15VAN
Socioeconomic Data / Policy Condition (YFAA)	15VAZ
<input type="checkbox"/> Highway Component Processing - Fixed Distribution Analysis	
<input type="checkbox"/> Transit Component Processing - Fixed Distribution Analysis	
<input type="checkbox"/> Mode Choice Component Processing - Fixed Distribution Analysis	
<input type="checkbox"/> Execution Control Flag	
<input type="checkbox"/> Create Output Path File (Universal Select-Link, Large Files)	
Highway Path Trace - Origin Zone	81
Highway Path Trace - Destination Zone	785
Transit Path Trace - Origin Zone	422
Transit Path Trace - Destination Zone	570
Number of Zones in Model	2900
Value of Time (\$/hr.)	14.4
Toll Scaling Factor (Sensitivity Analysis)	1
<input type="checkbox"/> Halt Execution for User Defined Fatal Messages	
<input type="checkbox"/> Abort Model Run if Duplicate Access Links Found	
Maximum Number of Model Feedback Iterations	5
Custom Program Directory	{CATALOG_DIR}\software
Number of Districts for Selected System	42
File with District Titles	D:\... \DistrictSys\DistLab42A.DBF
Zone District Equivalency	
Alt	
TRACE_ORG	
TRACE_DES	
array dimension 1	43500
array dimension 2	87000
catalog	
skm_disp	
Cluster Toggle	

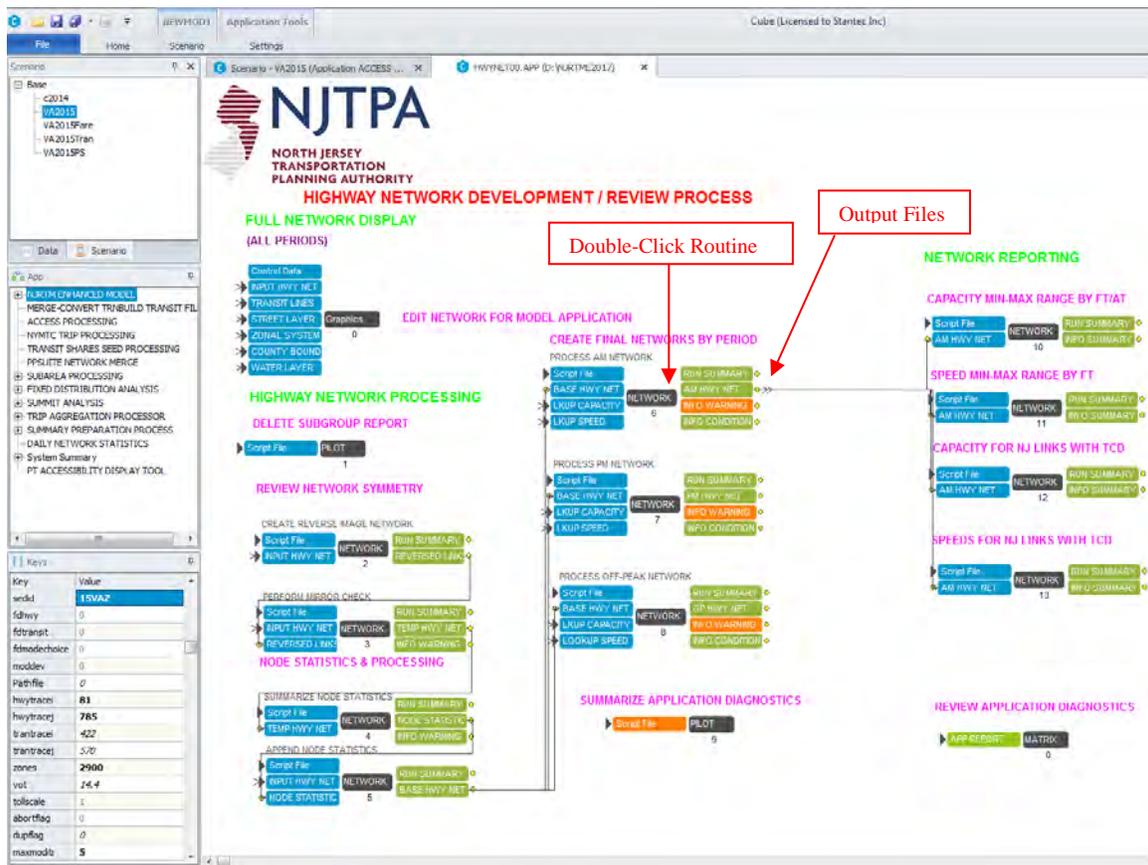
## **6.4 Execution Process**

CUBE provides several methods to control the execution of the model. These methods are useful for selective processing of individual components or routines in specific situations where networks are being developed and tested. Normally, the user will execute the entire model either as a full iterative model with feedback or under the fixed distribution analysis option where the person trip matrices are held constant. The following sections of this report provide examples of the selective execution as well as the full model execution.

## 6.5 Single Routine Execution

In order to execute a single routine within NJRTM-E, the user must designate the execution is a stand-alone execution rather than a full model run with feedback iterations. The user designates the selective execution by setting the “Execution Control Flag” {moddev} to a value of 1 or checking the box in the scenario editing panel. To execute a single routine, a user can simply double-click on a routine and it will launch immediately. As an example, Figure 109 provides a graphic display of selecting a NETWORK routine (listed as the 6<sup>th</sup> step shown as the yellow box) within the NJRTM-E Highway Network Development Application. It should be noted that the application will use the input files and parameters that have been specified in the current data files and the output scenario directory.

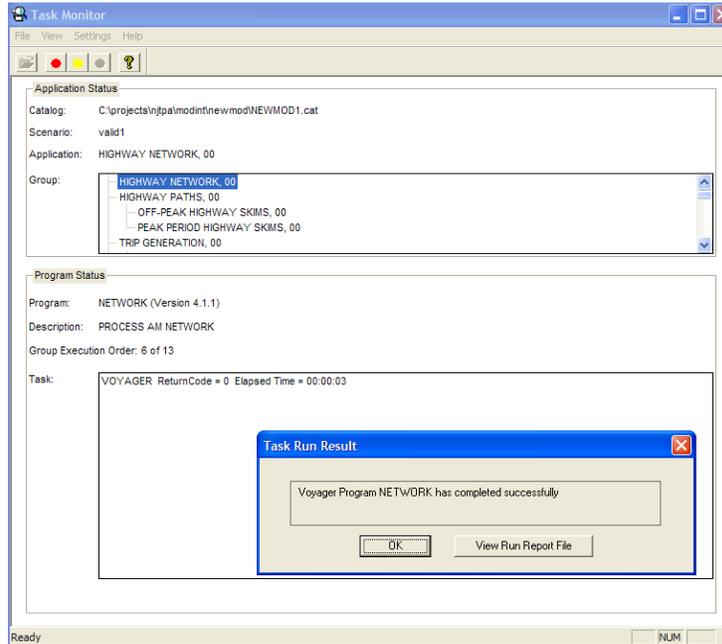
Figure 109 – Single Routine Execution



Note that to review the results of the model execution, the run summary listing and output files associated with this NETWORK routine will be updated at the conclusion of the execution.

Upon execution, CUBE will launch an execution window that shows the progress of the execution and will indicate the completion of routine. Figure 110 displays the task monitor window along with the message displayed at the end of a successful conclusion.

**Figure 110 – Task Monitor Window**

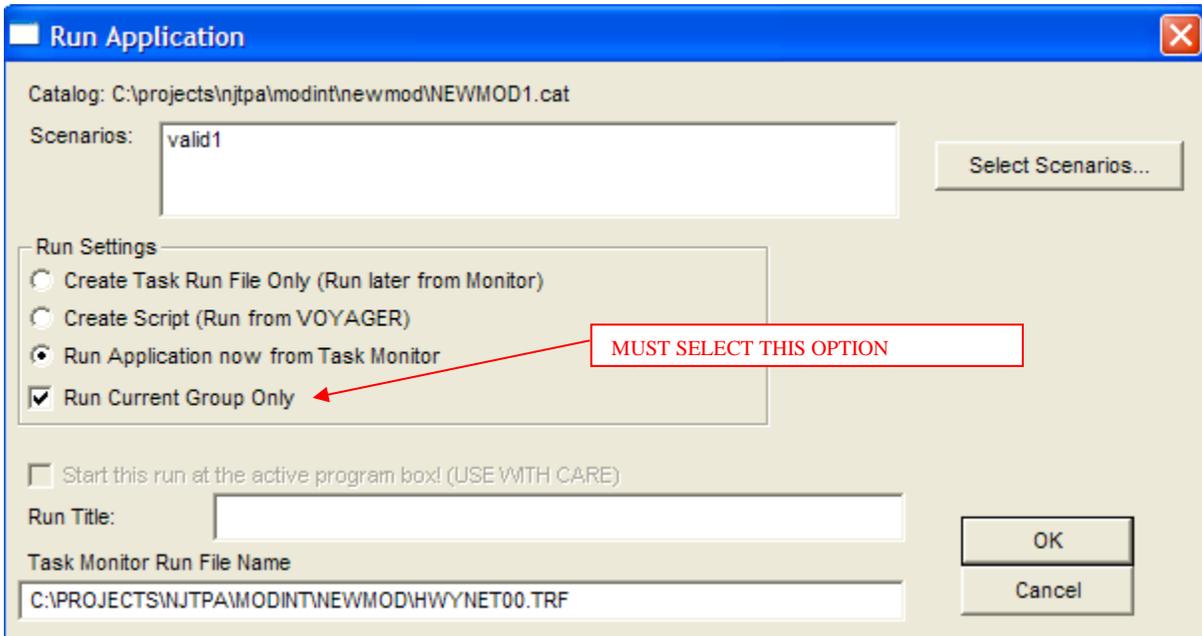


For several routines, such as highway assignment and the transit path building applications, it is necessary to execute the entire application since parameters are defined as substitutable arguments in the initial routine of the application. These parameters are normally defined in PILOT routine as the first step of the application.

## 6.6 Single Application Execution

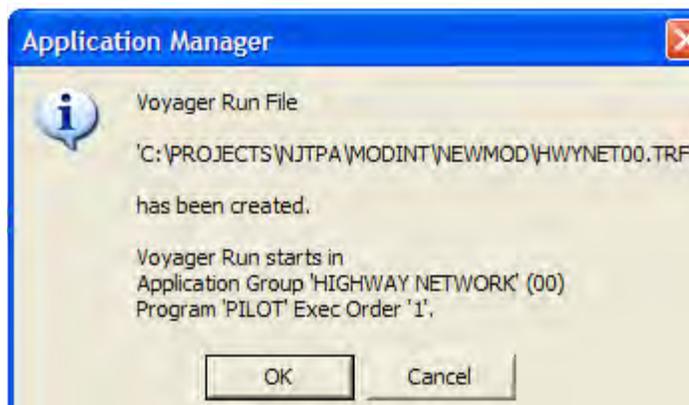
A more common situation is the execution of a full application, say highway assignment, where only selected inputs are being modified. When an application is being executed CUBE runs all of the “non-zero” routines in numerical order. The numerical order is defined by the number shown at the bottom of each routine box. Note that routines with zero execution numbers can only be executed manually. Similar to the execution of single routine, the user must designate that a selective execution is being performed by setting the “Execution Control Flag” {moddev} to a value of 1 or checking the box in the scenario editing panel. Launching a single application is accomplished in one of two methods. The user can simply press the F2 Key or selecting the “Application” and “Run Application” options from the CUBE menu. With either method, CUBE will display a dialog box as shown in Figure 111. From this dialog box, the user must check the “Run This Application Only”. If the user does not enable this option, the entire NJRTM-E will be executed rather than just the current application.

**Figure 111 – Single Application Execution**



After the user confirms the selected settings by selecting “OK”, CUBE will prepare an execution script and search for all of the necessary files. Normally a confirmation dialog box will be displayed as shown in Figure 112. After the user confirms the request to execute the script, the task monitor window will be launched so that the user can monitor for each routine in the application.

**Figure 112 – Execution Script / Launch Confirmation**

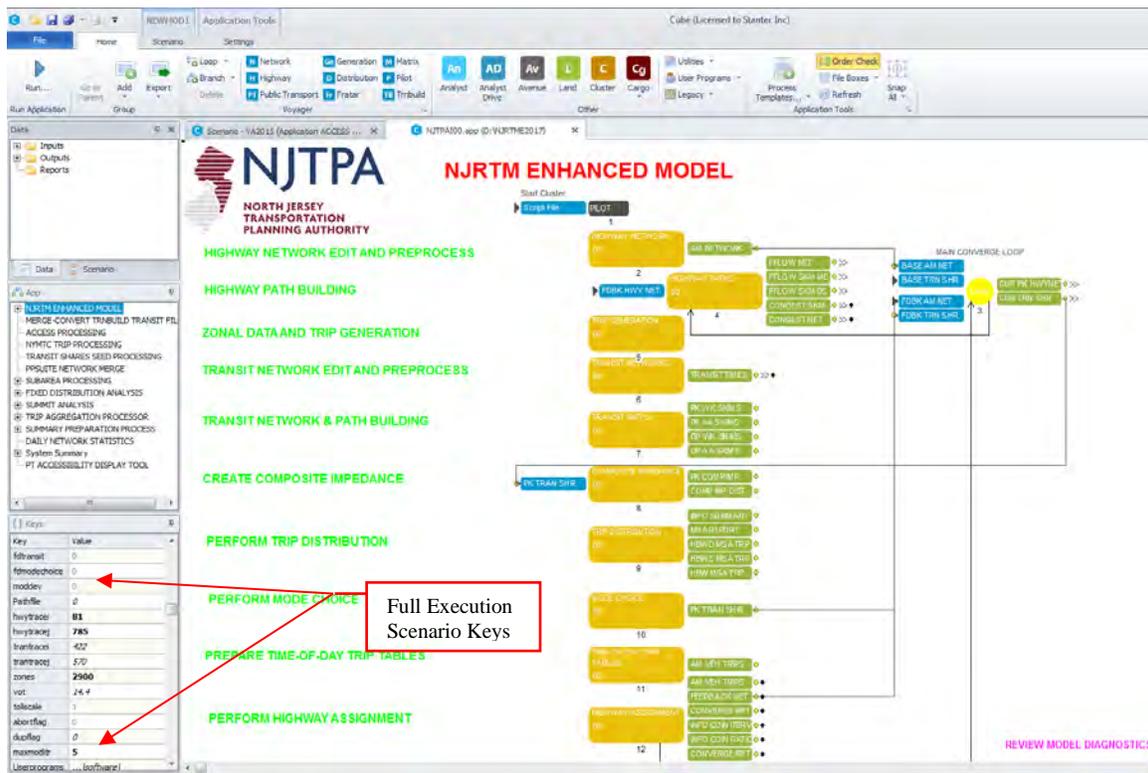


Note that if the application is being launched and necessary input files are not available, the user will still have the option to launch the application. The application will execute up to the step where the missing input files are required.

## 6.7 Full Model Execution

In order to execute the full model with the iterative feedback process, the user would normally be within the main application (NJRTM Enhanced Model), as shown in Figure 113 and will have completed all of the necessary editing for the various input files. The user will also need to ensure that certain scenario keys are properly defined. The model execution control key {moddev} must be set to zero (or unchecked, if the scenario is being launched from the edit/run menu option) and the maximum number of model iterations needs to be set to 7. To launch the application, the user can then selection Application/Run Application menu options at which point CUBE will generate the full model application script, check for the existence of all input files, and then following the user’s confirmation, initiate the model run. Note that when running the model for the first time, many of the output files that are used as inputs in subsequent steps will be listed as “not found”. This is not an error condition, but the user is encouraged to review the listing of missing files to ensure that all files are present for the execution.

Figure 113 - NJRTM Enhanced Model Application



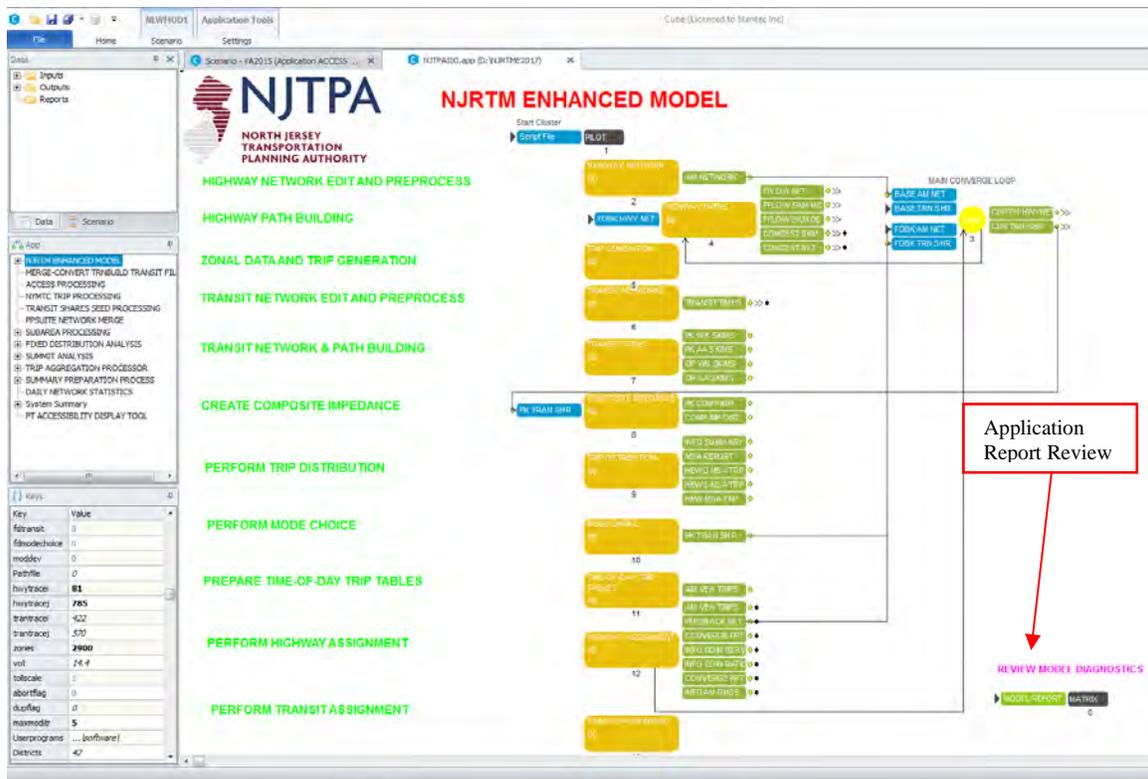
Note that the user must ensure that all necessary files from the input-related support applications must be available for the execution of the full model. These required support applications and the required files were discussed previously as part of Section 5.13.

## 6.8 Execution Summary Diagnostics

The execution of a scenario generates a large set of output listing files and customized reports designed specifically to inform the user of issues that occurred during the model run. Because of the model's complexity, a summary of key diagnostic reports are generated for specific applications within the NJRTM-E. Most of these applications are components where input data is accessed by the user and/or modified by the model prior to its use in subsequent step of the modeling process.

The summary diagnostic reports utilize a hierarchical system where individual component reports are merged into an overall "application report". The application report is accessible directly within the NJRTM Enhanced Model Application by double clicking the Review Report box on the lower right-hand side of the flowchart display, as shown in Figure 114. At the conclusion of a standard model run, a user would initially inspect the application report to determine if any critical errors and unexpected warnings occurred. Since the model has an iterative feedback process, the reports of individual applications are generated during each iteration and appended to the main report as necessary. As an example, peak period highway path-building is summarized for each iteration of the model, since the congestion and travel paths vary as a result of the previous assignment steps.

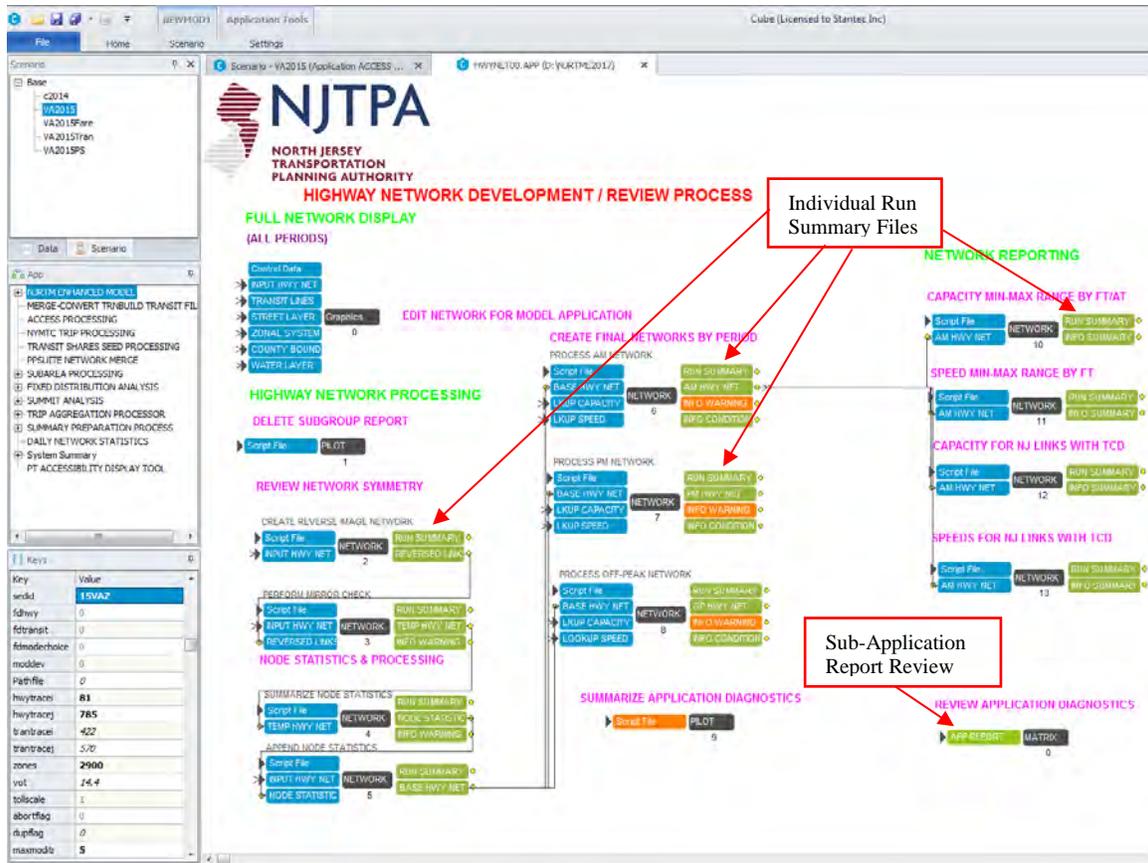
Figure 114 – Accessing Application Report



After reviewing the main application report, the user could then review the individual run summaries from all of the steps within a given application. As an example, if problems were identified in the highway network processing, the user would open the highway network development application (as shown in Figure 115) and review the individual run summary reports from each step in order to

review the warnings in further detail. For reference, the user can also review the application diagnostics for this particular application as shown in the lower right-hand side of the flowchart.

Figure 115 – Sub-Application and Run Summary Review



The run summary reports are listing files of the standard Voyager routines and contain detailed information about the input and output files from each step of the application. Included in these summary reports are any warnings or errors encountered in the processing of the data along with information about the ranges of input file variables. This detailed information is also useful to check the reasonableness of the data sets and the resulting output files.

## **6.9 Scenario Archiving Process**

The archiving process for a full model run of the NJRTM-E is accomplished by preparing copies of three model directories. These directories include two input subdirectories and the scenario directory that contains all output files and listings. The user would normally copy all of these directories onto a series of DVDs. Since the current output files exceed the storage limitations of a single dual-layer DVD, it will be necessary to store a single run to multiple DVDs. Most DVD software permits storing archives across multiple DVDs. As an alternative approach, the user can elect to store a series of critical scenarios to small portable external hard-drive. This approach is the most efficient method of storing and transporting a large number of scenarios.

Since the NJRTM-E is currently an “open model” where the user has access to many of the standard model procedures and common parameters, it is recommended that the user also archive the main model directory for critical scenarios, such as those that might be used in the regional conformity analysis. Archiving this directory will ensure that other input parameters (such as trip generation rates or friction factors) used during the execution of these scenarios are available and can be restored if necessary.

## 7.0 Typical Analysis Tasks

This section of the user's guide provides procedures to perform common tasks associated with the preparation of the various input data sets. The discussions are focused primarily on the specific coding requirements used in the NJRTM-E. The discussion also includes some instructions for the general editing features provided within CUBE. Note that since most of the input files are either DBASE files or ASCII text files, the user can also edit some of the files via standard methods outside of CUBE. As an example, a user may want to perform some large scale modifications to the socioeconomic data and since the zonal file with this data is maintained in DBASE format, the user could easily edit the file in Microsoft EXCEL or ACCESS

The typical tasks are stratified into several broad areas including the modifications to the zonal data containing socioeconomic data and other zone-related data. A series of typical network modification tasks are also included for both the highway and transit networks. Lastly, examples of utilizing some of the output support applications are provided including the subarea extraction and transit walk access coverage.

Note that the following examples represent only a subset of all of the potential editing tasks that might be performed during a project. The examples provide the process to access the data and perform the editing tasks. With an understanding of how to access the various input files for the network and zonal data, the user can easily modify any of the variables. A comprehensive list of all of the available data files and descriptions of the fields are provided in Appendix E.

### 7.1 Socioeconomic Data and Zonal Data Modification

A common task in modeling would be to modify the attributes selected zones in a corridor based on some policy initiative, such as New Jersey's Smart Growth Initiative. To update the socioeconomic data in the NJRTM-E, the analyst would access the socioeconomic data file through the following series of steps:

1. Select the "Trip Generation Module" from the main application of the NJRTM-E as shown in Figure 116 and then select Socioeconomic Data application from the Trip Generation Module as displayed in Figure 117.

Figure 116 – Trip Generation Module

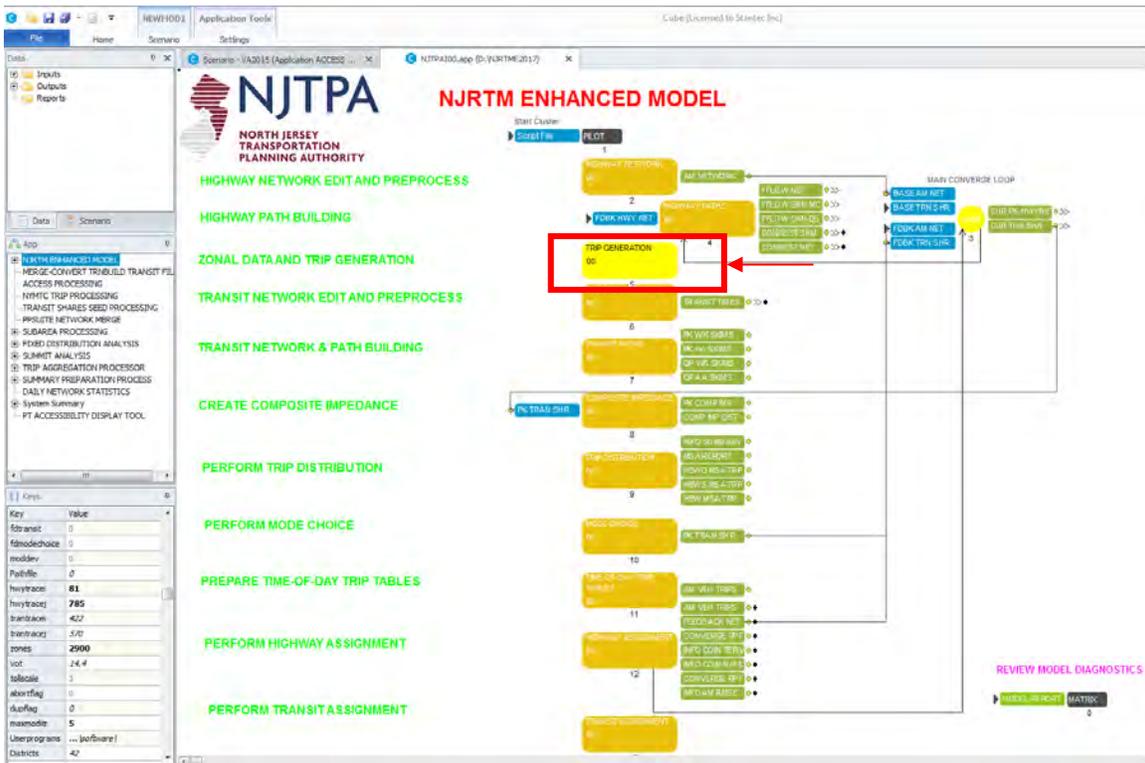
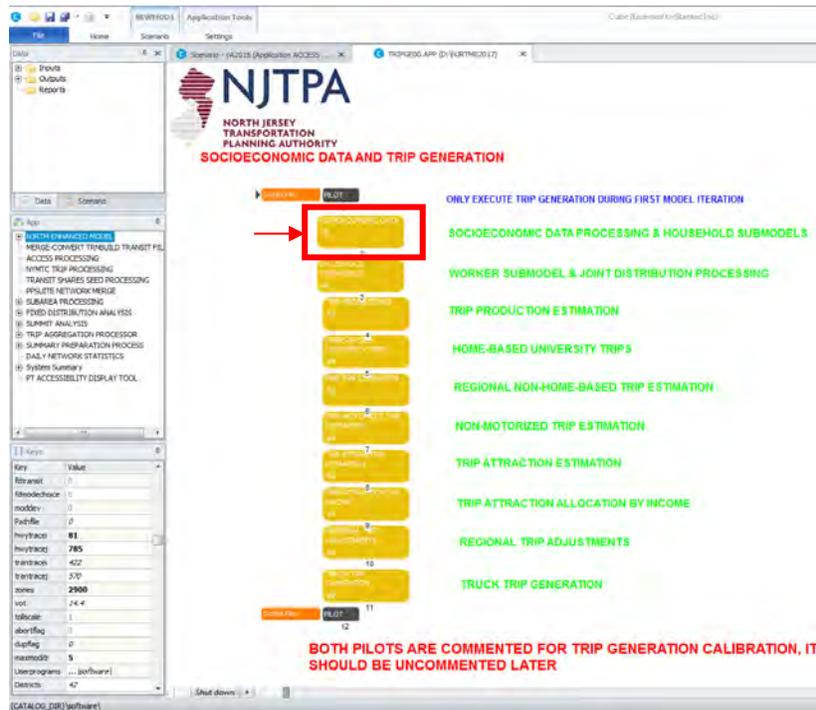
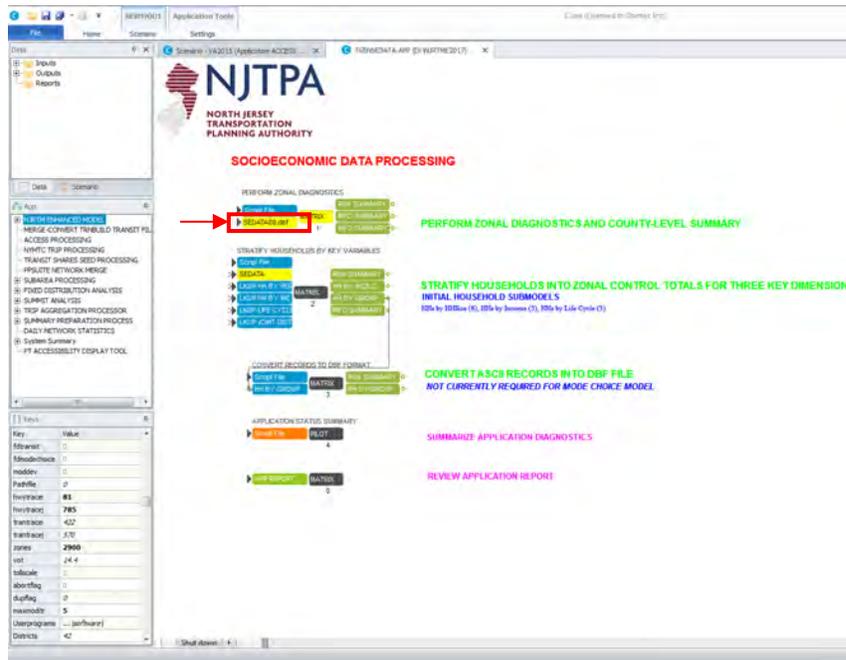


Figure 117 – Socioeconomic Data



2. Select SE Data file box from Socioeconomic Data Processing application as shown in Figure 118.

Figure 118 – Socioeconomic Data



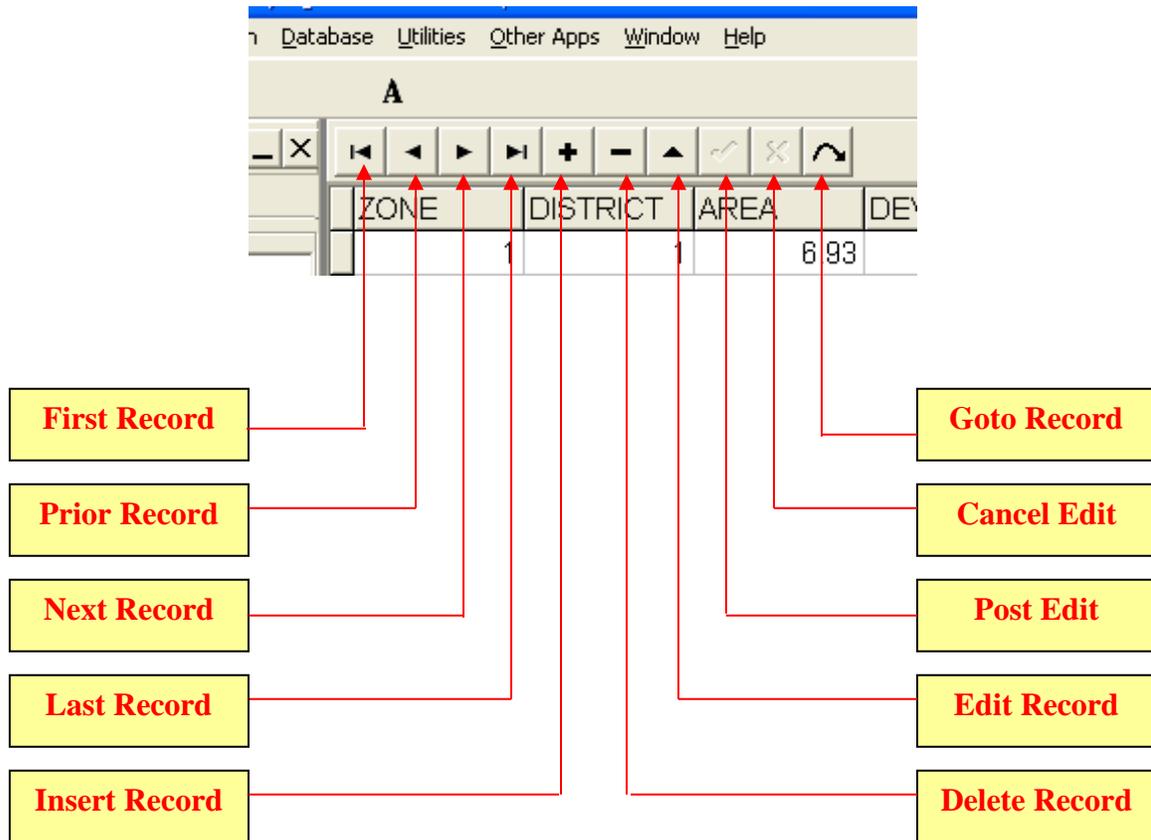
3. Selecting SE Data box will display the socioeconomic database on the screen as shown in Figure 119. The analyst can update the socioeconomic data directly from this display.

Figure 119 – Socioeconomic Database

ZONE	DISTRICT	AREA	DE	AREA	ATB	POP	HH	INCOME	AMIN
1	1	6.03	3.39			7638	2467	55170	
2	1	16.03	5.72	3	2	40517	16577	38508	
3	1	9.85	2.82	4	3	12584	6174	55103	
4	1	7.6	7.21	6	4	3973	1758	44110	
5	1	34.54	34.54	6	4	7436	2709	50795	
6	1	9.94	1.54	6	4	488	195	54450	
7	1	62.75	46.26	6	4	10241	3289	61414	
8	1	11.45	1.19	4	3	10241	3289	99115	
9	1	0.97	0.35	3	2	10242	3289	44387	
10	1	11.49	4.23	5	3	4545	1598	40430	
11	1	54.85	27.39	6	4	1595	512	54450	
12	1	8.46	5.64	6	4	1072	853	61205	
13	1	112.91	52.19	6	4	31209	9695	60158	
14	1	112.97	68.03	6	4	20499	6688	58270	
15	1	41.38	28.9	5	3	12804	4398	53207	
16	1	4.12	2.39	4	3	7172	2454	94404	
17	1	0.56	0.35	4	3	1054	601	98400	
18	1	1.65	1.39	4	3	8193	3882	65449	
19	1	55.92	38.03	6	4	5912	1969	57395	
20	1	3.45	2.73	4	3	7725	2639	68378	
21	1	7.31	4.23	4	3	19012	6348	44387	
22	1	8.53	3.29	6	4	1037	342	52320	
23	1	5.13	2.93	4	3	11614	4768	52320	
24	1	2.62	1.6	4	3	12910	4929	52915	
25	1	12.58	9.82	6	4	2257	797	52915	
26	1	3.18	2.39	4	3	8699	2110	148189	
27	1	9.14	1.59	4	3	2183	708	234201	
28	1	0.77	0.75	4	3	3646	1277	82842	
29	1	1.51	0.79	4	3	1206	372	91923	
30	1	2.72	1.73	4	3	5751	1957	122713	
31	1	0.48	0.44	3	2	5057	1728	74528	
32	1	0.48	0.45	3	2	4464	1701	57774	
33	1	0.68	0.62	3	2	8676	2151	76431	
34	1	0.29	0.28	4	3	2536	940	88585	
35	1	0.41	0.37	3	2	3383	1074	80548	
36	1	0.55	0.32	3	2	4101	1477	63098	
37	1	0.81	0.89	3	2	8249	2874	71574	

Figure 120 displays the database editing icons in greater detail along with a description of their use.

**Figure 120 – Database Editing Keys**



- First Record: brings the cursor back to the first record of the same variable.
- Prior Record: locates the cursor to the previous record of the same variable.
- Next Record: locates the cursor to the next record of the same field/variable.
- Last Record: brings the cursor to the last record of the same variable.
- Insert Record: inserts an additional record between the record where the cursor is currently located and prior record.
- Delete Record: deletes the record where the cursor is currently located.
- Edit Record: edits the record
- Post Edit: accepts revision
- Cancel Edit: cancels revision
- Goto Record: locates the cursor to the specific record of the same variable. If this key is selected, the analyst will be prompted to fill the record number on a window as displayed as follows:



## 7.2 *Independent Socioeconomic Data Modification*

The socioeconomic data modifications can also be performed independently from CUBE using standard database or spreadsheet software packages such as Microsoft Access or Microsoft Excel. Note that within CUBE, a user can determine the actual file name and directory path by simply right-clicking the file in the application and selecting the “properties” option. In the case of the socioeconomic data file, the file name is named “SEDATA00.DBF” and it is located in a zonal input subdirectory under the “modeldata” directory, as described earlier in this document. The following steps describe how to revise the socioeconomic data using this technique:

1. Open “MODELDATA” folder inside the model directory. Note that the actual model directory name will vary by installation site since the name is designated during the installation process.
2. Open the proper zonal input subdirectory folder. The user may elect to copy the existing zonal input subdirectory in preparation for a new scenario, so it is incumbent on the user to select the proper subdirectory for the anticipated modifications. In the current example, the zonal subdirectory is named “00VAZ”.
3. Locate the SEDATA00.DBF inside this folder. This file contains the socioeconomic data by zones.
4. Open this file using Microsoft Excel or Microsoft Access or other database software. Modifications can be performed and must be saved prior to use in the model.

## 7.3 *Highway Network Modifications*

With the exception of turn penalties, all highway network modifications are implemented through a single network file. Common editing tasks would include modifications to the attributes of selected facilities in a corridor based as part of proposed improvement projects. This would include standard tasks such as splitting highway network links, changing links parameters, adding new links, updating intersection information, etc. Note that a complete listing of all highway network variables is provided in Appendix F. To access the highway network in the NJRTM-E, the analyst would perform the following series of steps:

1. Select the “Highway Network Module” from the main application of the NJRTM-E as shown in Figure 121.
2. Select “INPUT HWYNET” file from the Highway Network Development Module as shown in Figure 122. After selecting this box, the highway network, including its associated layers, will be displayed on the screen as shown in Figure 123.
3. As discussed earlier, the highway and transit networks are fully integrated with respect to highway-based transit services such as bus lines. If the user anticipates splitting any links which are traversed by bus lines, the user is required to “enable” or “activate” the transit line layer so that any links split will automatically be updated in the transit route cards. To activate the transit layer, select layer icon as shown in Figure 123 below, and the layer control window (shown in Figure 124) will be displayed. Click the transit box to activate the transit layer and close the dialog box by clicking the CLOSE button. As the transit network is being read, the analyst will be prompted to either read an XY file for missing coordinates or to ignore them. Figure 125 shows the confirmation window. Select “No” to ignore reading these coordinates. In accordance with the procedures developed for the NJ Transit Regional Transportation Model’s transit path-building process, these additional nodes will be incorporated in the highway network in the subsequent process.

Figure 121 – Highway Network Module

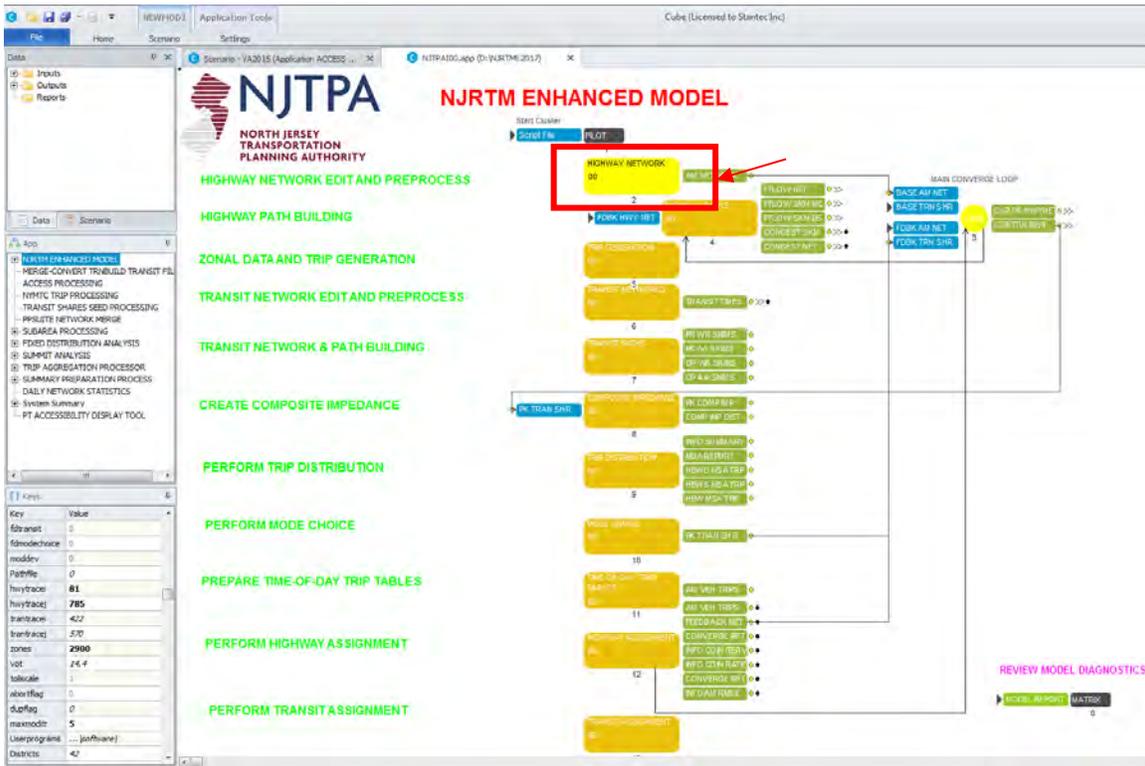


Figure 122 – Highway Network Input File

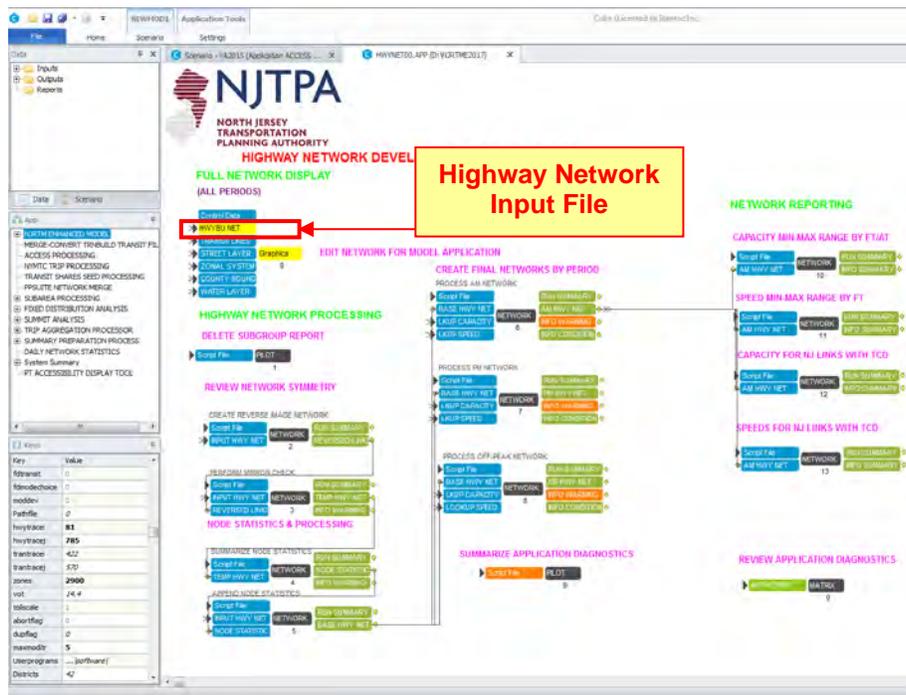


Figure 123 – Highway Network Display

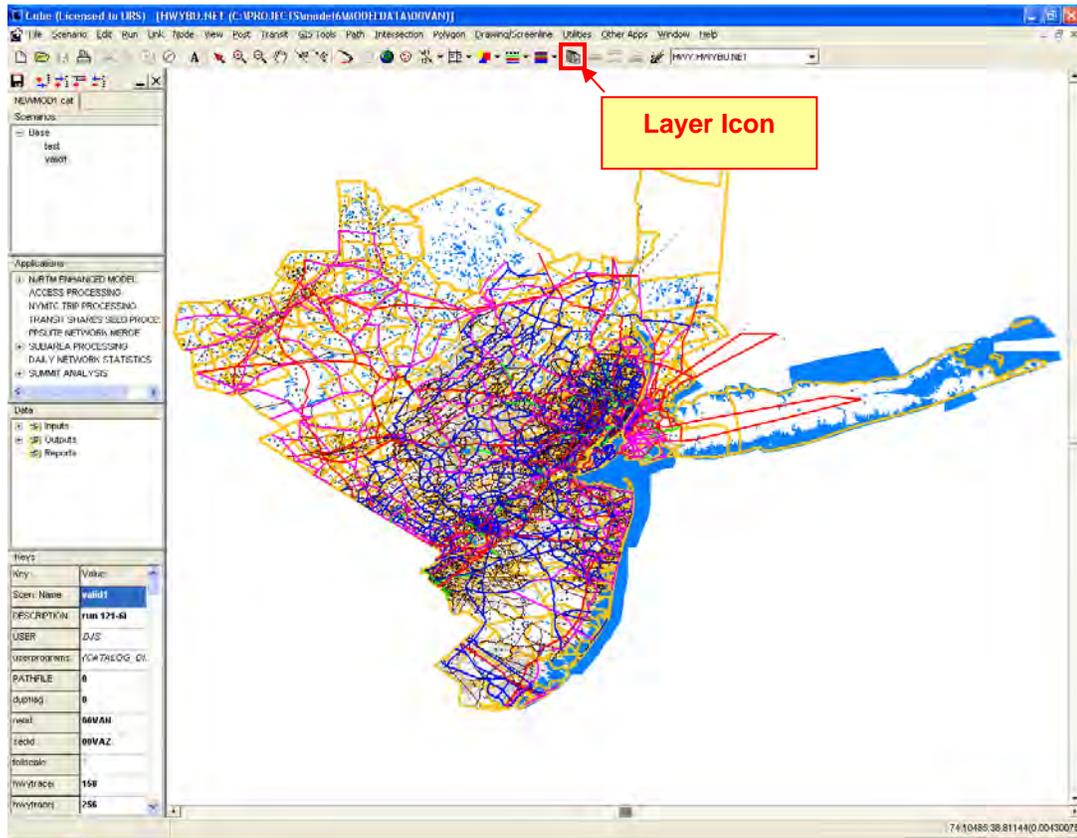


Figure 124 – Layer Control

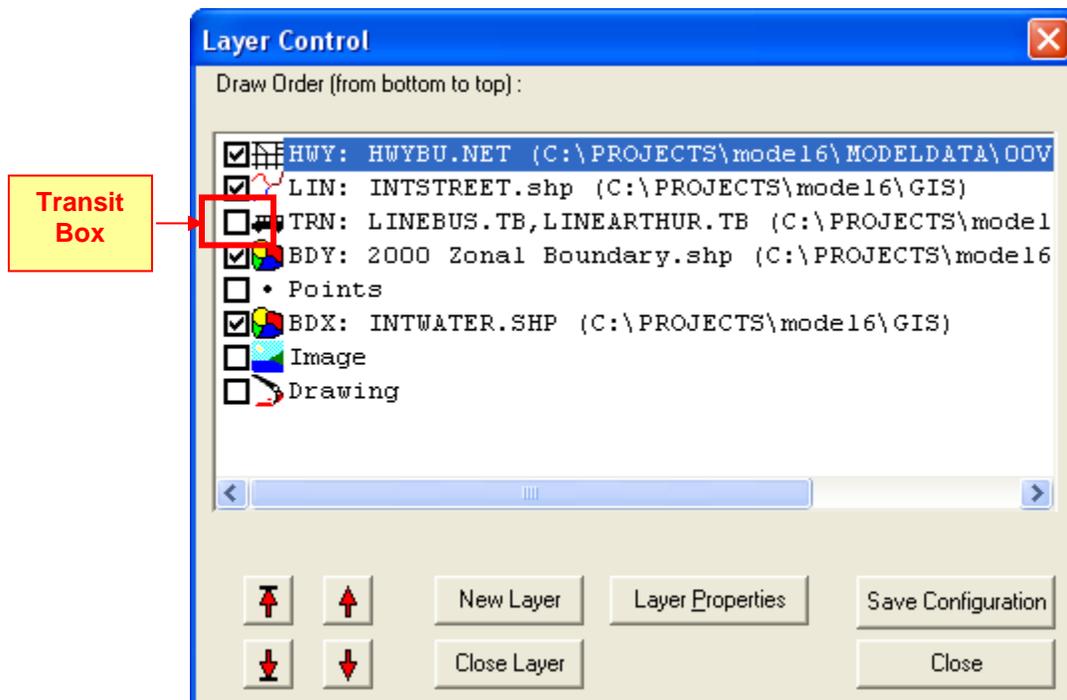
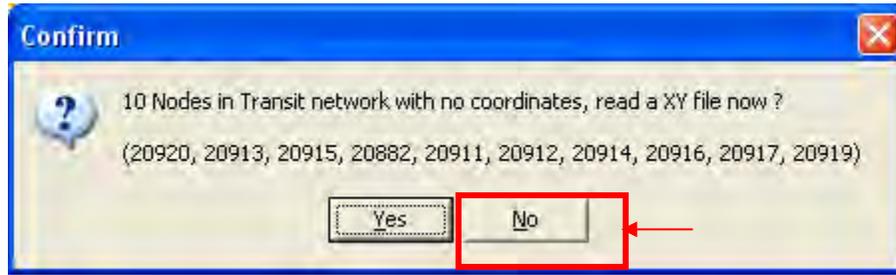
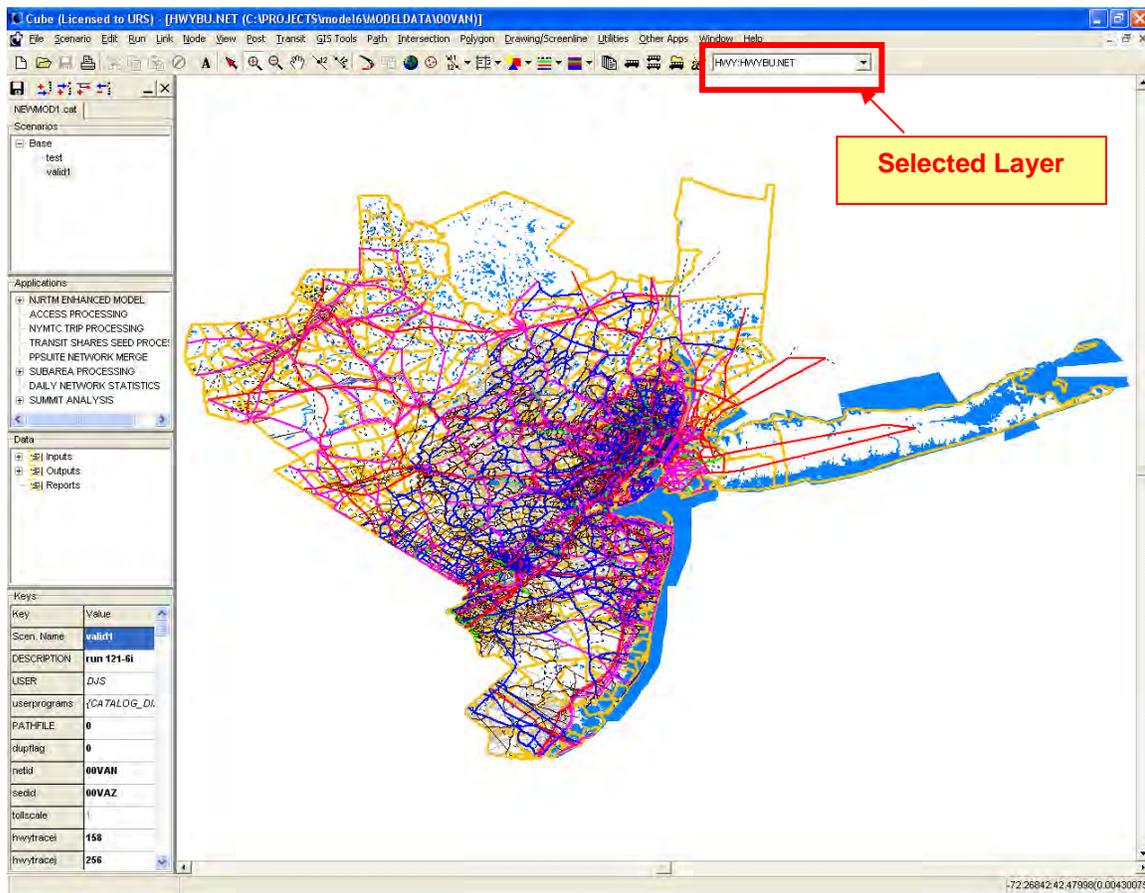


Figure 125 – Confirmation Window



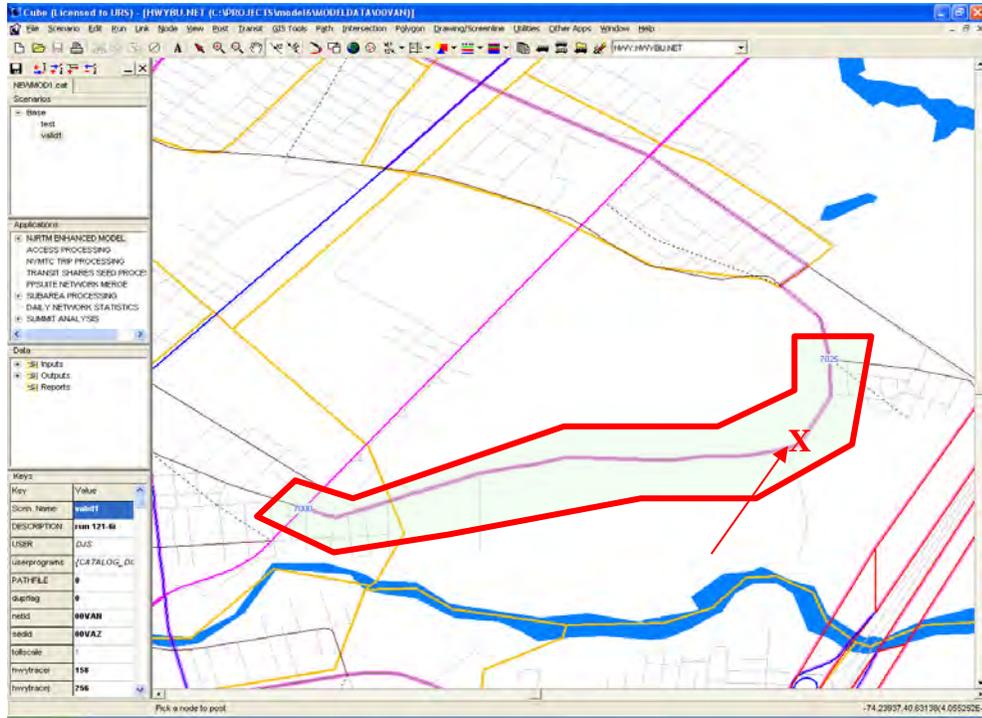
4. Figure 126 shows the highway network display with activated transit layer. In order to enable the highway network for modification, the highway network layer should be selected using the drop-down box on the right side of the toolbar.

Figure 126 – Highway and Transit Networks



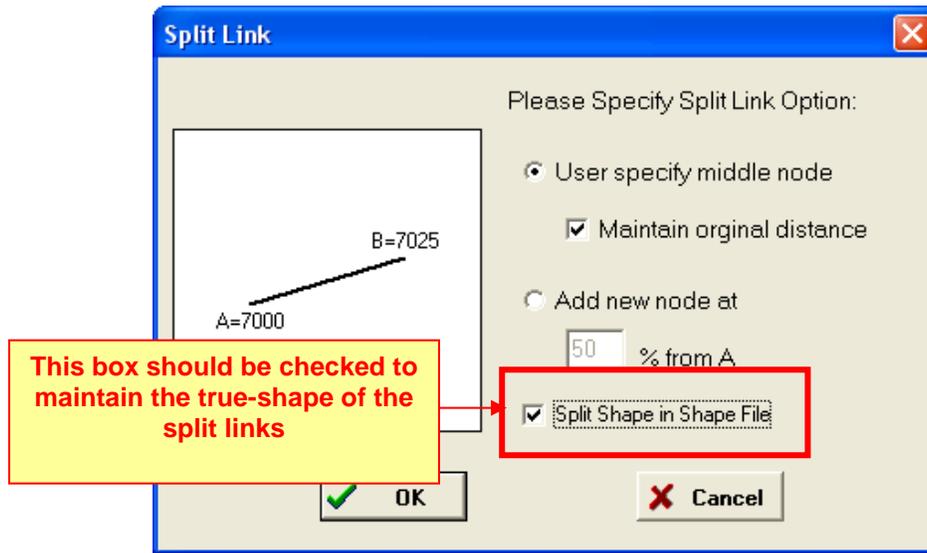
Now that the transit layer has been activated and the highway network is selected as the active layer, the highway network can be modified. NOTE: this discussion assumes that analysts are generally familiar with CUBE/Voyager network editing process. This includes how to search for links and select links using the standard CUBE icons. The following highway network modification example demonstrates how a link is split along with the automatic transit route updating process and the adjustment of the underlying shape file for the purpose of the true-shape display feature. Figure 127 shows link 7000-7025 will be split at “X” location.

**Figure 127 – Split Link Example**



Use the “Split” command from “Link” menu to split this link and the Split Link dialog box will appear on the screen (see Figure 128). Note that in the default user profile the network is provided with the true-shape display enabled. While most links have been referenced to the underlying street layer there will be some links, including centroid connector that are not referenced to the street layer. In the cases where the true-shape display is activated, to maintain the true-shape of the split links, the analyst should check the box in front of “Split Shape in Shape File” as shown in Figure 128. It is recommended that the network editing always be performed with the true-shape display feature enabled so that newly-created links and other network adjustments are properly referenced to the underlying street layer.

Figure 128 – Split Link Dialog Box



Following the “Split Link Window”, a warning window will be displayed as shown in Figure 129 to confirm that the shape file will be updated. Select “Yes” to proceed to next step.

Figure 129 – Splitting Shape Confirmation Window

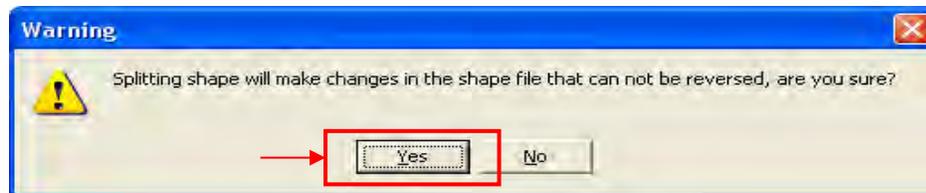
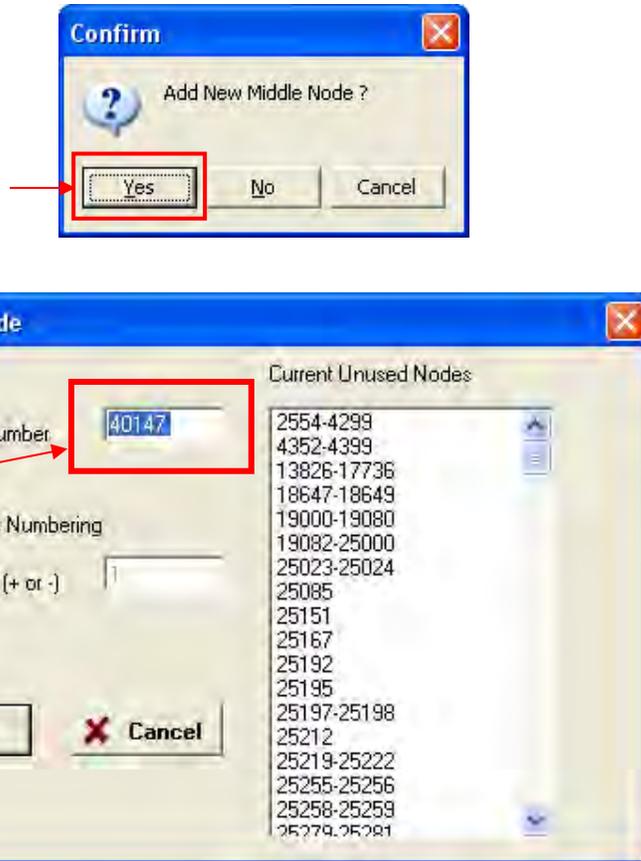


Figure 130 shows the process of adding a new node on the split link and defining the new node number. Note that care should be utilized in the selection of new node numbers for split links or new projects as certain node ranges are reserved for fixed guideway transit services and future highway projects in the NJTPA Capital Plan. The listing of reserved nodes as well as those nodes provided for project-specific editing is provided in Appendix G. In the dialog box in Figure 124, CUBE is attempting to use the next available node number beyond the highest current node. The user has the option, after reviewing the reserved node list in Appendix G, to insert a different number from the unused list displayed in the right side of the dialog box. As an example the user could select node number 13826 listed as the being node of an unused range from 13826-17736. If that node was selected, any subsequent additional nodes needed would be selected from this range. So for the next split link, node 13827 would appear as the node to be used as the intermediate node.

Figure 130 – Add New Middle Node Window



In this example, there are several transit lines that traverse this link. When this link is split, a transit link option window will be displayed as shown in Figure 131. The analyst is prompted to select whether this new node (X) will be defined as either a stop-node, a non-stop node, or do not add node (in transit line). If the analyst defines the node either as a non-stop or stop node, this new node will automatically be added to all transit lines using this link. The split link will maintain its shape as shown in Figure 132.

Figure 131 – Transit Link Split Options

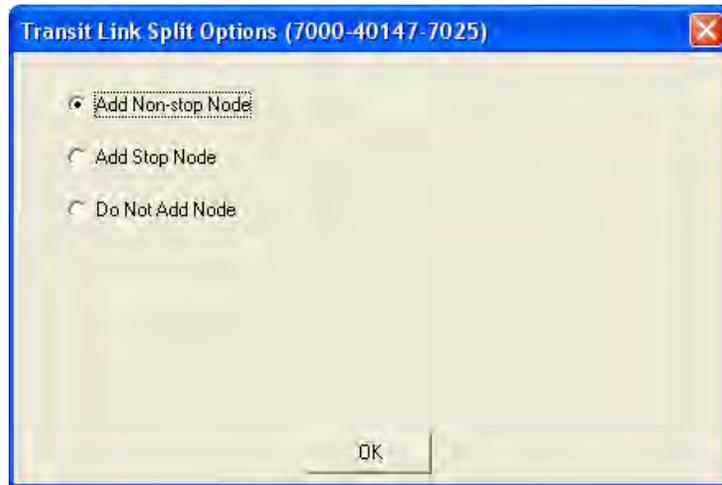
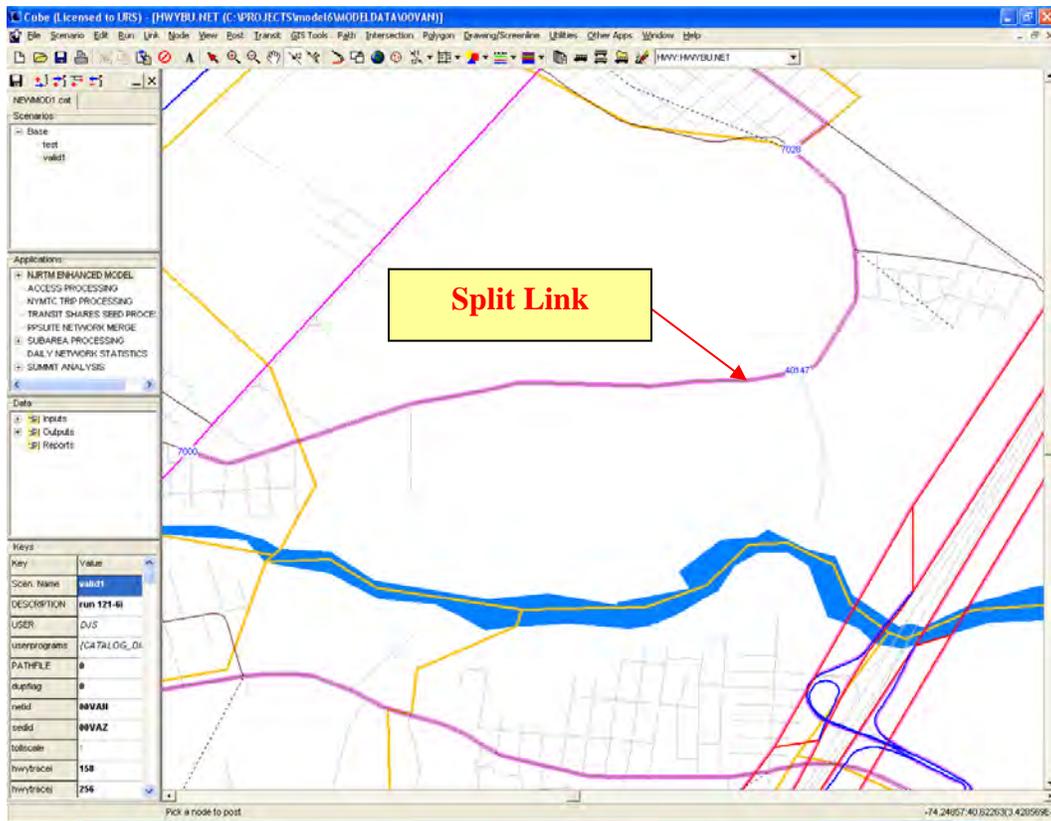


Figure 132 – Final Split Link Display



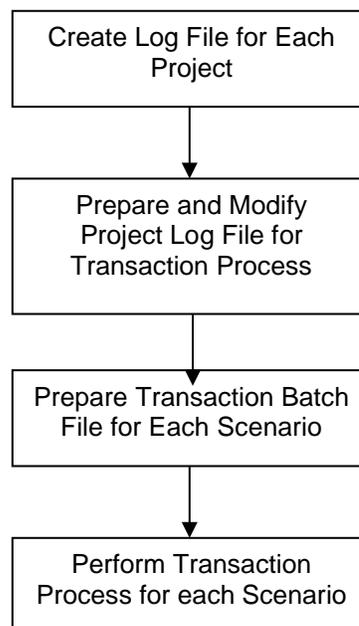
## 7.4 Automated Network Modifications

Due the need to alter highway networks to incorporate changes in the NJTPA Capital Improvement Plan and/or the Long Range Plan, it was necessary to develop a flexible process that merges individual projects into a baseline network. Under this approach individual projects are coded as separate files that allow the analyst to move the projects between horizon years or policy conditions (build vs. no-build) with minimal effort. In addition, this process also provides a mechanism to confirm the network merging process and identify any coding inconsistencies that might occur. This process utilizes the CUBE “LOG” feature to record and store the changes associated with individual projects. The process is referred to as the “Project Transaction Technique” since each project is viewed as a separate element or transaction being merged into the baseline network.

The project transaction approach requires that each transportation project be created as a stand-alone set of actions (remove links, add links, change links, etc.) that can later be merged into a baseline network file. The creation of these separate files uses the “LOG” feature within CUBE. The LOG feature enables CUBE users to store all changes made to a highway network file within CUBE environment during a particular session. Those changes or updates to the highway network file will be saved to a “log” file, which is a file with a .LOG extension. This is a text file cataloging all changes made during that particular session. Note that the creation of these LOG files must be done with CUBE although it need not be specifically performed within the NJRTM-E.

In this approach, each project will be coded as a separate “project” log file, a similar approach to the former NJTRM project coding. Coding each project individually will provide flexibility for future changes, such as revising or deleting the project. These projects can then be grouped into a “scenario log file” that corresponds to a specific model year and policy condition (such as 2015 Build) which would be part of a given scenario. The coding procedures for the transaction process are described schematically by the flowchart shown in Figure 133.

**Figure 133 – Project Coding Procedures**



A description of the four steps is as follows:

1. Create Project Log Files - In this step, the highway network will be revised or updated within CUBE to reflect changes indicated in the project description.
2. Prepare Project Log Files - The modification includes adding the project description to the log file, creating the title information and header log file, while deleting title/header information from the individual project log files.
3. Prepare Transaction Batch File - The preparation includes combining all project log files pertaining to certain scenario into one scenario log file. A user can manually add the separate project files in a text editor or use a DOS batch file to merge the files into a single file.
4. Perform Transaction Process. The transaction process is performed in Cube environment by executing the scenario log file with a given baseline highway network.

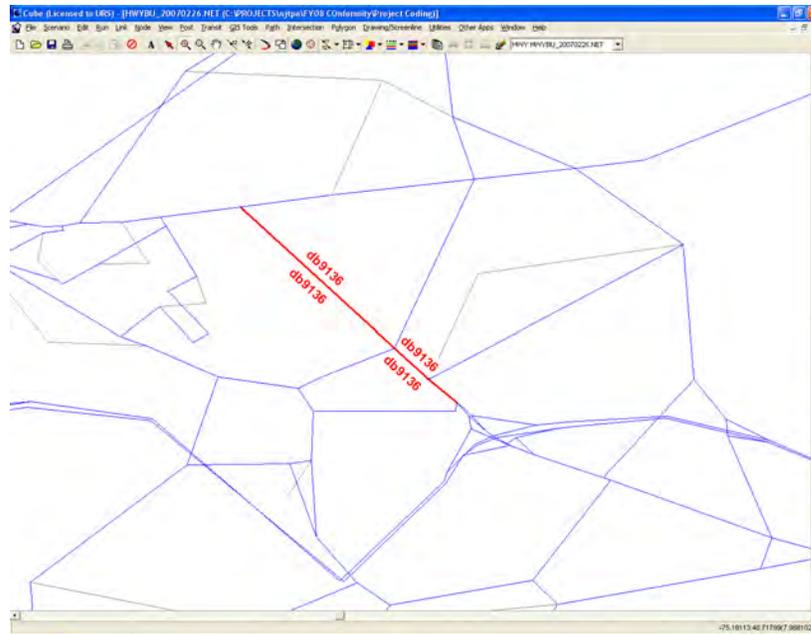
Each of these steps is described in further detail in the following sections provided below.

### 7.4.1 Log File Creation

A log file for each project is created in the CUBE Environment using “Save Log File” command under “FILE” menu. The log file is created as follows:

1. Open the base highway network in CUBE. The base highway network is the highway network from the year prior to the analysis year. For example, if model years are 2007, 2009, 2010, 2015. The base network for analysis year 2010 is the 2009 highway network.
2. The user has the option of added new fields, typically for descriptive purposes. As an example, for the Conformity Analysis the highway variable named PROJYR is added. This field represents the project completion year and the field would be initially unused (blank) for all links in the network. When a particular project is coded, the links being altered will be coded with the appropriate completion year.
3. Update or revise highway network to reflect changes for a particular project. Project DB9136 is selected as a sample in this discussion. This project widens Rt. 22/Rt. 519, in Warren County, from three lanes per direction to four lanes. Figure 134 displays the location of the updated highway network links included in this project.

**Figure 134 – Revised Highway Links for DB9136 Project**



4. After the network revision is completed for this project, save the log file using “Save Log File” command in File Menu. Use the project number as the file name (see Figure 135) to help identifying the project easily.





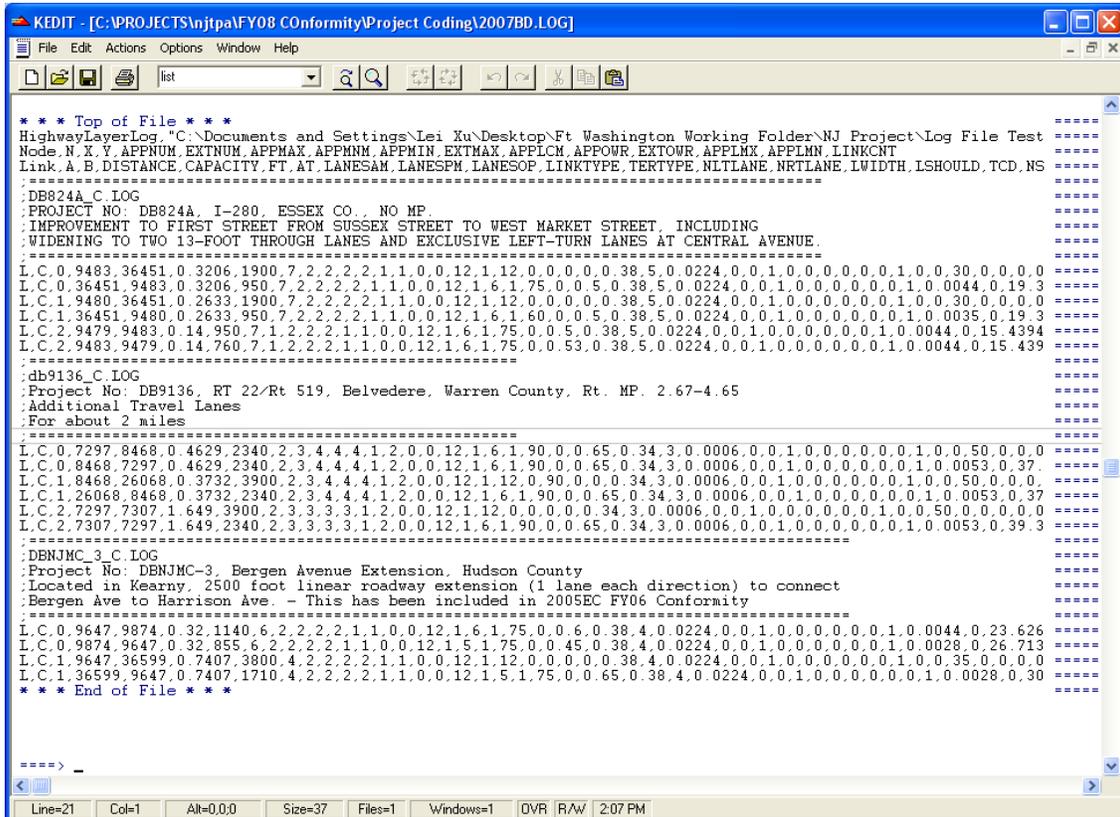
### 7.4.3 Transaction Batch File Preparation

The transaction batch file combines all project log files for a particular scenario into a scenario log file. A sample of transaction batch file is shown in Figure 138. In this example, the batch file creates a 2007 Build Scenario log file (2007BD.LOG) that combines one title log file (TITLE2007.LOG) and three project log files. Figure 139 displays the contents of a sample of scenario log file.

Figure 138 – A Sample of Transaction Batch File



Figure 139 – A Sample of Scenario Log File

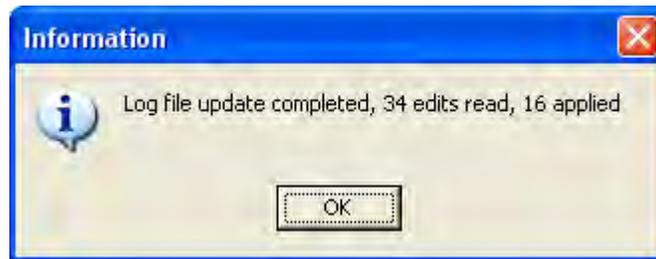


#### 7.4.4 Perform Transaction Process

The transaction process is performed to generate the analysis year highway network by adding the projects in the scenario log file to the base highway network. The transaction steps are as follows:

- Open the base year network in CUBE or NJRTM-E environment
- Activate the transit layer as well.
- Open the scenario log file using “Play Log File” command in the FILE Menu.
- If the transaction is successful, CUBE will display a message window that is shown in Figure 140.

**Figure 140 – Successful Transaction Window**

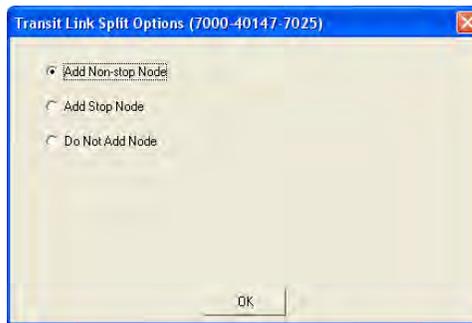


- If any transactions are not executed successfully CUBE will display a message indicating that the link does not exist (see Figure 141). In the current CUBE version this message is only displayed on the screen and not listed to a print file. Therefore, the users have to record each link manually for further investigation. Note that this type of error could occur in the underlying base network was modified in the vicinity of a project’s location after the initial project log file was created. Note however, that this process does provide the user with a method to audit the process to ensure the successful creation of the final merged network.

**Figure 141 – Link Modification Error Message**



- If transit lines traverse the updated highway links, a transit link option window will be displayed (see Figure 142). The analyst is prompted to select whether this new node (X) will be defined as either a stop-node, a non-stop node, or do not add node (in transit line). This topic has been discussed in a previous section that described procedures for splitting highway links.

**Figure 142 – Transit Link Split Options**

- Upon the completion of a successful transaction process, the highway network file will then be saved as the model year highway network.
- The transit network should also be saved at this point by selecting the save transit files under the transit menu option.

#### **7.4.5 Process Limitations**

There are two principal limitations related to the project transaction process. Each is described as follows:

- Turn penalties can not be coded using the log file approach. Therefore, for projects which contain turn penalties, those turn penalties should be coded separately in a turn penalty file (or added to the current turn penalty file if the file currently exists).
- Shape files are not modified during the transaction process as is currently possible with standard manual editing of networks.

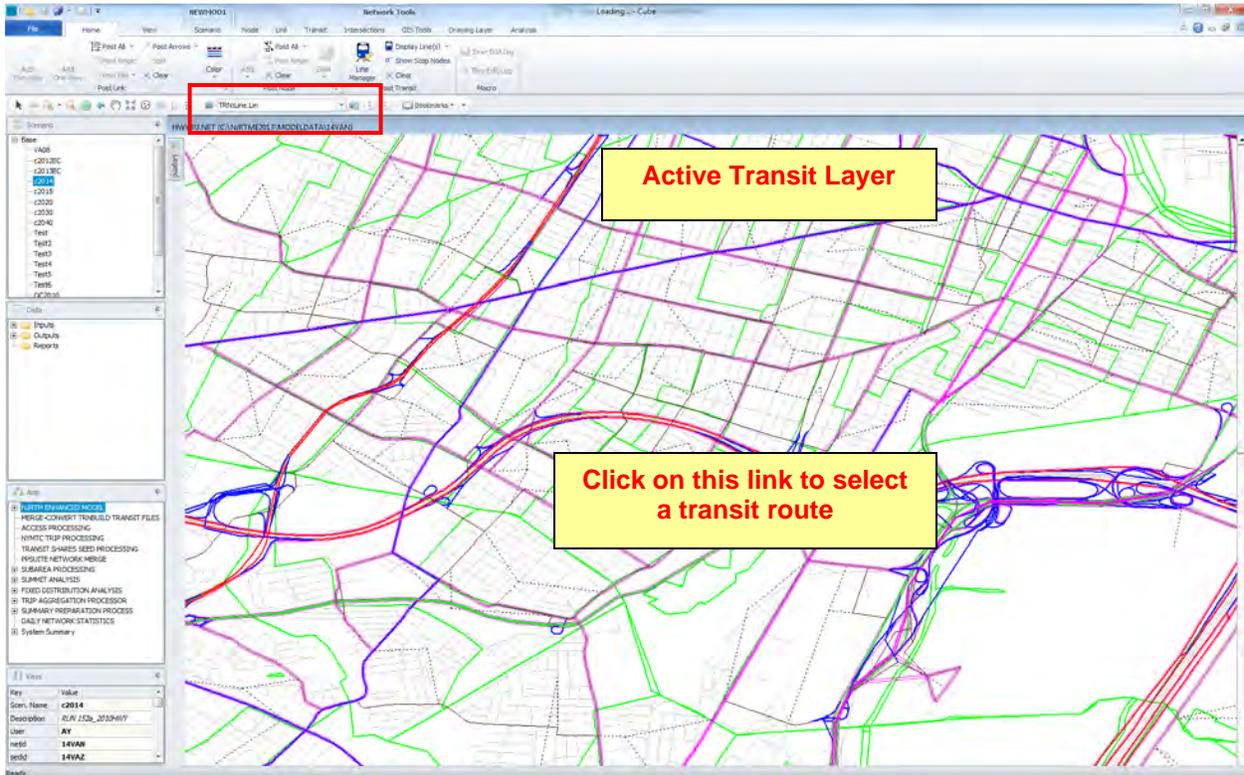
#### **7.5 Transit Network Modifications**

Typical transit route revisions include the following types of modifications:

- Frequency/headway updates
- Route extension
- Route truncation
- Route Realignment

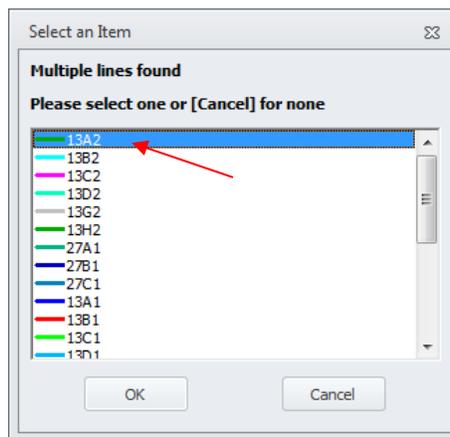
In order to edit a transit route, the user should enable both highway and transit layers as shown previously in Figure 113. To enable the editing of transit routes, the transit layer should be selected as the active layer as shown in Figure 143.

Figure 143 – Active Transit Layer



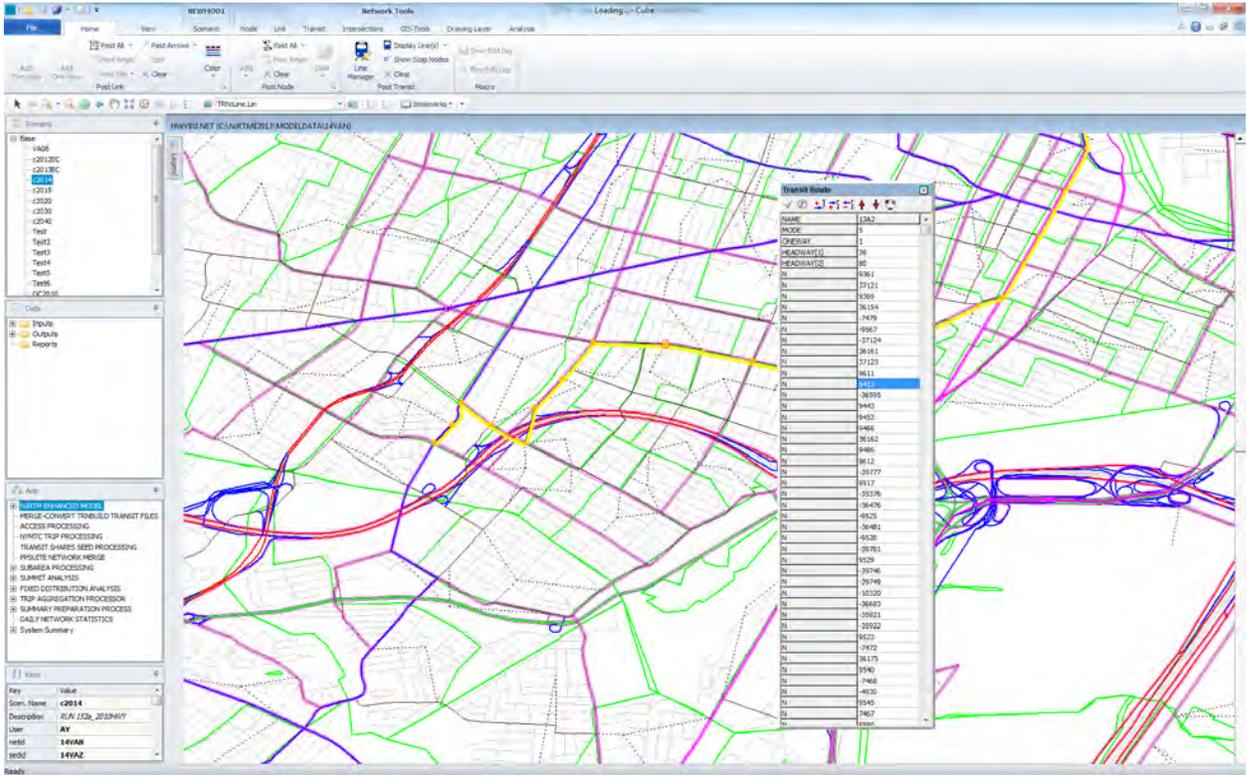
Click on a link as shown in Figure 143 above to select a transit route to edit as shown in the figure. CUBE will display the list of transit routes that traverse this link as shown in Figure 144. Select route 13A2 which is used as example in this discussion.

Figure 144 – Transit Routes List



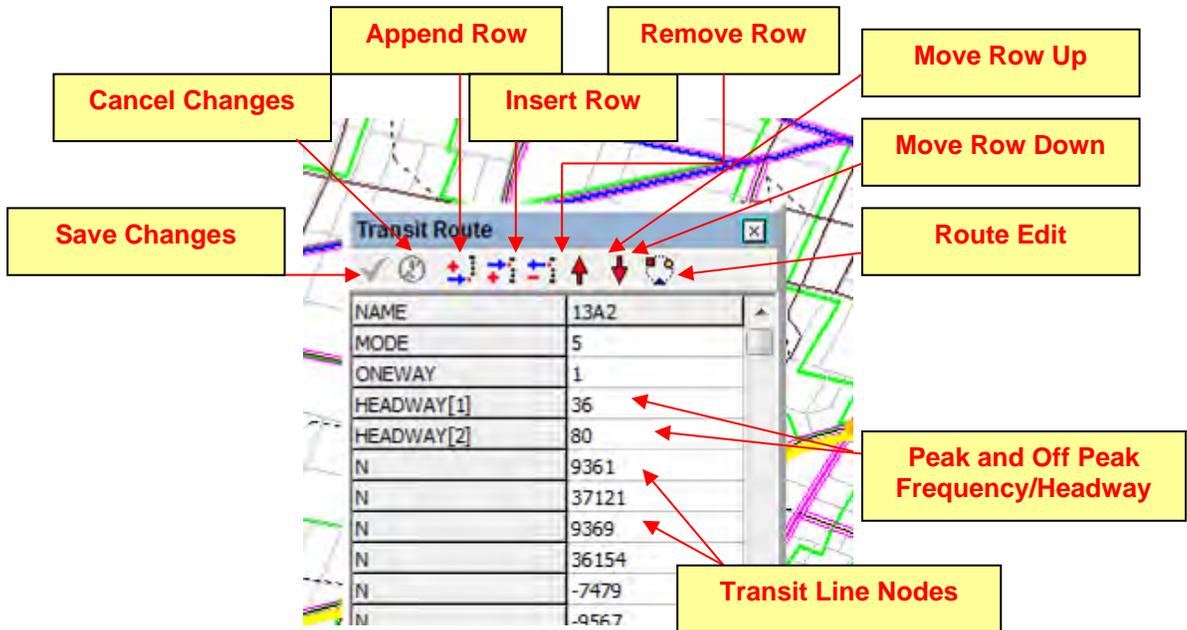
Once selected, the information for Route 13A2 will be displayed on the screen as shown in Figure 145. The user can then edit the line in detail using the keys listed in Figure 146.

Figure 145 – Transit Route Information



Several important keys for transit editing are shown in Figure 140.

Figure 146 – Transit Editing Keys



### 7.5.1 Editing Mode, Frequency, and One-way Parameters

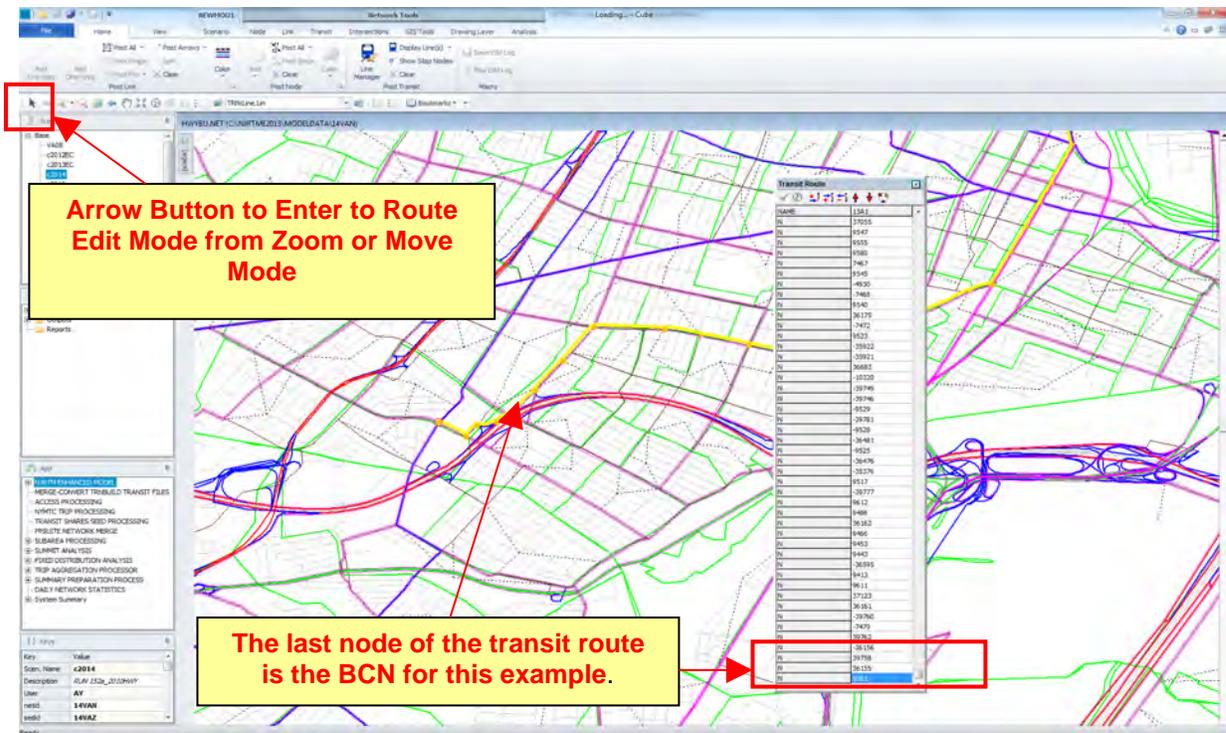
Transit mode, service frequencies, and directionality can be altered by changing the values in the transit route window directly. Transit mode indicates the mode number assigned to the transit route. HEADWAY(1) and HEADWAY(2) indicate the peak and off-peak frequencies or headways in minutes, respectively. “Oneway” is a flag to indicate whether the route provides one-way (1) or two-way(0) service. Select “save changes” to complete and save and the revision, or “cancel changes” to ignore the revision.

### 7.5.2 Extending Transit Routes

A transit route can be extended in one or both ends of the line to expand the service coverage. The process of extending transit line is as follows:

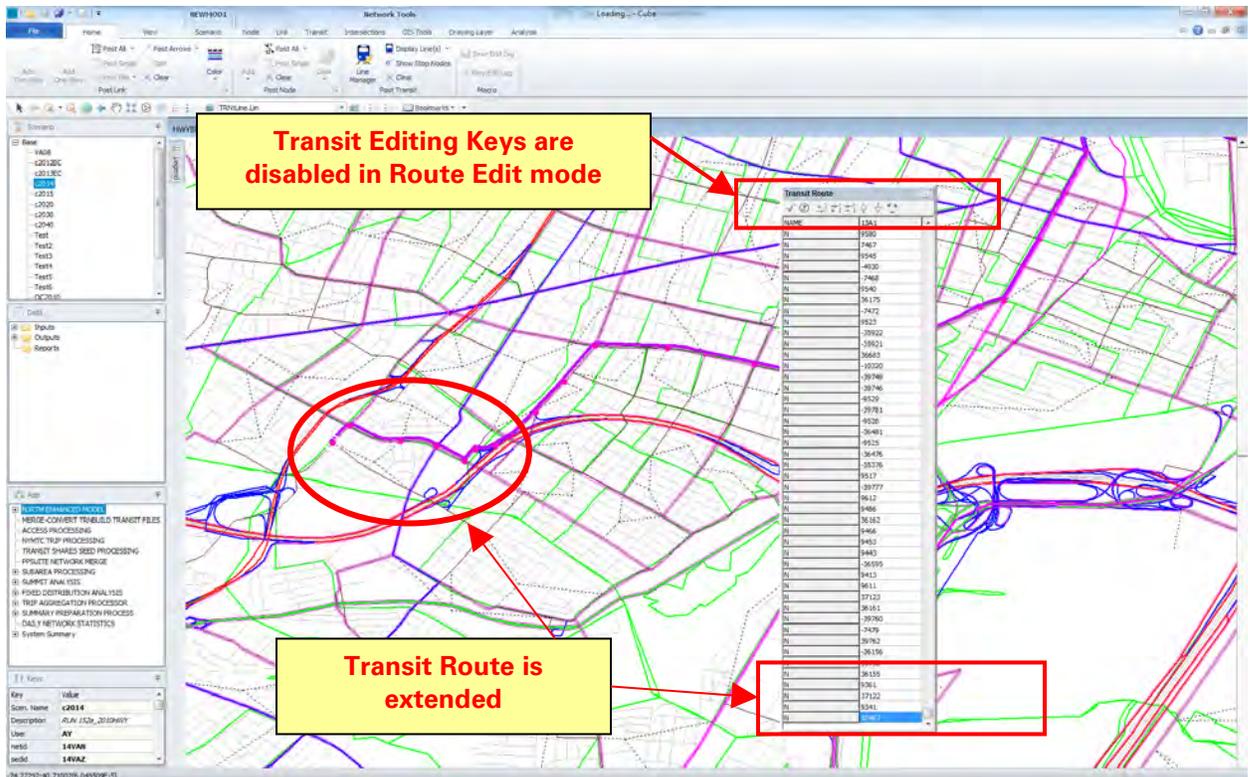
- Select the transit line that will be revised and display the transit route information. This step has been described above.
- Define the “Begin Change Node” (BCN). This is the node where the changes will start. For example, we would like to extend the route starting from the last node. The last node will be the BCN (node 9361 in this example), see Figure 147.
- To select the BCN, double click the node. This will initiate the Route Edit mode. In this mode, all editing keys are disabled as shown in Figure 148. The BCN is highlighted with a large flashing circle and the cursor now appears as a cross-hair symbol.

Figure 147 – Defining Begin Change Node



- In the route edit mode, the cursor will change to a crosshair, and the selected transit line will change to orange. All the transit editing keys will be disabled during this mode.
- In this mode, the zoom and move commands are available to adjust the window display. When zoom or move commands are selected, the crosshair will change to the zoom or move icons. The user can bring back the crosshair icon and enter to transit mode again by selecting or clicking the “arrow” button (see Figure 147) or “esc” key.
- With crosshair icon user can select the extension nodes starting from the BCN. The extension nodes will be added to Transit Route window under variable “N”.
- To complete the update, the user can select “Arrow” button. This will reactivate the transit editing keys.
- Select “save changes” to complete and save the revision, or “cancel changes” to ignore the revision.

**Figure 148 – Transit Route Extension**



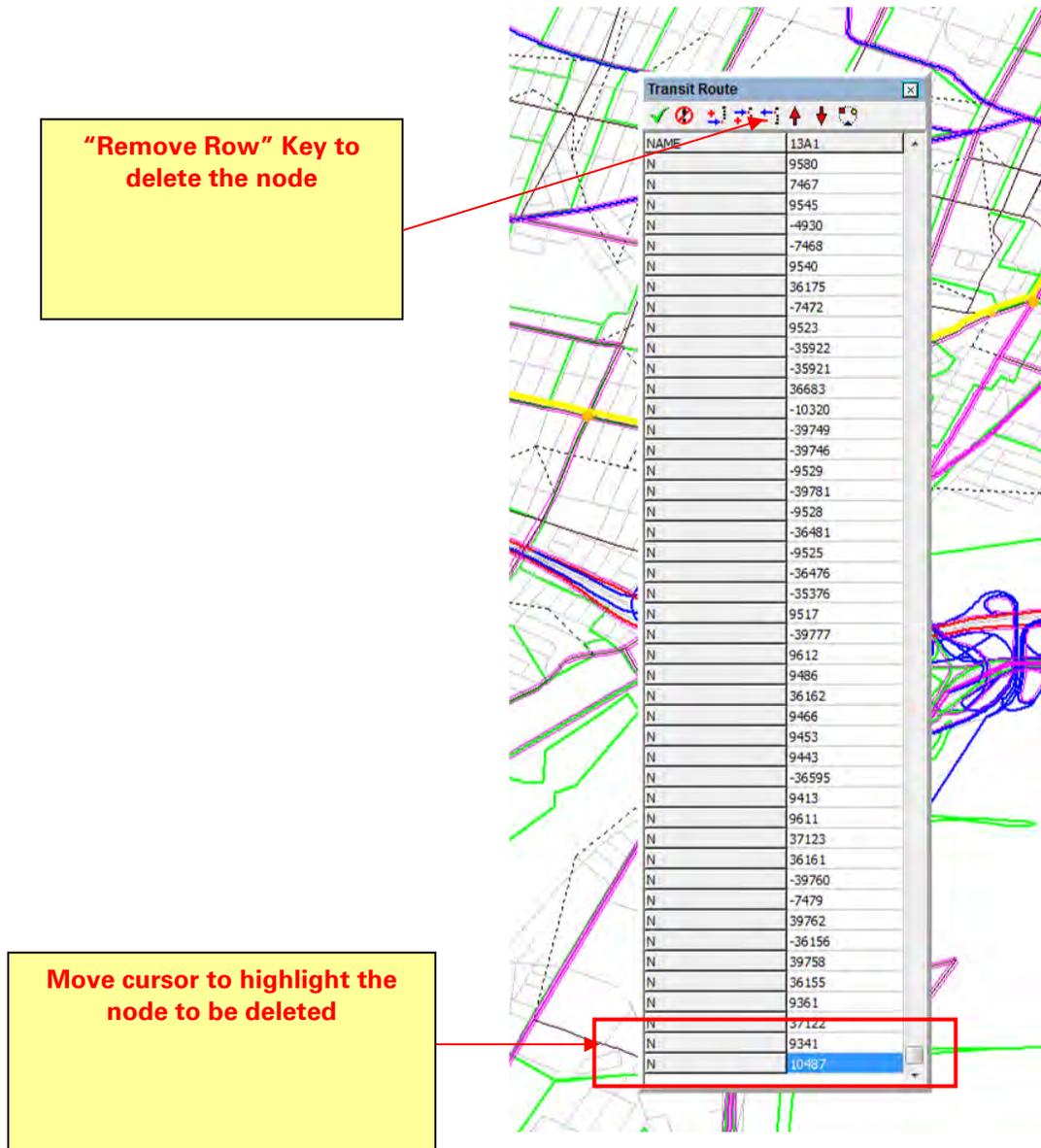
### 7.5.3 Transit Route Truncation

Transit lines can also be truncated to shorten their service area. The process to truncate a transit route is as follows:

- Select transit line that will be revised and display the transit route information. This step has been described above.

- Move cursor to the node to be deleted. For example, if the last node will be deleted, move the cursor to highlight the last node (see Figure 149).
- Select “Remove Row” from the transit editing keys.
- Repeat this process to delete all nodes that need be truncated.
- Select “save changes” to complete and save and the revision, or “cancel changes” to ignore the revision.

Figure 149 – Truncated Transit Line

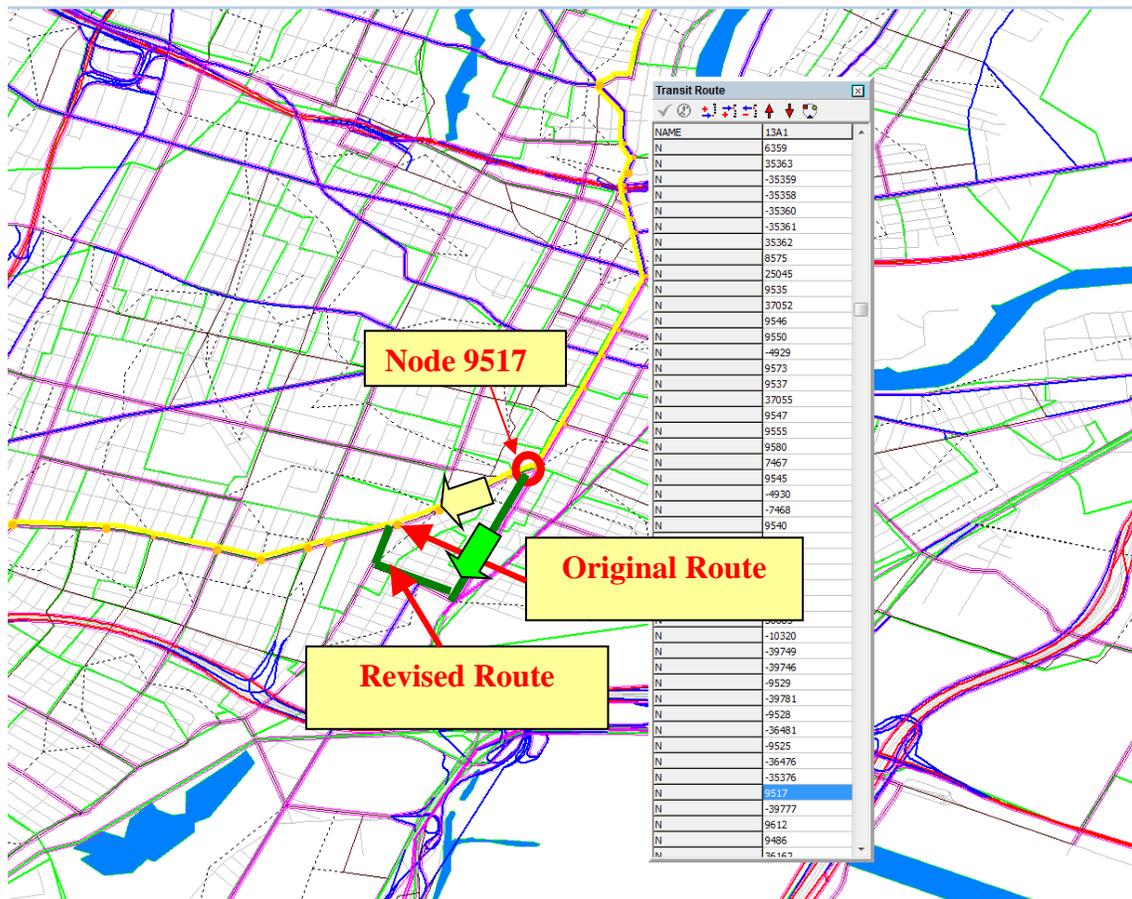


### 7.5.4 Transit Route Realignment

The rerouting process is essentially a combination of addition and deletion of transit nodes. For example, Transit Line 13A1 will be re-routed from its original route to its revised route as shown in Figure 137.

- In this example, the rerouting will start at Node 9517. Therefore, this node is defined as BCN by double clicking the node and entering the Route Edit mode. Note that the route direction is also shown in Figure 150.
- With the crosshair cursor, select the next node as shown in Figure 151. In this example, the next selected node is 9505. It should be noted that although the nodes should be selected in sequence, not all nodes have to be specified along the route. By default, CUBE is in AutoRoute mode, which means that when two nodes are specified, the program automatically generates the shortest highway distance path between the two nodes and inserts all the nodes between the end points as “*non-stop*” nodes

Figure 150 – Transit Rerouting Example.



- After selecting the next node, the transit route is rerouted as shown in Figure 151. Figure 152 shows the completed revised route.
- Select “save changes” to complete and save the revision, or “cancel changes” to ignore the revision.

Figure 151 – Rerouting Process

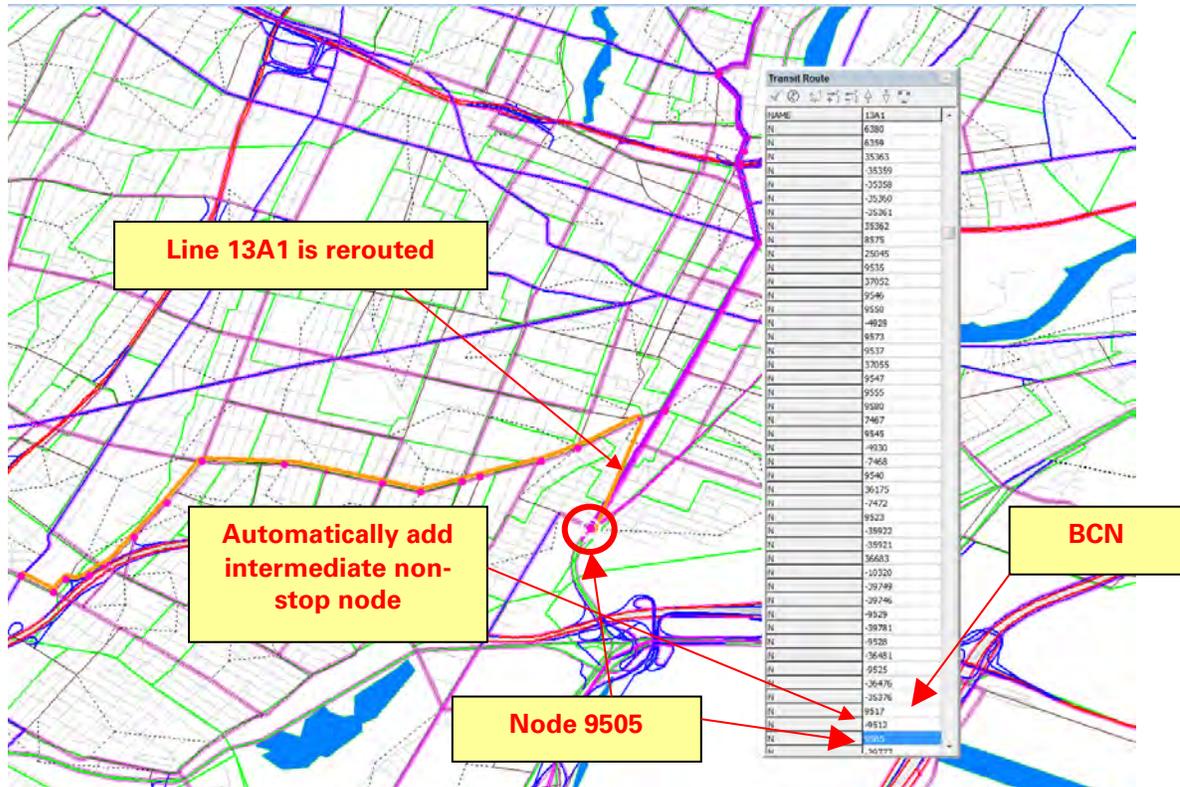
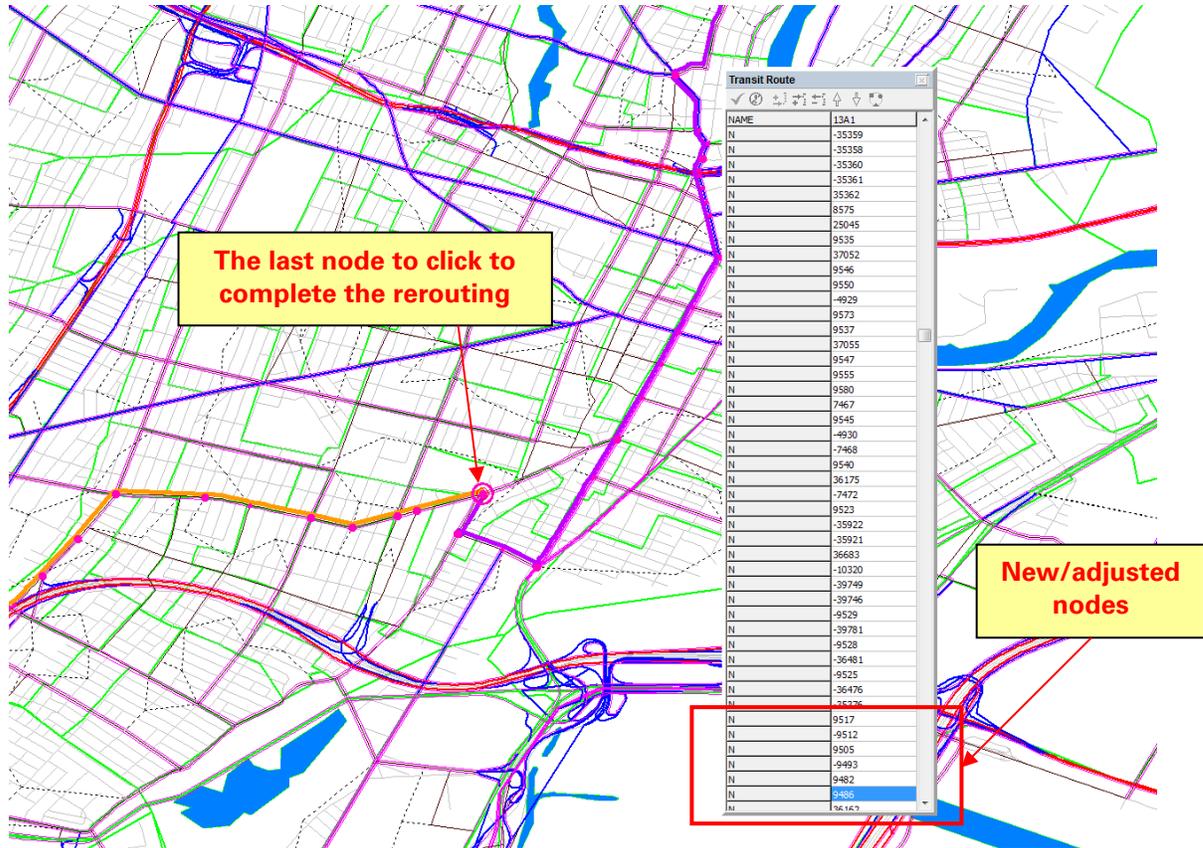


Figure 152 – Completed Rerouting Process



**7.5.5 Transit Route Revisions Using Text Editor**

In addition to editing transit route within the NJRTM-E environment, the analyst can also edit transit routes using a text editor within or outside the NJRTM-E. All of the transit parameters, such as mode, headways, line name, and route (N), can be revised using the text editor. The first step is to open the transit line file that will be edited. The transit line file for this model is LINE.LIN stored in the network data folder in the “modeldata” directory. This file includes all transit routes from different modes.

A typical transit line in the NJRTM-E has the following structure:

```

LINE NAME="1A1", MODE=5, ONEWAY=T, HEADWAY[1]=30, HEADWAY[2]=60,
  N=9321,9327, 9328, 9335, 9596, 9347, 9358, 7475, 36126, 9389, 36131,
  9395, -28581, 7478, 9610, 9433, -28580, 9459, 9484, 9510, 9521,
  -36561, -9525, -36528, 9531, -9536, 9568, 9569, 9544, -28555,
  9554, 9584, -11757, -10288, 37202, 37219, 37218, 37194, 37196,
  37193, 37195, 37163, 37162, 9669, 37164, 37165, -39815, 9700,
  
```

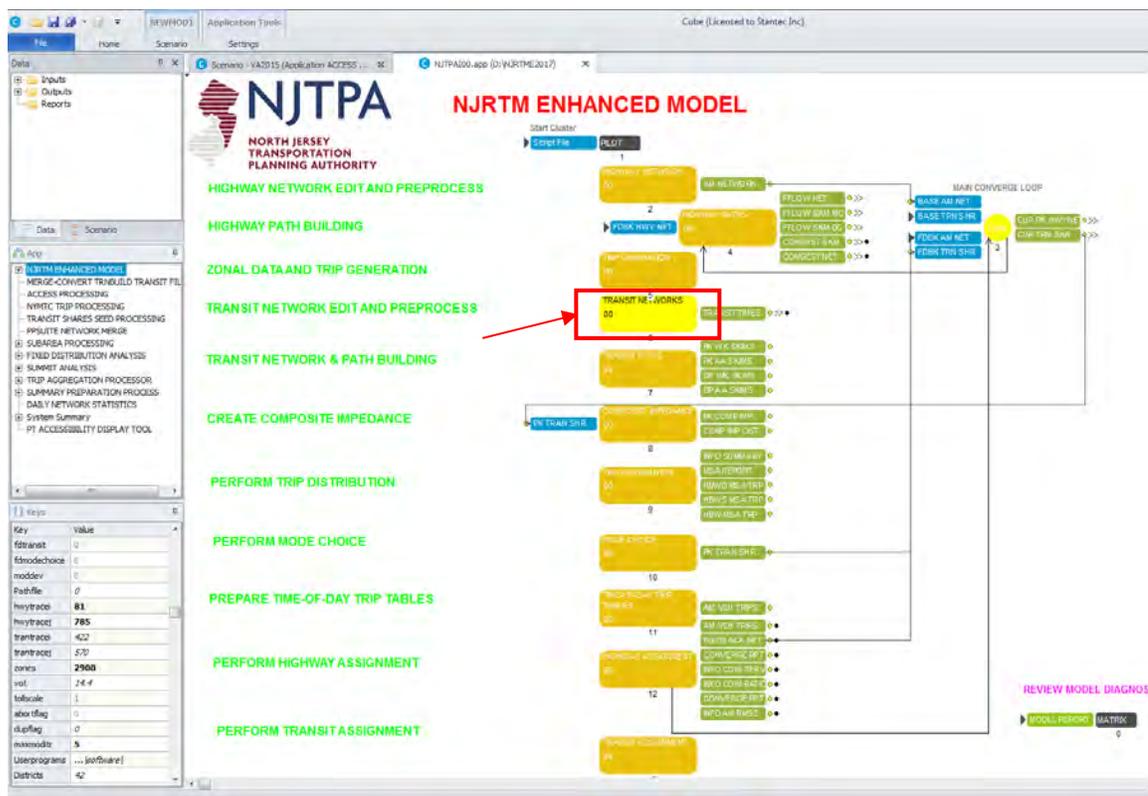
-6023, 9708, 9712, 9716, 7138, 9727, 9731, 9752, 8689, 36636,  
9765, 9778, -8395, 9783, -10245, -8401, 10021, -8396, 9942

The analyst can edit the above line information as necessary. The user can consult CUBE Voyager Manual in the Public Transport (PT) section for a more detailed description about the LINE command.

The editing can also be done within the NJRTM-E environment. The following steps describe how to edit transit line using text editor within the NJRTM-E environment:

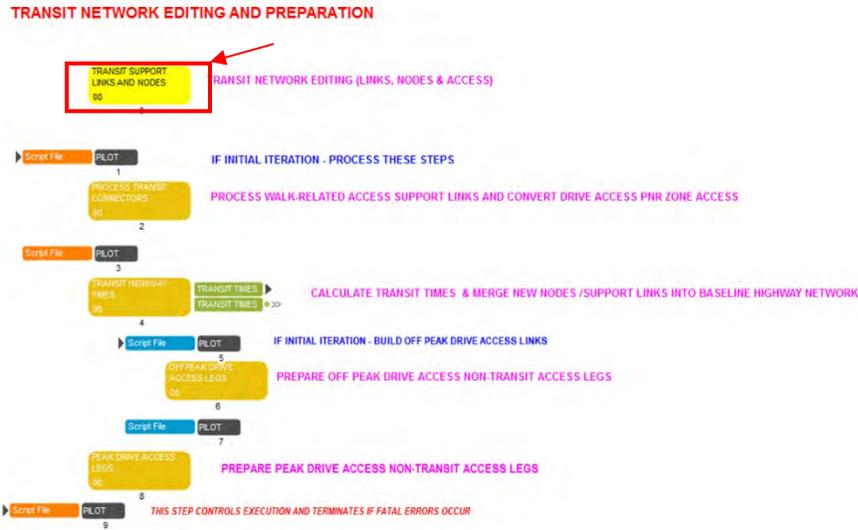
- Select Transit Network Box from the NJRTM-E main menu as shown in Figure 153.

**Figure 153 – Transit Network**



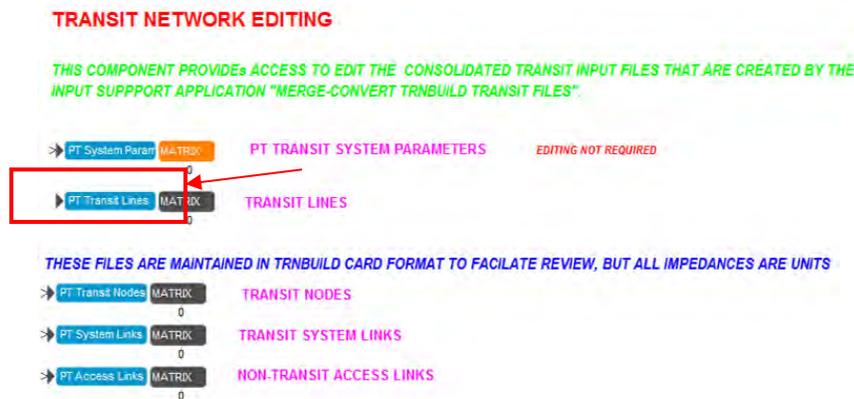
- Select the Transit Route Editing sub-application shown in Figure 154.

**Figure 154 – Transit Route Editing**



- Prior to editing the line cards for any mode, the user must execute the first step of the process shown in Figure 155 which integrates the existing comments in the proper sequence within the line files. After this step is complete, the user can then select transit line file to edit. In this example, the bus line file is selected for editing.

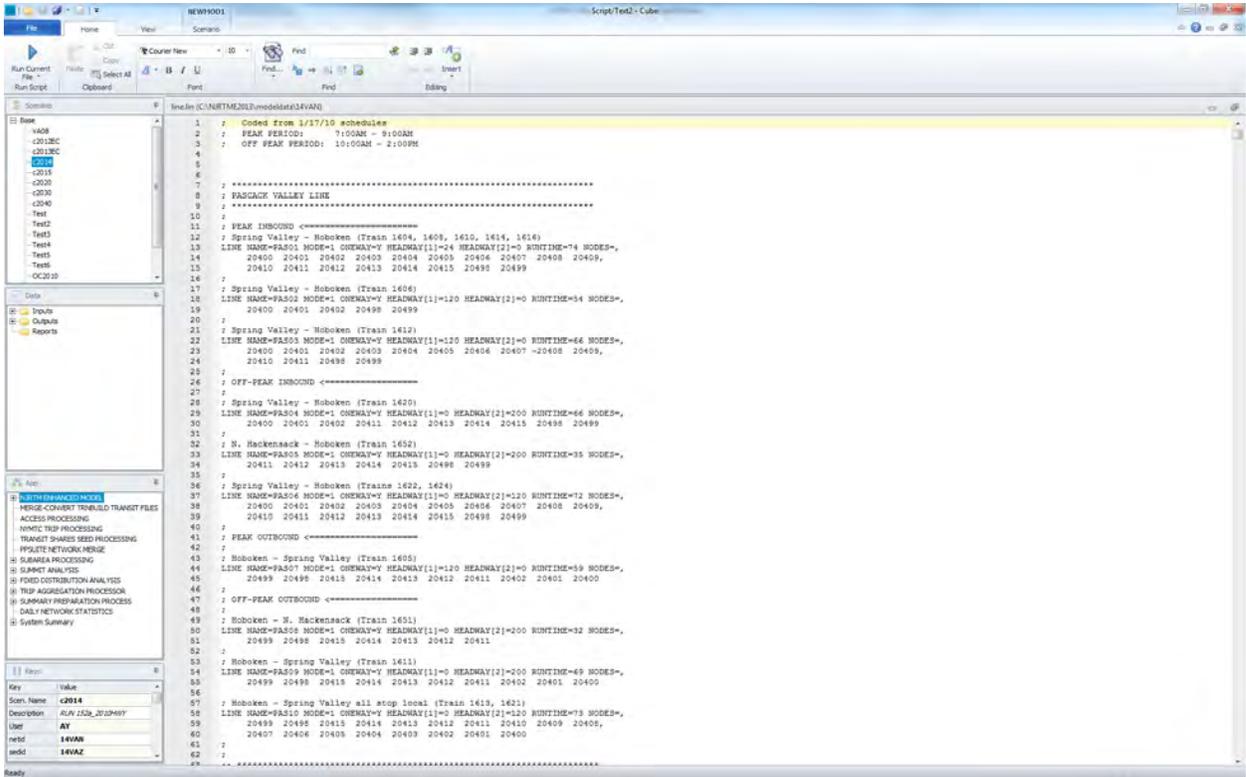
**Figure 155 – Transit Line File Selection**



- Transit routes will be displayed in a text editor environment. Updates and changes can be performed in this environment and saved using File>Save command. Note that all additional line-related comments must include the PT line name value enclosed with < > symbols as shown in the example in Figure 156. This enables the customized program to reference the line comments to the particular transit line. The <name> reference code must

follow the standard comment semicolon and its length must not exceed the 12-character limit for the NAME variable as defined by the PT routine.

**Figure 156 – Transit Line Displayed in Text Editor Environment**



### 7.5.6 Transit System Editing

In addition to transit route editing, the analyst often has to adjust other transit-related information, such as transit support links and nodes, park and ride catchment zones, and exclusive guideway links. The following steps describe how to update this type of information:

- Select “Transit Network” box as shown in Figure 153.
- Select “Process Transit Connectors” as shown in Figure 157. Select the transit system data that need be updated, for example, Park and Ride Catchment zones for rail (see Figure 158)
- The PNR catchment zones will be display in text editor environment, in this sample the PNR catchment zones of Princeton Junction was selected from Create PK Rail PNR Records section (see Figure 159). The analyst can revise and save the updated information using File>Save command.

Figure 157 – Transit Network Editing and Preparation



Figure 158 – Transit Support Links and Nodes



**PREPARE TRANSIT SUPPORT LINKS FOR TRANSIT PROCESSING**



This routine is used to create the additional underlying highway links that TRNBUILD requires to complete the access related links. It is only necessary to provide the distance field, as the card decks in TRNBUILD control the travel times and directions

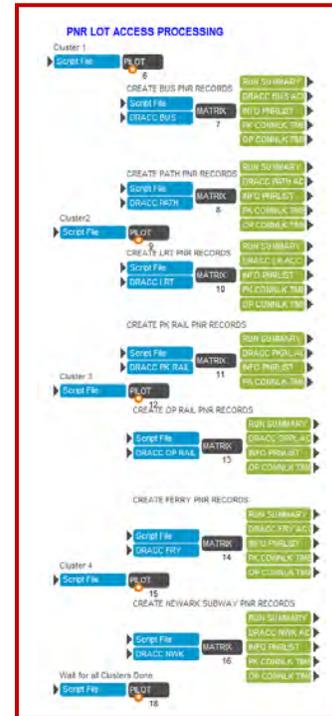
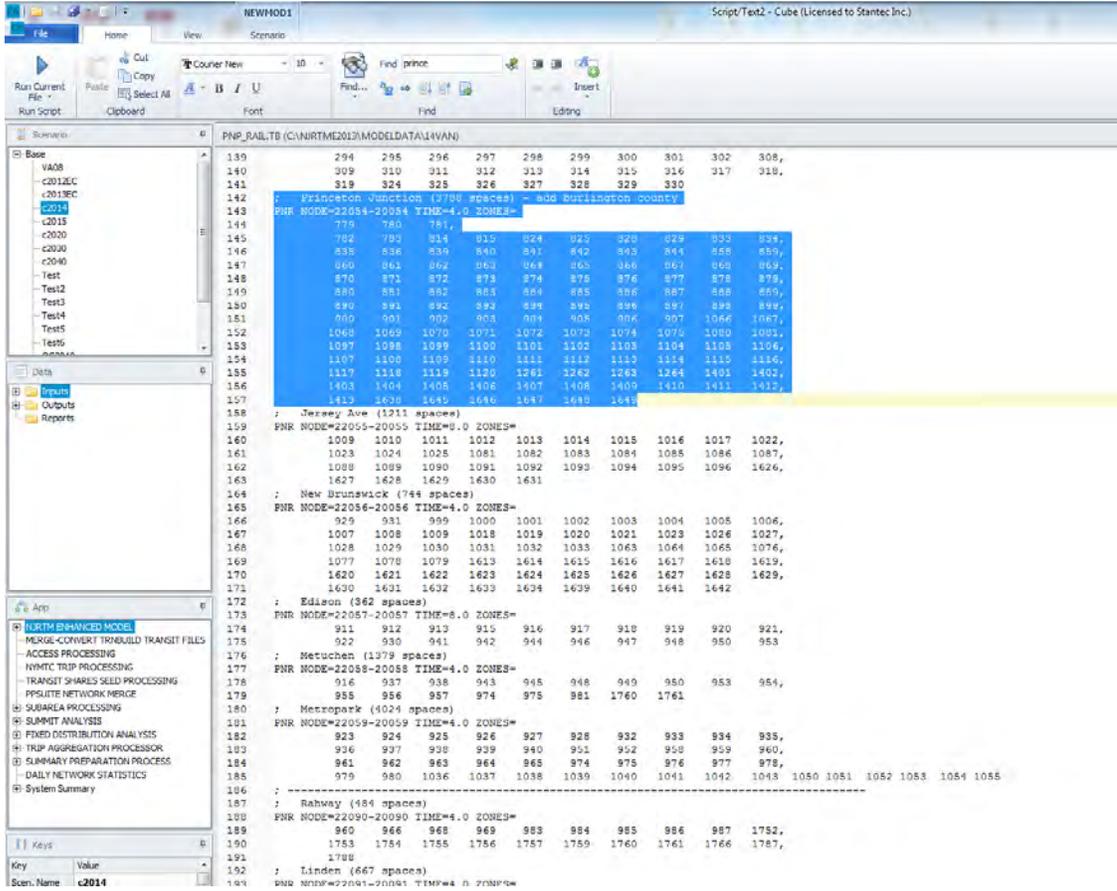


Figure 159 – PNR Catchment Zone Example

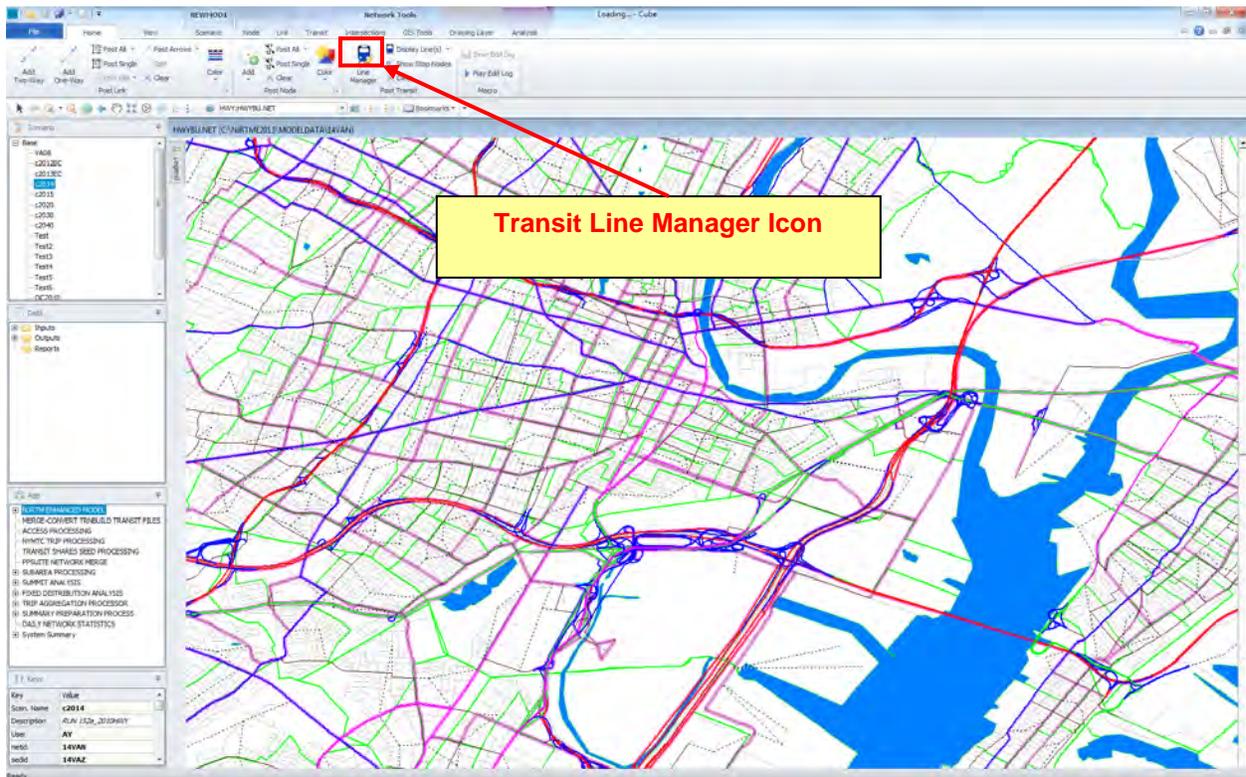


### 7.5.7 New Transit Lines

The analyst can also add new transit lines within the NJRTM-E environment using the following procedures:

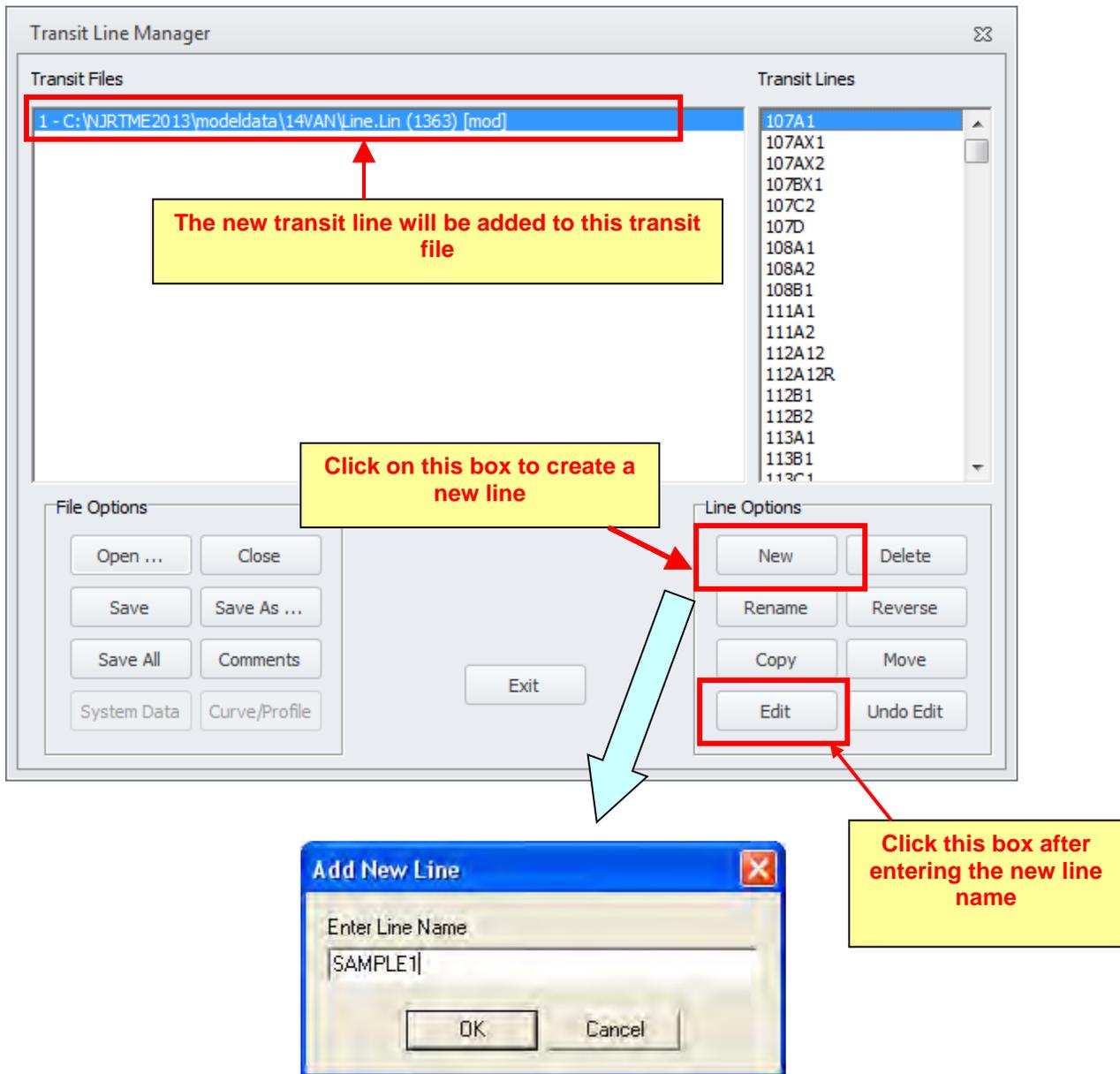
- Choose the “Transit Line Manager” icon to create new transit line, as shown graphically in Figure 160.

**Figure 160 – Transit Line Manager**



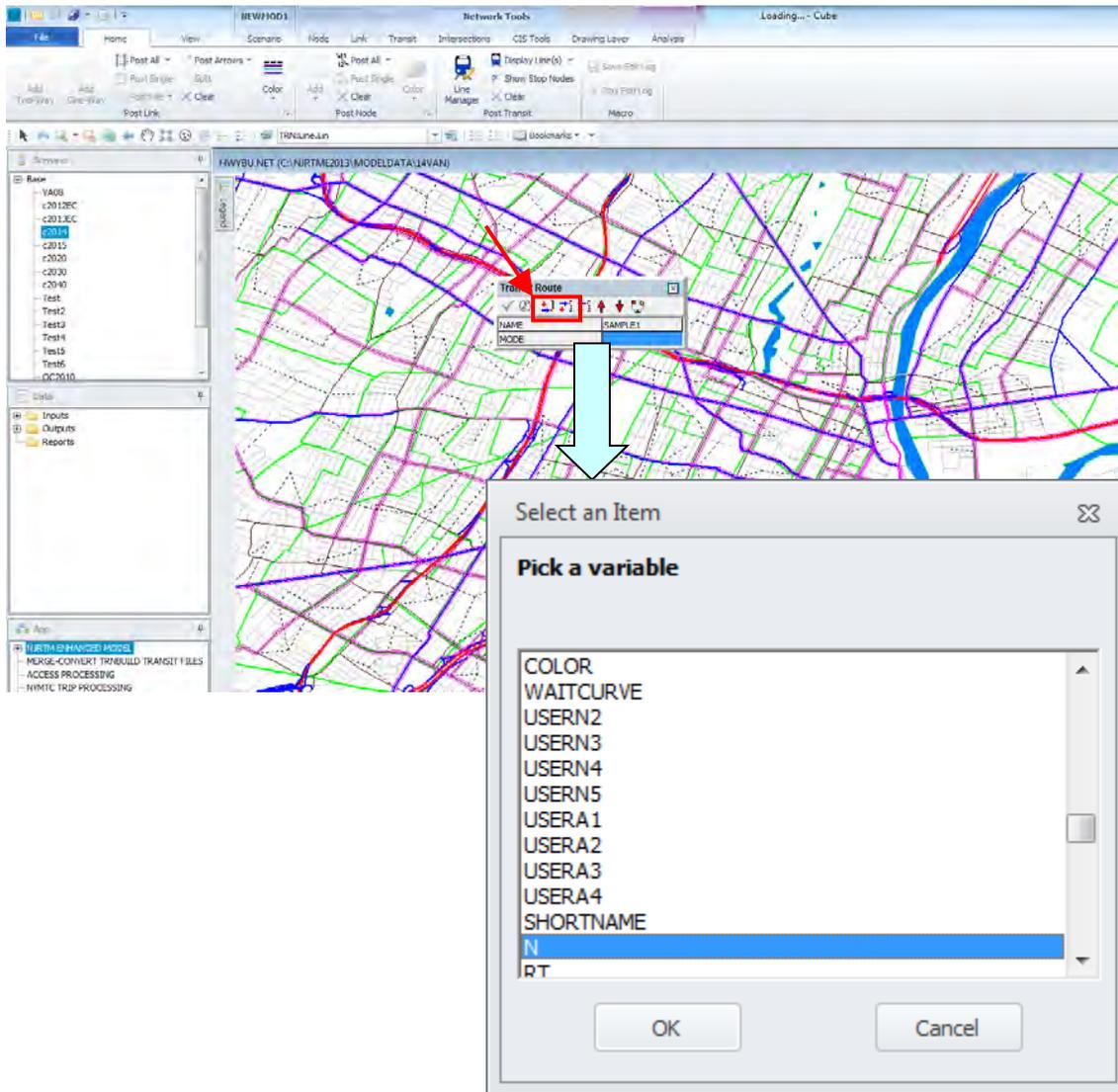
- The transit line manager window will be displayed as shown in Figure 161. Select a transit file in which the new line/route will be stored.
- Add new line window will be display and the analyst can input the transit line name (see Figure 161).

Figure 161 – Transit Line Manager Window



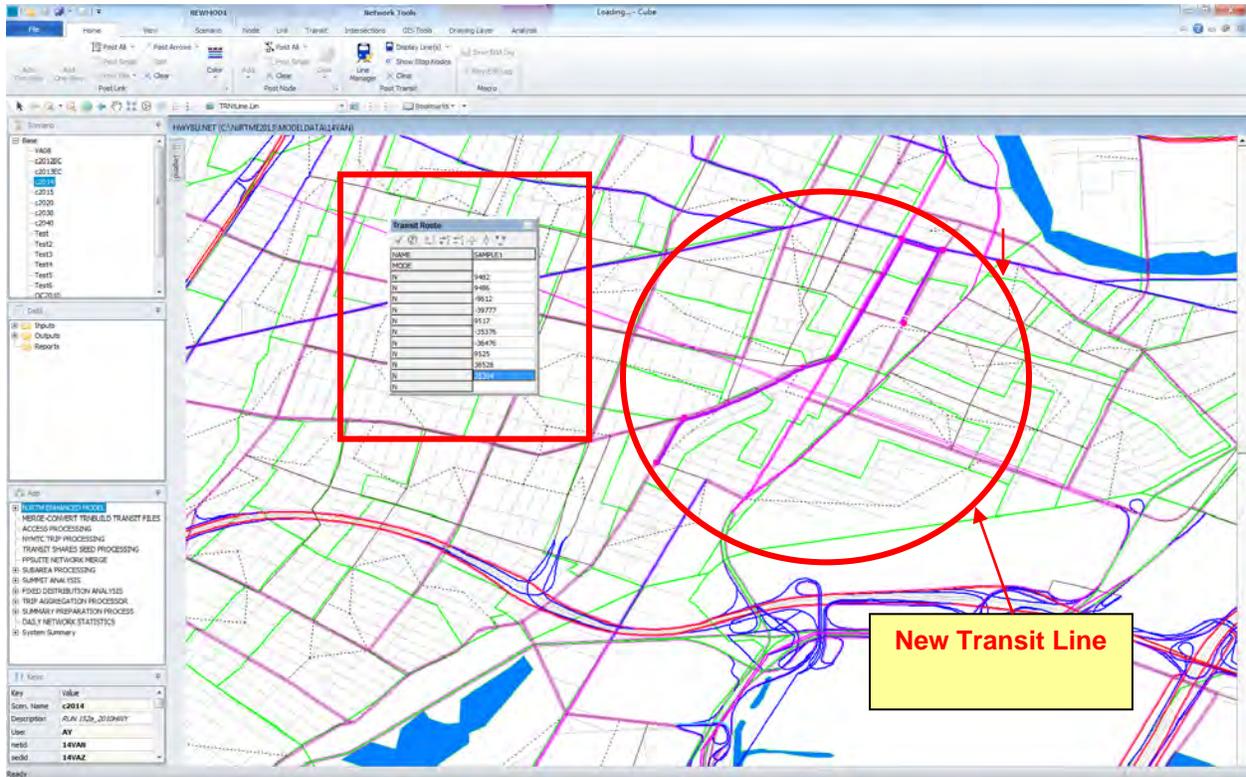
- Select "edit" to start coding the new line. The new transit route window will be displayed on the screen as shown in Figure 162. Select "Insert" or "Append" keys to add transit information to the line, such as, frequencies, nodes (N), etc. To start coding the alignment of the transit route, the analyst should add "N" variable in the transit route window.

Figure 162 – Transit Route Window



- After variable N is added, select “cancel” to close “Select an Item Window” and then click on “Route Edit” key to start editing. The cursor will change to cross-hair. Start to click on nodes where the transit route will pass, see Figure 163.

Figure 163 – New Transit Line Addition

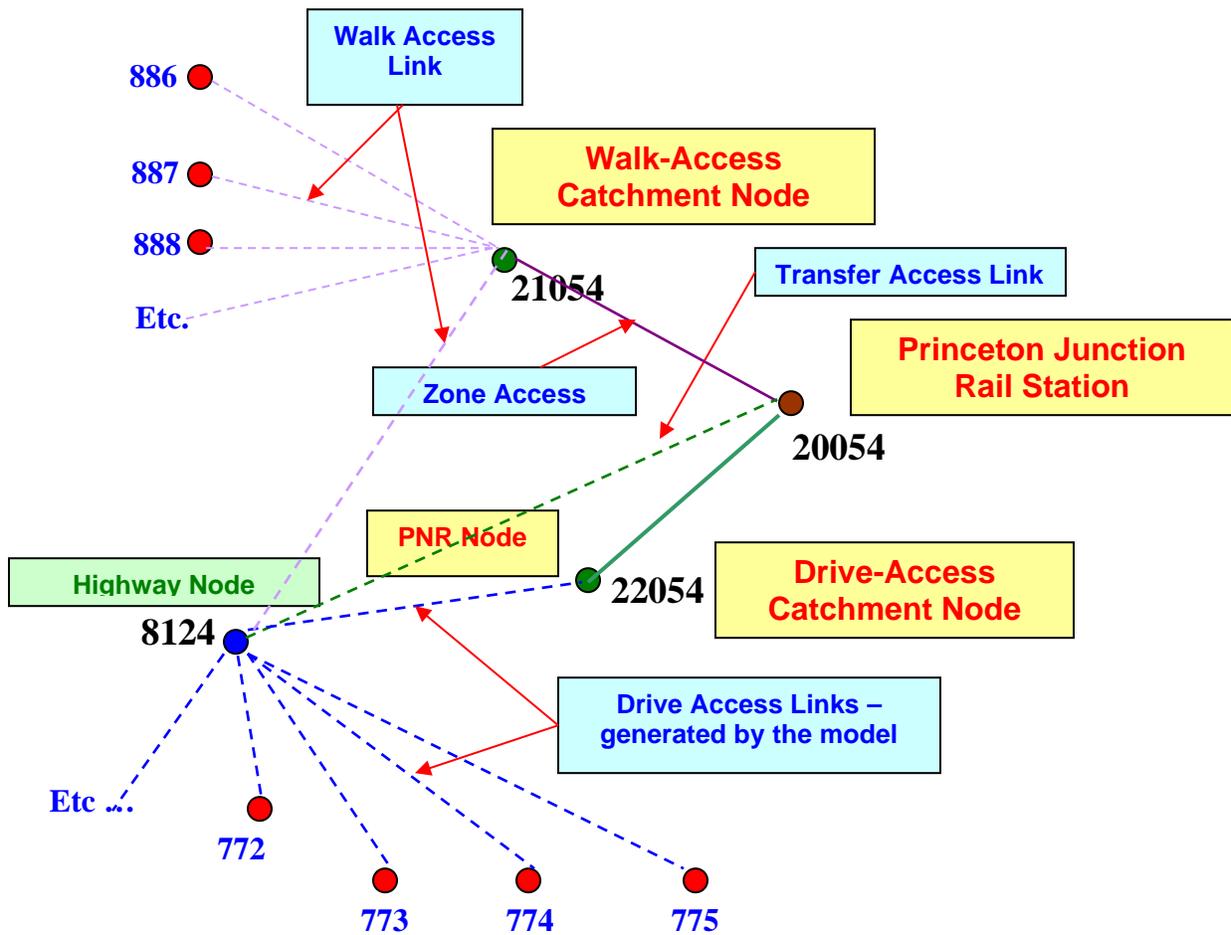


- Click on arrow key (pointing mode) to activate the transit route editing keys. Select “Save” to save the new transit line, or “Cancel” to delete the newly-coded line. Note that if the user wants to add descriptive comments to the line, the user must go the transit network sub-application and enter the comments in accordance with the procedures established for this task. The user can review this process as part of the application as described previously in Section 5.4 and the example of coding comments in the line file described in Section 7.5.5.

### 7.6 Transit Access Coding Procedures

The transit coding procedures require a detailed abstraction of transit access for stations serving fixed guideway transit modes. As an example, the access coding for a typical rail station (Princeton Junction) is provided as a schematic diagram in Figure 164. The access links for the transit station depicted in this figure include the system of links developed for both walk and auto access, along with a sample of Park and Ride (PNR) catchment zones for available for auto access, and other related support links. Note that the two links (21504-20054 & 22054-20054) act as collector links to gather all trips by access mode utilizing the station.

Figure 164 – Transit Station Access Coding Example



The transit access links are coded using a series of general rules defined as follows:

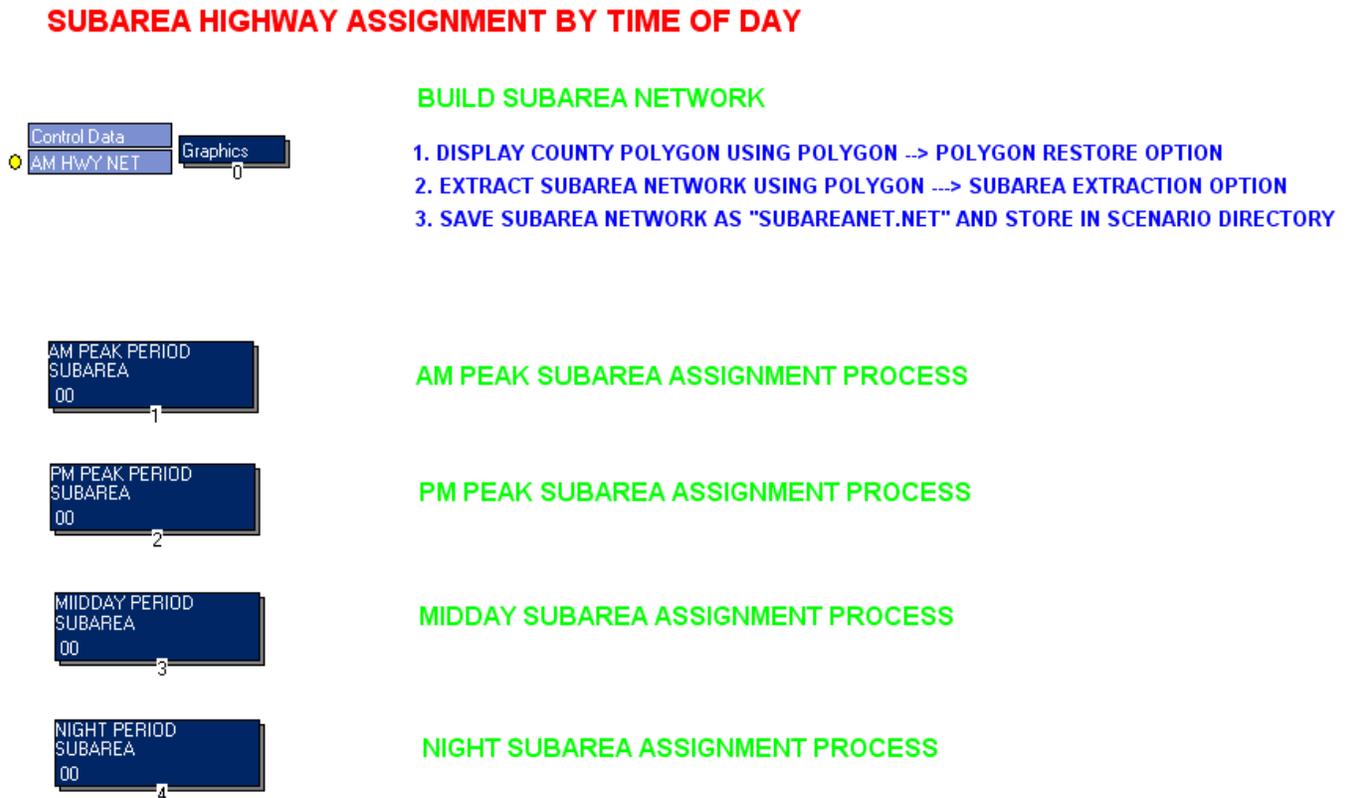
- Walk access links from zones were pooled to a walk-access catchment node numbered with 21000+ corresponding to its station number. For example, Princeton Junction Station was coded as node 20054, and the associated walk-access catchment node is coded as **21054**.
- Similarly, the drive-access catchment node is numbered with 22000+ series. In this example, the drive-access catchment node is 22054.
- The zones that are assumed within walk-access coverage are defined in Access/Transfer Links module within the transit network sub-application. These zones are coded directly to the walk access collector link (21054-20054). Other zones may have walk paths constructed during the access generation process. For these zones, paths are built along the highway network (where sidewalks are assumed) and these paths are routed to walk collector link through a special link connected from the nearest highway node to the walk connector node. This link is shown as 8124-21054 and is coded as mode 14.
- The zones that are within drive-access coverage are defined in PNR Catchment Zones module within the transit network sub-application.
- In situations where local bus service is available for transfers, transfer links connect the highway network node with the rail station node. The highway network node is selected at the location where bus line stops to serve the station. The transfer links create a direct link from one mode to another, such as, from bus to rail or vice versa. The use of these transfer links is controlled in the transit path-building process with transfer (NOX) restrictions.
- Walk-access links are defined as mode 14, drive-access links are defined as mode 11, and transfer links are mode 12. The PNR collector link (22054-20054) is a mode 15 link.

Note that during the transit path-building process, access paths are constructed for both walk and auto submodes.

## 7.7 Subarea Processing

The procedures used to define and extract a subarea network and associated trip tables are relatively straightforward. Note the support application entitled “Subarea Processing” performs this task with guidance from the user. The application is structured with the assumption that the main NJRTM-E has already been processed and the required time-of-day trip tables for highway assignment already exist in the scenario output directory. The first step is to select that support application from the application list. Once this application is selected, the sub-applications listed in Figure 165 will appear.

Figure 165 – Subarea Extraction Process



The user will then select the first routine which is a graphics function that loads the highway network and a series of predefined boundary files for the 15 NJTPA sub-regions. Note that each subarea is defined as a polygon consistent with the county boundaries. The user selects the “polygon” icon, followed by the “restore” option to list the available subarea boundaries. As an example, the predefined boundary for Bergen County is selected in Figure 166. After selecting the Bergen County polygon, CUBE will display the boundary as shown in Figure 167. Note that the user can manipulate the boundary file within CUBE to either add adjacent areas or remove areas within the selected polygon. Figure 168 displays an adjusted boundary file that was created by clicking on the polygon line and dragging points to extend the boundary west of the county border. Note that the revised polygon can also be saved as a new, “named” polygon, using the “polygon” / “save” option.

Figure 166 – Boundary File Selection

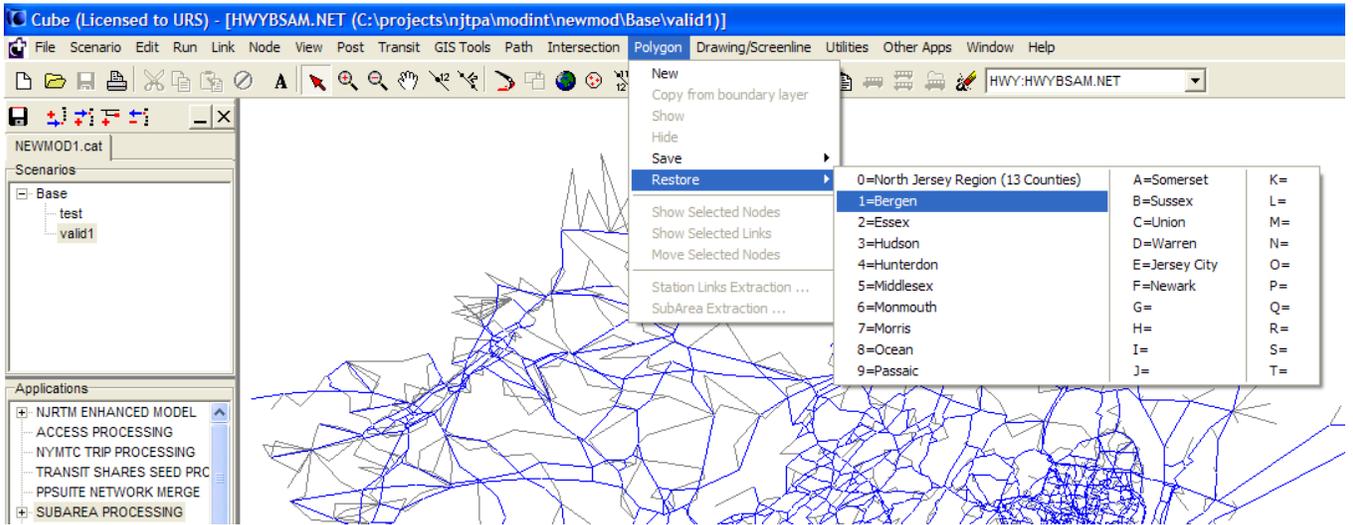


Figure 167 – Boundary File Display

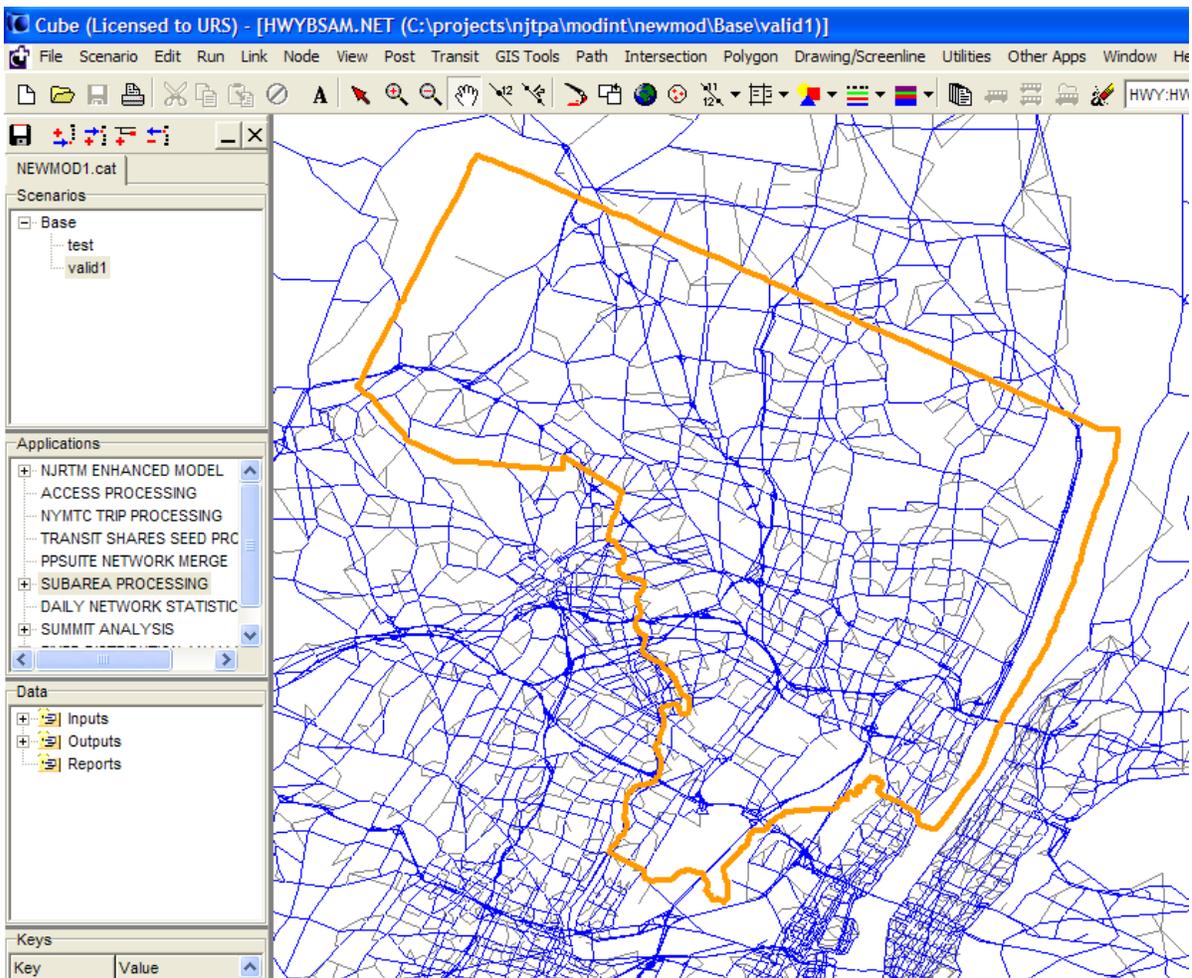
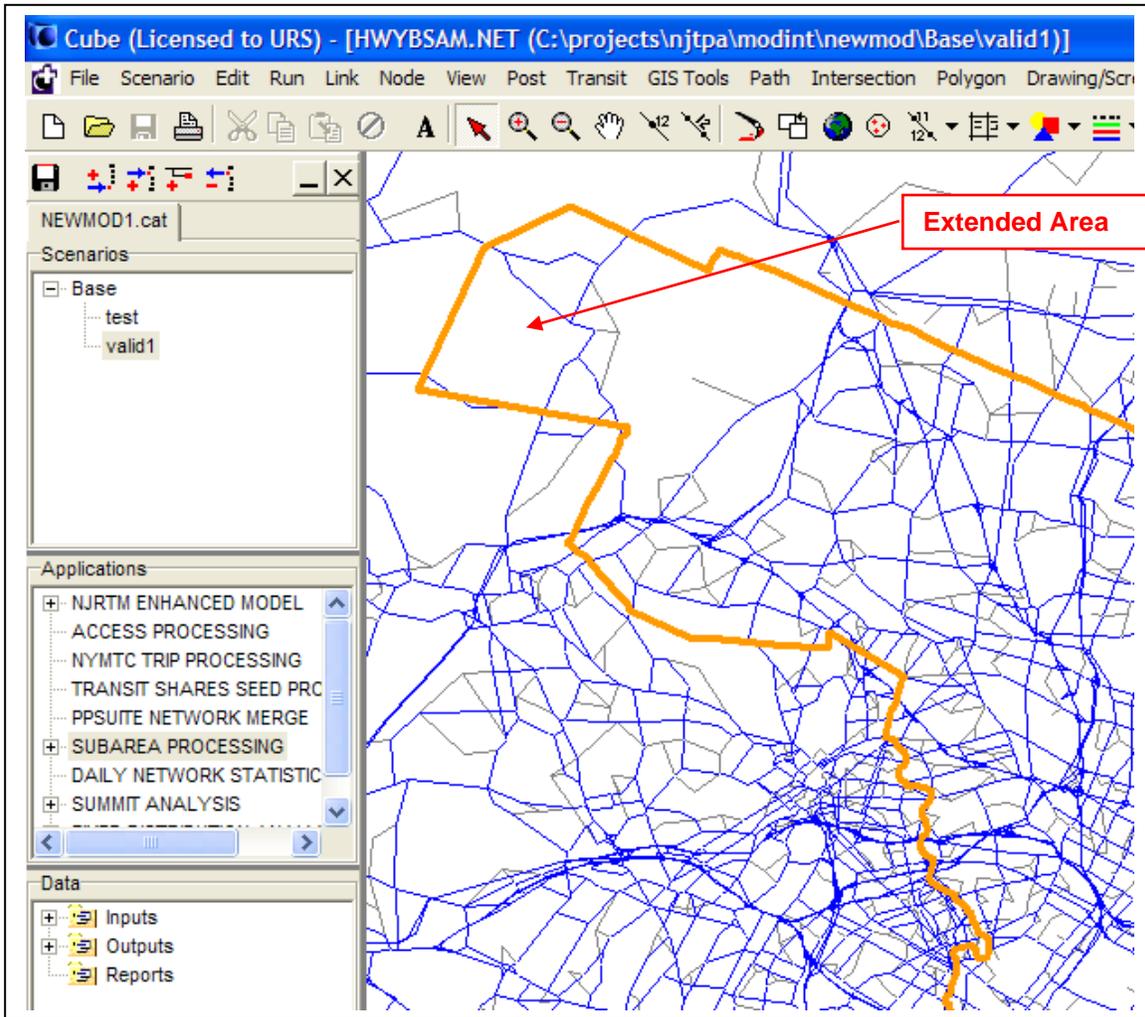


Figure 168 – Extended Boundary Display



In order to complete the subarea extraction process, the user must then extract the subarea network. Referring back to Figure 166, the user then selects the “subarea extraction” option under the polygon menu and saves the selected network as SUBAREANET.NET within the scenario output directory. After completing this step, the user can then execute the entire Subarea Processing application which launches the highway assignment for the four time periods shown in Figure 159.

## 7.8 Transit Walk Access Coverage

Transit “walk” accessibility can change due to any changes to the transit routes. For example, adding or extending transit routes will most likely increase transit accessibility, while eliminating or truncating transit routes will reduce transit accessibility. Rerouting a transit line will also affect the transit accessibility for particular zones. These types of changes to transit route require adjustments to transit accessibility if they are the primary route or only route providing walk access to particular zones.

CUBE includes a feature called “Transit Accessibility Function” which will create accessibility coverage/buffer based on transit stop nodes. The accessibility buffer for the express buses and rail services were based on defined stop nodes for these lines. If necessary, flag service could be approximated by using all the transit line nodes to create buffer along the local streets served by these transit, particularly local buses.

The transit accessibility function will create five output files, four of which are intermediate shape files. These five output files are as follows:

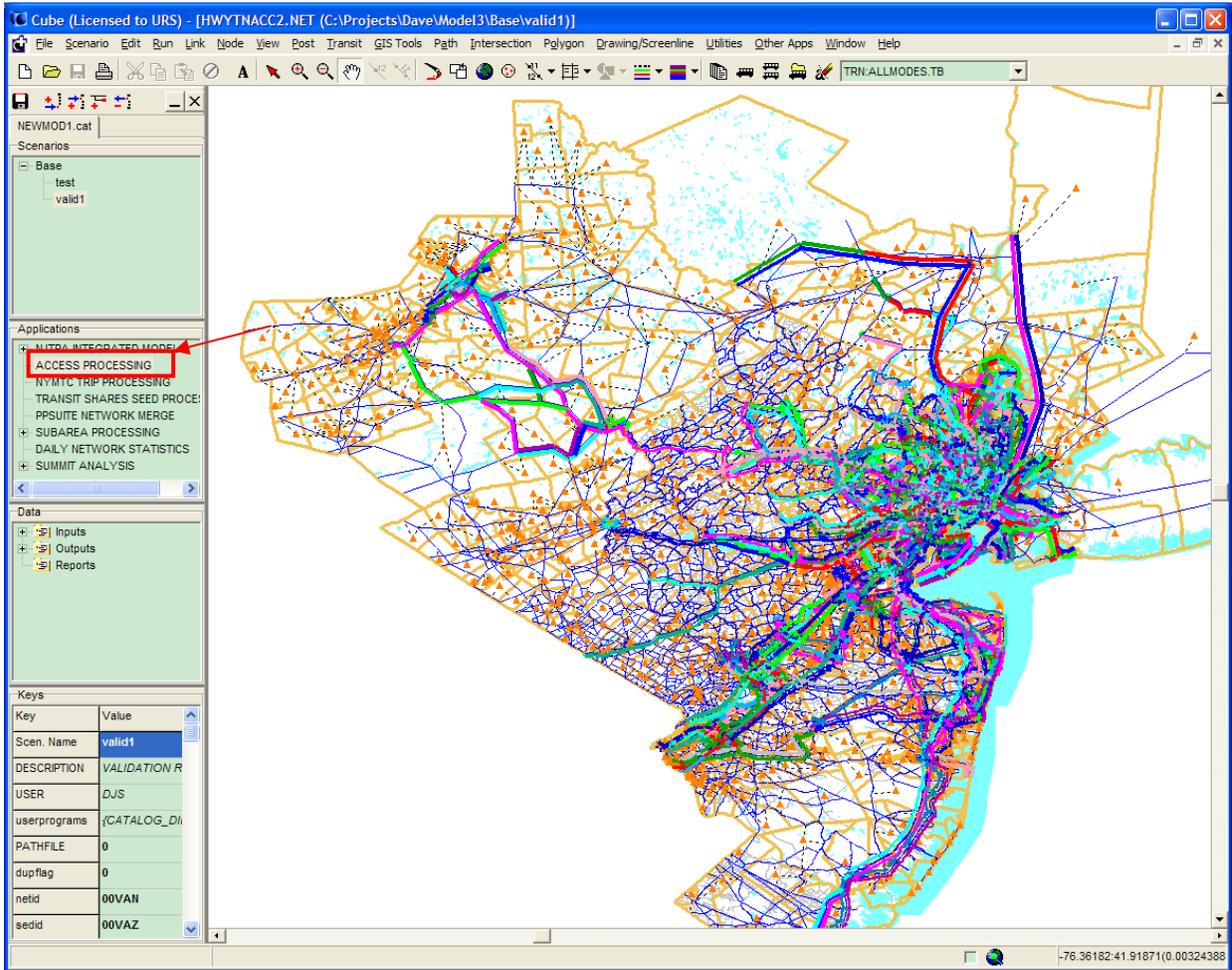
1. The DBF file for saving the zone, length percentage, and area percentage. This file is called ALLMODE-WALK.DBF and is used in a subsequent step of the walk access support application.
2. The “Stop Node Points” shape file stores those nodes identified as transit stop nodes. In the example, the file is named “STOPBUFFER1.SHP”
3. The “Stop Buffer” shape file provides the buffer area surrounding each transit stop and is stored in a file named “STOPBUFFER2.SHP” in the example.
4. The combined shape file from the union of “Stop Node Buffer” and “Zonal Boundary”. For each zonal polygon shape, the area which is also covered by stop node buffers is stored.” The filename in the example of this “union” shape file is “UNIONBUFFER.SHP”. This file will permit the user to display the coverage area around each stop, as well as the combined coverage in each zone.
5. The shape file for intersect results of the “Stop Node Buffer”, “Zonal Boundary” and “Street Layer”. For all zones an intersect area is calculated using the underlying street layer. This shape file provides walk access coverage with respect to the underlying street layer. In the example, this shape file is named “INTERSECTBUFFER.SHP”.

The following requirements shall be satisfied in order to run the transit accessibility geoprocessing function properly:

1. A valid copy of ArcGIS must be installed on the computer using the same drive as the CITILABS software. As of the drafting of this document, the function work with the latest version of ARCGIS 10.4.
2. There must be a transit layer loaded with transit lines displayed on the screen.
3. Only transit lines that are selected will be analyzed.
4. A zone boundary shape layer and a street shape layer must be loaded and visible in the network window. Basically, the valid highway network, background street layer, zonal boundary and transit layer are all needed to make this function work.

The analyst can select the “Access Processing” subroutine from the applications window, as shown in Figure 169, to perform the transit accessibility processing within the NJRTM-E environment.

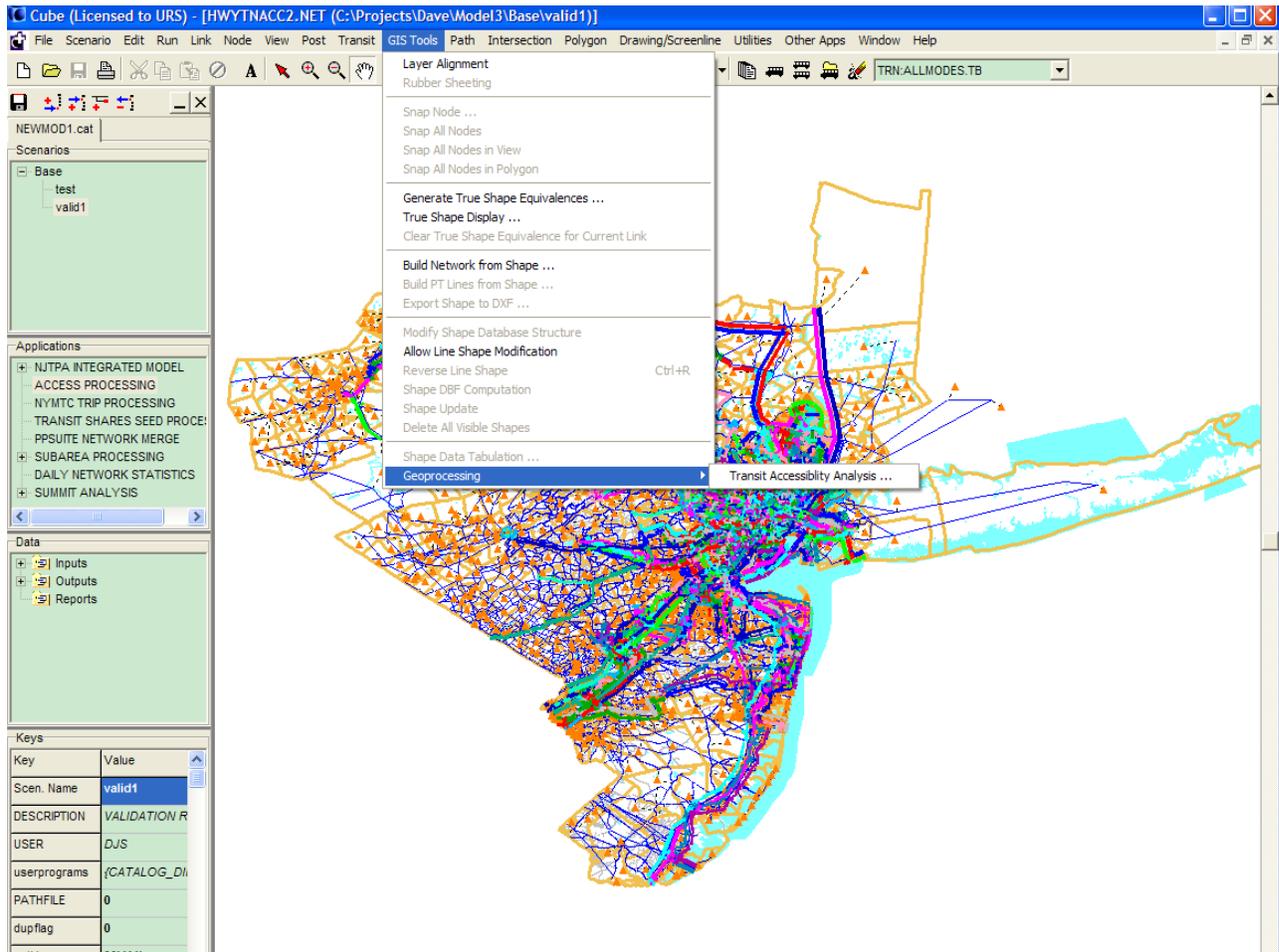
**Figure 169 – Access Processing Subroutine**



The following steps will describe the complete process of creating or updating the transit accessibility information:

1. Select “Geoprocessing” command from “GIS Tool” menu as shown in Figure 170.

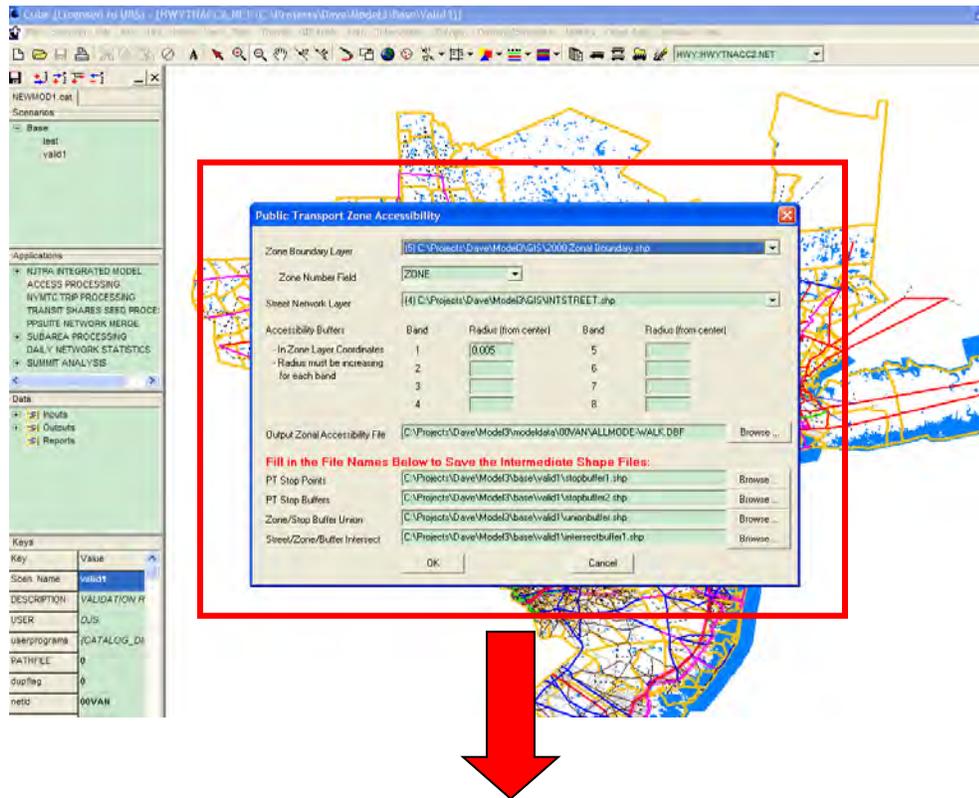
Figure 170 – Geoprocessing Menu Option



2. “Public Transport Zone Accessibility” will be displayed on the screen as shown in Figure 171. There is some information that need to be entered into the dialog, such as:

- Zone boundary layer: the name of zonal boundary layer for this project. Zonal boundary will be used to calculate the percentage of transit accessibility for the corresponding zones.
- Zone number field: a field where zone number information is stored.
- Street Network Layer: a street network shape file (not highway network file).
- Accessibility buffer: the radius of buffer for each band. There are 8 bands allowed in this process. The radius increases with the increasing band number.
- Output zonal accessibility file: the output file name (in DBF format).
- The four additional output files as explained in the beginning of this section.
- A buffer walk radius for the transit stops The current buffer setting should be set at 0.005 which is approximately ½ mile using the latitude / longitude coordinate system.

Figure 171 – Public Transport Zone Accessibility



**Public Transport Zone Accessibility**

Zone Boundary Layer: (5) C:\Projects\Dave\Model3\GIS\2000 Zonal Boundary.shp

Zone Number Field: ZONE

Street Network Layer: (4) C:\Projects\Dave\Model3\GIS\INTSTREET.shp

Accessibility Buffers

	Band	Radius (from center)	Band	Radius (from center)
- In Zone Layer Coordinates	1	0.005	5	
- Radius must be increasing for each band	2		6	
	3		7	
	4		8	

Output Zonal Accessibility File: C:\Projects\Dave\Model3\modeldata\00VAN\ALLMODE-WALK.DBF Browse ...

**Fill in the File Names Below to Save the Intermediate Shape Files:**

PT Stop Points: C:\Projects\Dave\Model3\base\valid1\stopbuffer1.shp Browse ...

PT Stop Buffers: C:\Projects\Dave\Model3\base\valid1\stopbuffer2.shp Browse ...

Zone/Stop Buffer Union: C:\Projects\Dave\Model3\base\valid1\unionbuffer.shp Browse ...

Street/Zone/Buffer Intersect: C:\Projects\Dave\Model3\base\valid1\intersectbuffer1.shp Browse ...

OK Cancel

3. Upon the completion of this process, the output window will be displayed on the screen as shown in Figure 172.

Figure 172 – Sample of Transit Accessibility Output

ZONE	LENGPERC0	LENGPERC1	AREAPERC0	AREAPERC1
1	83.87	16.13	91.8	8.2
2	90.52	9.48	96.66	3.34
3	100	0	100	0
4	100	0	100	0
5	100	0	100	0
6	100	0	100	0
7	100	0	100	0
8	100	0	100	0
9	67.24	32.76	94.1	5.9
10	100	0	100	0
11	100	0	100	0
12	100	0	100	0
13	97.86	2.14	99.5	0.5
14	100	0	100	0
15	100	0	100	0
16	100	0	100	0
17	100	0	100	0
18	100	0	100	0
19	100	0	100	0
20	100	0	100	0
21	84.87	15.13	93.02	6.98
22	100	0	100	0
23	87.36	12.64	91.3	8.7
24	100	0	100	0
25	100	0	100	0
26	48.24	51.76	54.75	45.25
27	38.03	61.97	65.94	34.06
28	25.33	74.67	25.17	74.83
29	51.98	48.02	80.83	19.17
30	30.76	69.24	46.57	53.43
31	55.17	44.83	51.07	48.93
32	3.26	96.74	2.3	97.7
33	67.17	32.83	62.76	37.24
34	24.54	75.46	25.38	74.62

Key	Value
Scen. Name	valid1
DESCRIPTION	VALIDATION R
USER	DJS
userprograms	{CATALOG_DI
PATHFILE	0
dupflag	0
netid	00VAN

### 7.8.1 Process Limitations

It is important to note that the function is controlled by the presence of zonal polygons. Therefore if a “special zone” is defined without area (i.e. no polygon), the user will need to enter coverage for that zone via the user-defined override percentages stored in the WALKACC-OVERLAY.DBF file. This file is in the last step of the application. This overlay file can also be used to provide a customized estimate of walk coverage for particular zones, overriding the values estimated by the routine.

## 7.9 Transit Ridership Summary

Transit Ridership Summary application is a part of the main model chain, and was developed in the Transit Assignment Application as shown in Figure 173. Figure 174 shows the Ridership Summary Sub-Application within the Transit Ridership Application.

Figure 173 – Transit Assignment Application

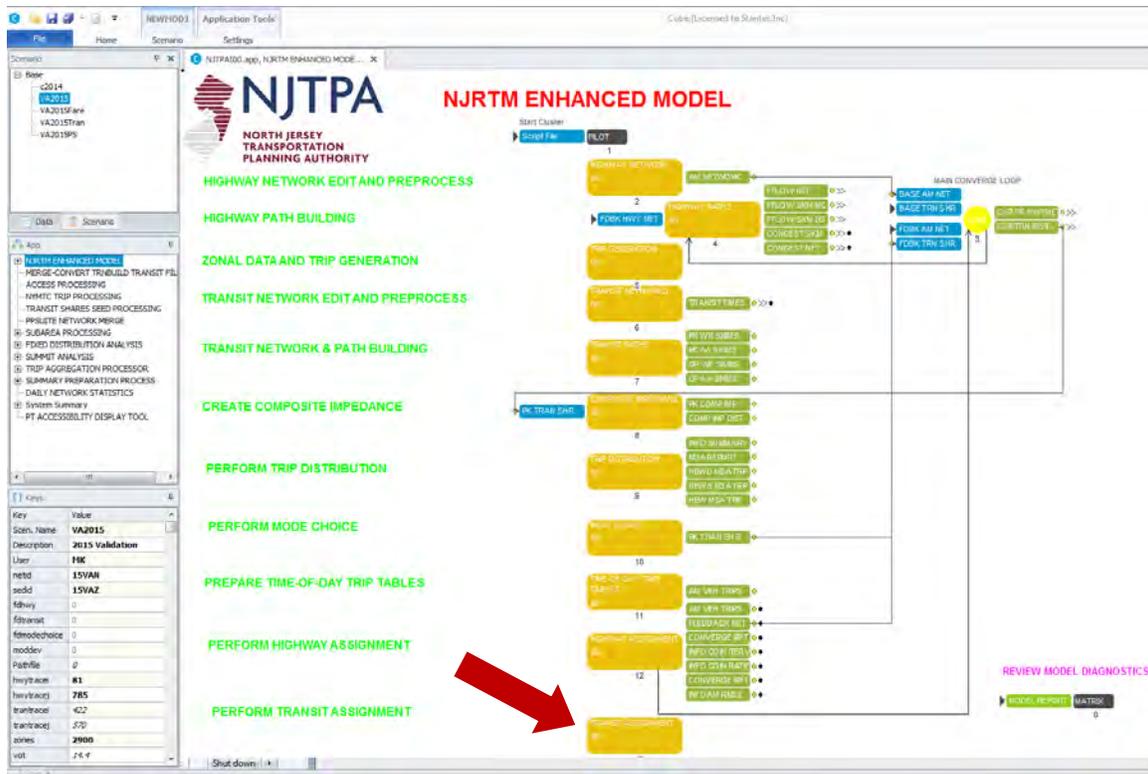
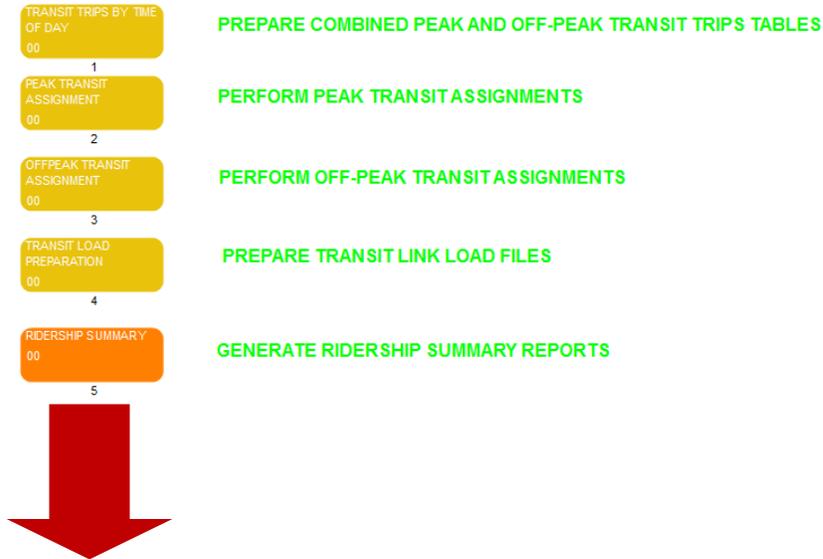


Figure 174 – Transit Ridership Sub-Application

**TRANSIT ASSIGNMENT AND SUMMARY PROCESS**





The users can select specific transit routes to be summarized. The route selections are defined, and can be adjusted in the “EDIT SUMMARY REQUEST FILES” portion of the application as shown in Figure 177. The file that controls the selection can be opened by double-clicking its corresponding blue-box. Figure 178 shows an example of ridership by line control file, and the routes that were selected for the summary.

Figure 177 – Edit Summary Request

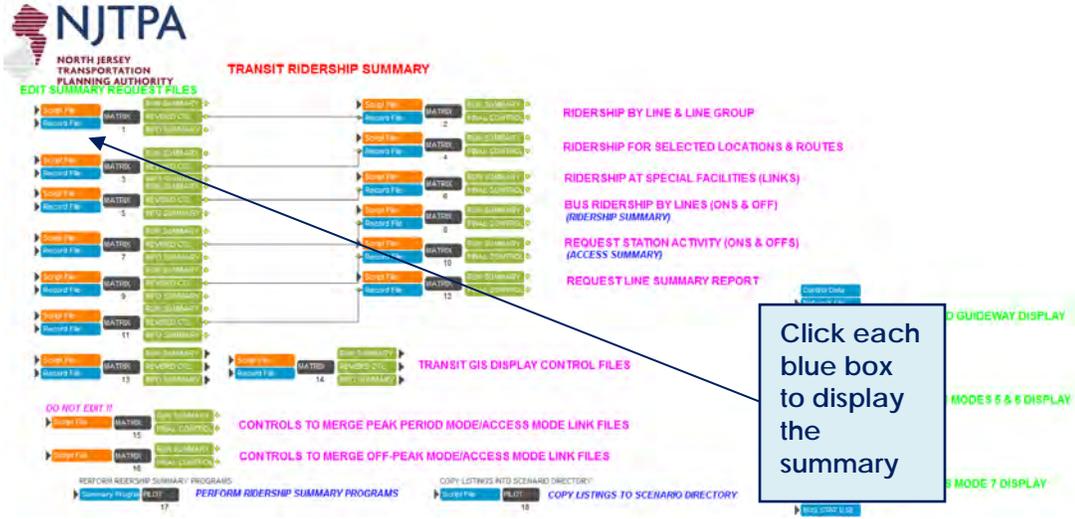


Figure 178 – An example of Ridership By Line Control File

```

1
2 LINE NEC10, NEC11, NEC12, NAME="North East Corridor Routes"
3 // STOP 8209, 8210, 8211, 8212, NAME="Port Authority Bus Terminal"
4 // LINK 10335-10346, NAME="GW Bridge Buses"
5 // LINK 11649-11291, 20909-20910, NAME="Lincoln Tunnel Buses"
6 // LINK 10011-20921, 10011-11375, NAME="Holland Tunnel Buses"
7
8 STOP 20911, 20912, 20913, 20914, 20915, 20916, 20917, 20918, 20919, NAME="Port Authority Bus Terminal"
9
10 LINK 20271-20999, 20264-20999, 20265-20999, 20271-20396, NAME="Midtown Direct"
11 LINK 20234-20271, NAME="Montclair Connection"
12 LINK 12335-12346, NAME="GW Bridge Buses"
13 LINK 13649-13291, NAME="Lincoln Tunnel Buses Inbound"
14 // LINK 13291-13649, NAME="Lincoln Tunnel Buses Outbound"
15 LINK 12011-13375, NAME="Holland Tunnel Buses"
16
17 ONOFF
18 //--- Route01 ---
19 1A1,1A2,1B1,1B2,1C12,1D1,1D2,1E1,1E2,1FX1,
20
21 //--- Route02 ---
22 2A1,2A2,2B1,2B2,
23
24 //--- Route05 ---
25 5A12,
26
27 //--- Route11 ---
28 11A1,11A2,11B2,
29
30 //--- Route13 ---
31 13A1,13A2,13B1,13B2,13C1,13C2,13D1,13D2,13E1,13E2,13F1,13F2,13G1,
32 13G2,13H1,13H2,
33
34 //--- Route21 ---
35 21A12,21B12,
36
37 //--- Route24 ---
38 24A12,24B1,24B2,24C1,24C2,24D1,24D2,
39
40 //--- Route25 ---
41 25A12,25B12,25C12,25D1,25D2,25E1,
42
43 //--- Route26 ---
44 26A1,26A2,
45
46 //--- Route27 ---
47 27A12,27B12,27C2,
48
49 //--- Route28 ---
50
51
52
53
54
55
56
57
58
59
60

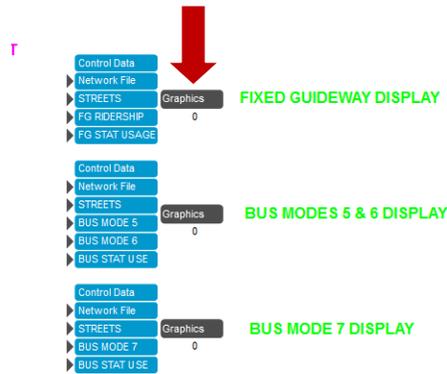
```

The final section of the transit summary is the graphical display of the line summaries as shown in Figure 173. Currently, three graphical displays are prepared including:

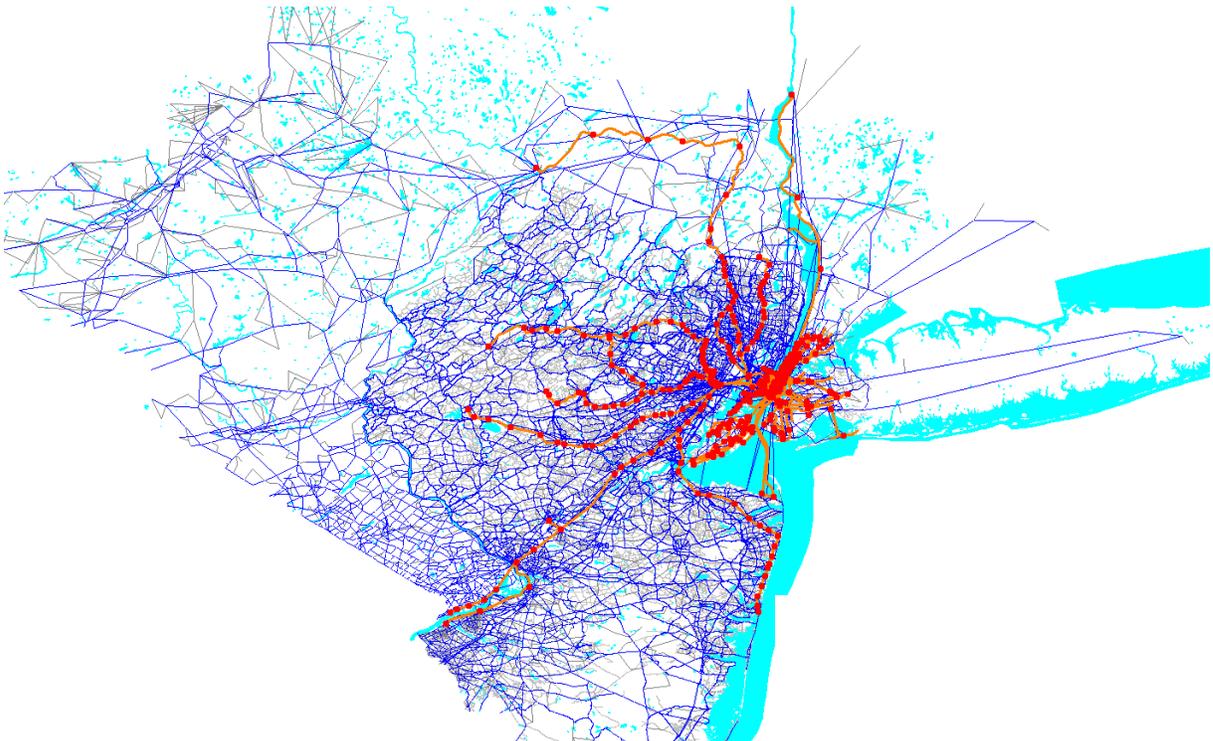
- Fixed Guideway
- Bus Modes 5 and 6, and
- Bus Mode 7 or express bus

The graphical presentation can be opened by selecting the graphic box as shown in Figure 179. A sample of the graphical display for fixed guideway transit is shown in Figure 180.

**Figure 179 – Line Summary Display**



**Figure 180 – An Example of Fixed Guideway Transit Display**



As part of graphical display, a series of GIS Shape Files are created and stored in the Scenario folder. Those files include:

- All Fixed Guideway Station (ALLFG\_Stations.shp)
- All Fixed Guideway Ridership (ALLFG\_Ridership.shp)
- Mode-5 Bus Ridership (Bus-Ridership\_Mode5.SHP)
- Mode-6 Bus Ridership (Bus-Ridership\_Mode6.SHP)
- Mode-7 Bus Ridership (Bus-Ridership\_Mode7.SHP)
- Bus Station (Bus-Stations.shp)
- Commuter Rail Ridership (ComRail\_Ridership.SHP)
- Commuter Rail Stations (ComRail\_Stations.SHP)
- LRT Ridership (LRT\_Ridership.SHP)
- LRT Stations (LRT\_Stations.SHP)
- Newark Subway Ridership (NWK\_Subway\_Ridership.SHP)
- Newark Subway Stations (NWK\_Subway\_Stations.SHP)
- PATH Ridership (PATH\_Riderships.SHP)
- PATH Stations (PATH\_Stations.SHP)
- Ferry Ridership (Ferry\_Ridership.SHP)
- Ferry Stations (Ferry\_Stations.SHP)

## 8.0 Output Descriptions

Each component of NJRTM-E model has a certain number of output files. Some of them are temporary and can be ignored, while others are either inputs of the following components or output files for review and summary. The major output files of each component are listed in Appendix H for reference.

The highway assignment process generates some output variables and stores them as link variables in the loaded highway network. The support application “Daily Network Statistics” generates some additional link variables for summary purpose. These variables are described in Appendix I for reference.

# Appendices

# Appendix A

## Machine Configuration

Figure A-1 below shows the machine configuration used for model calibration. Please note that a complete model run on this computer with 4 cores (clusters) requires about 8 and a half hours. If the user selects to run the model without cluster, it will be about 20 to 24 hours.

**Figure A-1 Machine Configuration**

Windows edition	
Windows 7 Enterprise	
Copyright © 2009 Microsoft Corporation. All rights reserved.	
Service Pack 1	
System	
Rating:	System rating is not available
Processor:	Intel(R) Xeon(R) CPU E5-1620 v3 @ 3.50GHz 3.50 GHz
Installed memory (RAM):	32.0 GB
System type:	64-bit Operating System

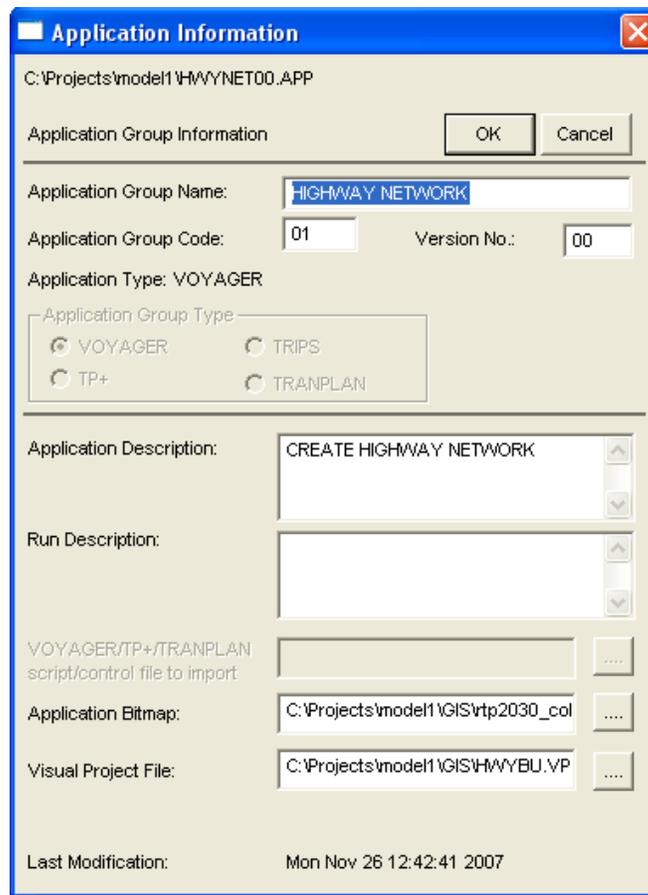
## Appendix B

### User-Defined Display Configurations

A set of default visual display configurations has been created for the model and saved in the GIS directory as VPR files. Each application can have a unique configuration for itself. With a certain application open on the screen, the user can select and click the “Properties...” under “Applications” menu to view or modify the corresponding display configuration for the current application.

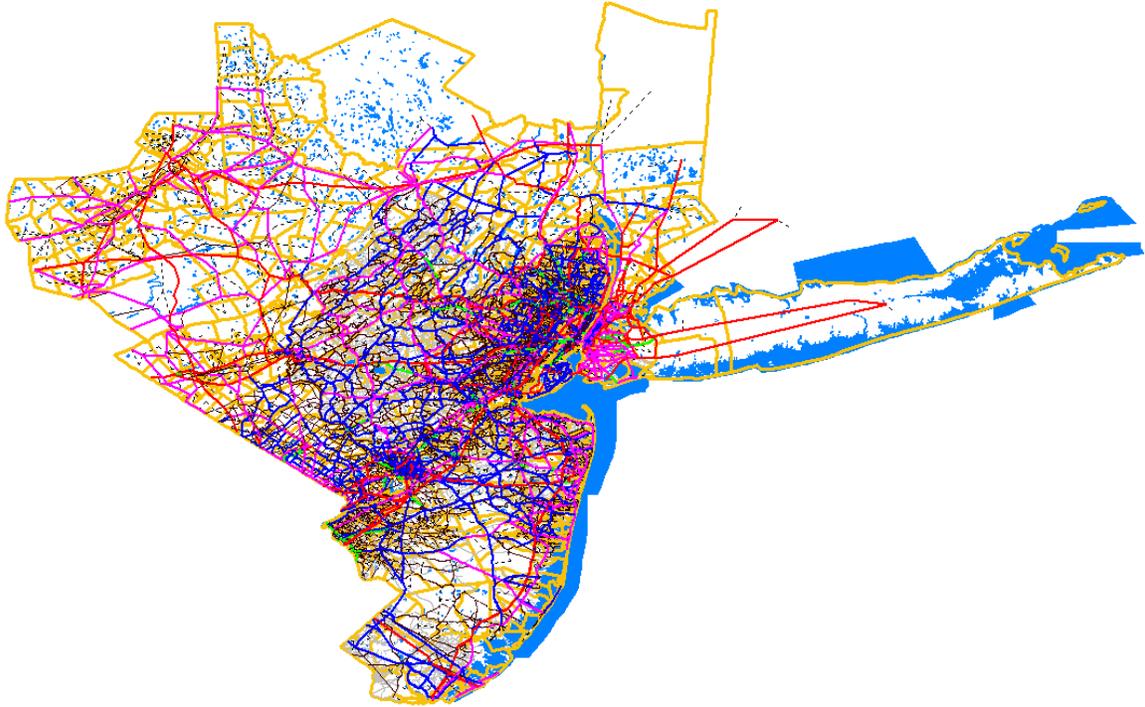
The following dialog (Figure B-1) shows the specification of the “Highway Network” application. The default visual display configuration is stored in the file “C:\projects\model1\GIS\hwybu.vpr”. The user can replace it with a different VPR file by clicking the right-side “...” button.

**Figure B-1 Properties of Application “Highway Network”**



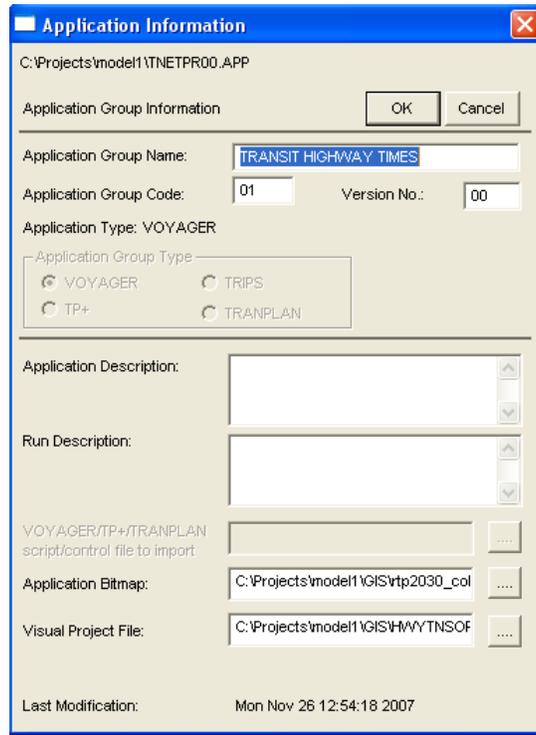
After the user clicks any input or output network in the application, Cube opens the highway network together with all the background layers and displays them using the stored settings (Figure B-2). For instance, the default HWYBU.VPR brings up the following display setup which contains zonal boundaries, water boundaries, GIS street layers and highway network.

**Figure B-2 Default Display of Network in Application “Highway Network”**

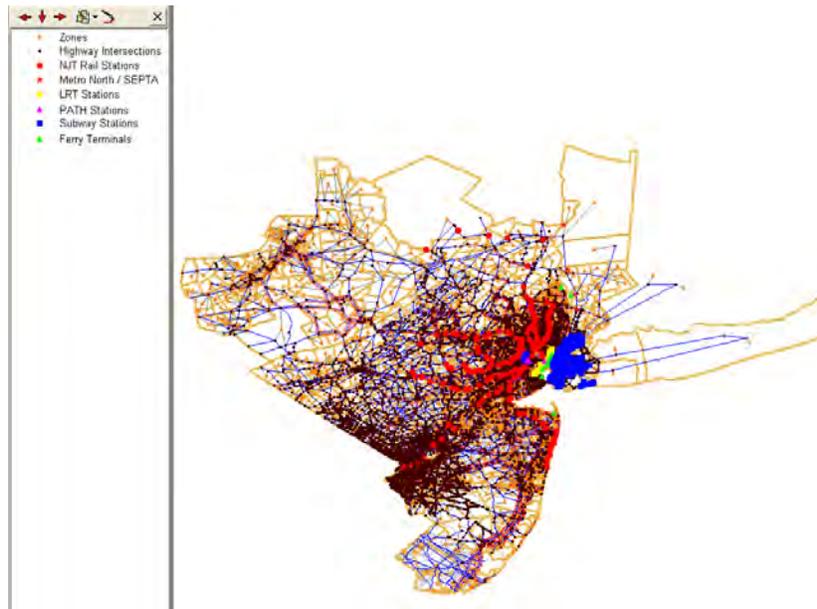


For the application “Transit Highway Times”, the default display configuration is stored in the HWYTN SOP.VPR file (Figure B-3). And by opening any network inside this application, transit lines, stations by group, highway network, GIS street layer, and zonal boundaries are shown as follows (Figure B-4).

**Figure B-3 Properties of Application “Transit Highway Times”**



**Figure B-4 Default Display of Network in Application “Transit Highway Times”**



For all 24 applications inside the two “Transit Paths and Skims Processing” panels (Peak and Off-peak), the default display configuration is stored in the TRANSPEED.VPR file (Figure B-5). And by opening any network inside this application, transit lines, access links by access sub-mode, highway network, GIS street layer, and zonal boundaries are shown as follows (Figure B-6).

**Figure B-5 Properties of Application “Bus Walk-PK”**

The screenshot shows a dialog box titled "Application Information" with a close button (X) in the top right corner. The path "C:\Projects\model1\TPATHF00.APP" is displayed at the top. Below the path are "OK" and "Cancel" buttons. The "Application Group Information" section includes:
 

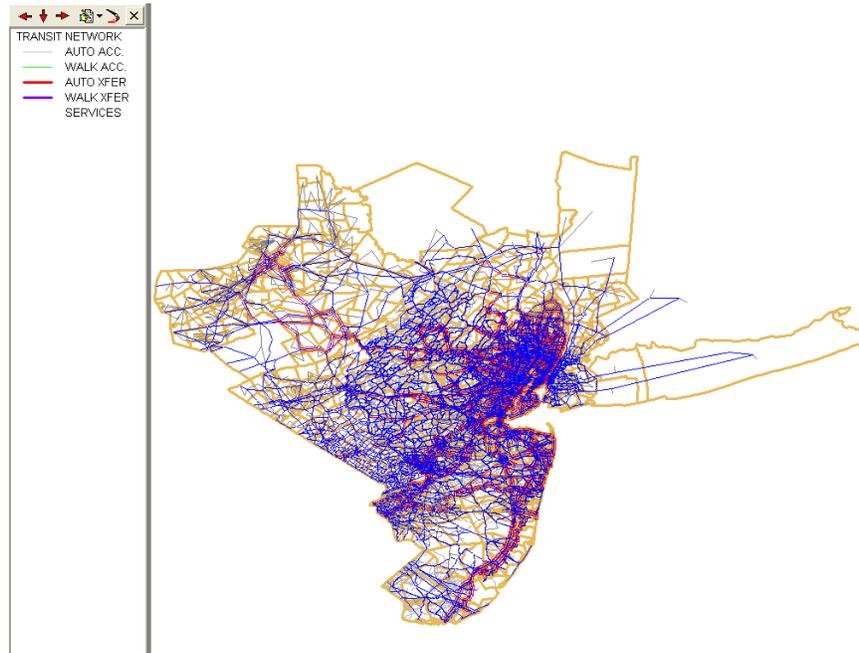
- Application Group Name: BUS WALK - PK
- Application Group Code: 01
- Version No.: 00
- Application Type: VOYAGER
- Application Group Type: A group of radio buttons with "VOYAGER" selected, and options for "TRIPS", "TP+", and "TRANPLAN".

 The "Application Description:" and "Run Description:" fields are empty text boxes with scroll arrows on the right. Below these are three fields with "..." buttons:
 

- VOYAGER/TP+/TRANPLAN script/control file to import
- Application Bitmap:
- Visual Project File: ects\model1\GIS\TRANSPEED.VPR

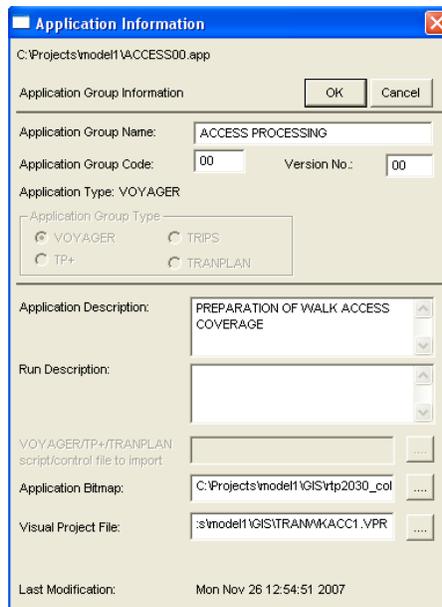
 At the bottom, "Last Modification:" is listed as "Mon Nov 26 12:54:19 2007".

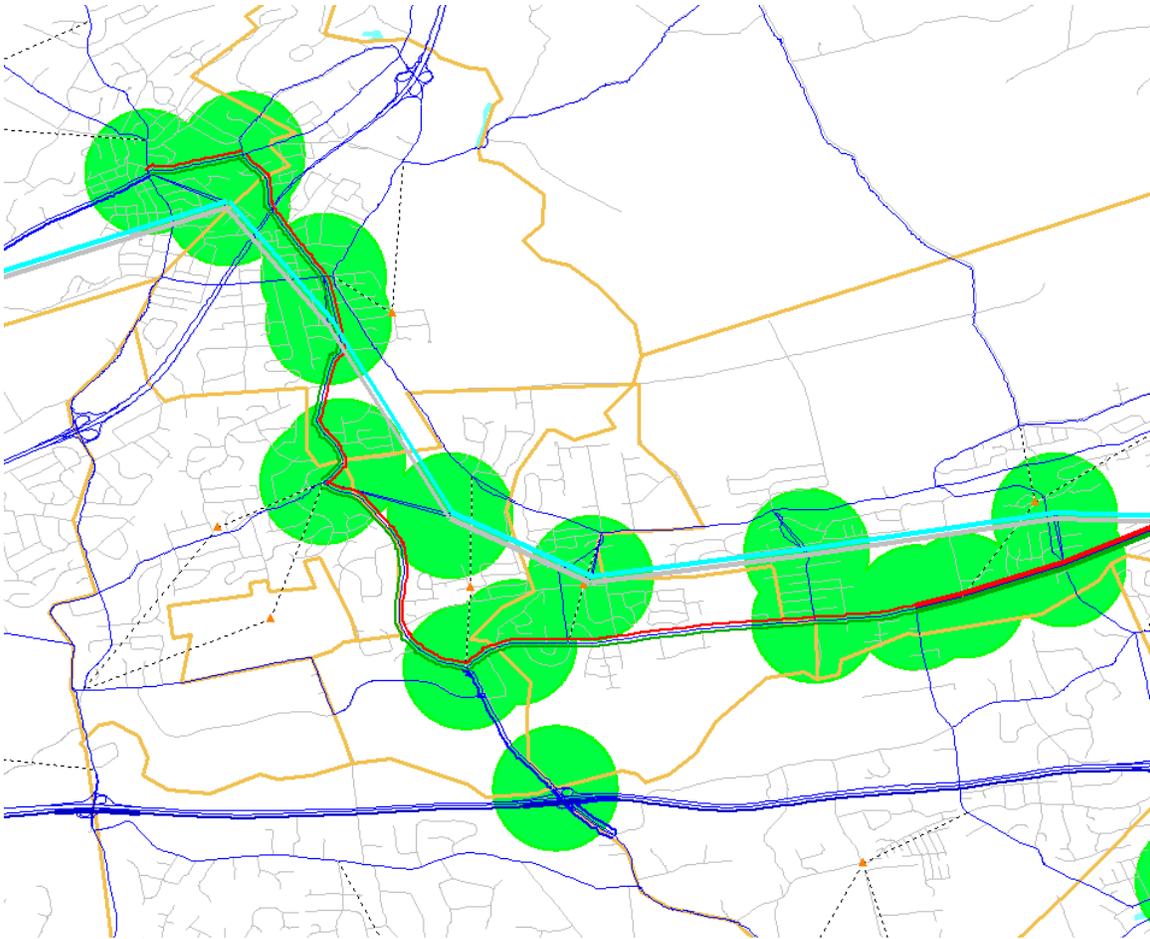
**Figure B-6 Default Display of Network in Application “Bus Walk-PK”**



For “Access Processing” support application, the default display configuration is stored in the TRANWLKACC1.VPR file (Figure B-7). And by opening any network inside this application, transit lines of all modes, highway network, GIS street layer, water boundaries, zonal boundaries and stop buffers are shown as follows (Figure B-8).

**Figure B-7 Properties of Support Application “Access Processing”**



**Figure B-8 Default Display of Network in Support Application “Access Processing”**

For the “Subarea Processing” support application, the default display configuration is stored in the SUBAREA.VPR file (Figure B-9). By opening the network “HWYBSAM.NET” inside this application, the user can pull out the pre-defined polygons (Figure B-10). There are 16 pre-defined polygons stored in the SUBAREA.VPR file as displayed in the following graph (NJTPA whole region + 13 counties + 2 CBDs). After bringing up a certain polygon, subarea extraction can then be performed.

Figure B-9 Properties of Support Application “Subarea Processing”

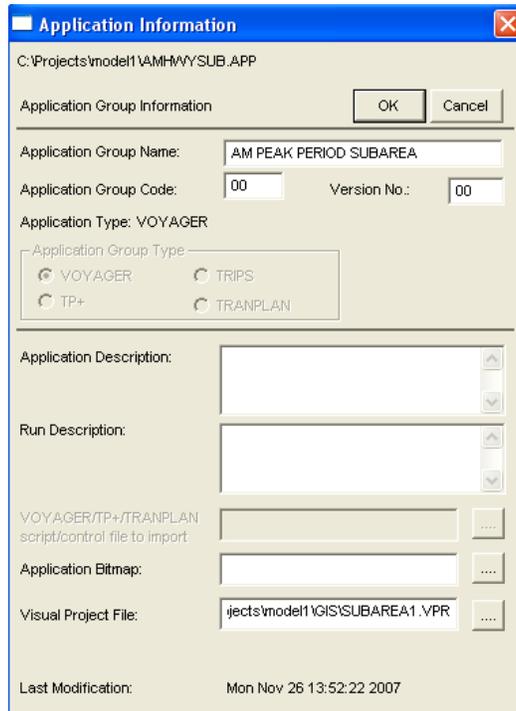
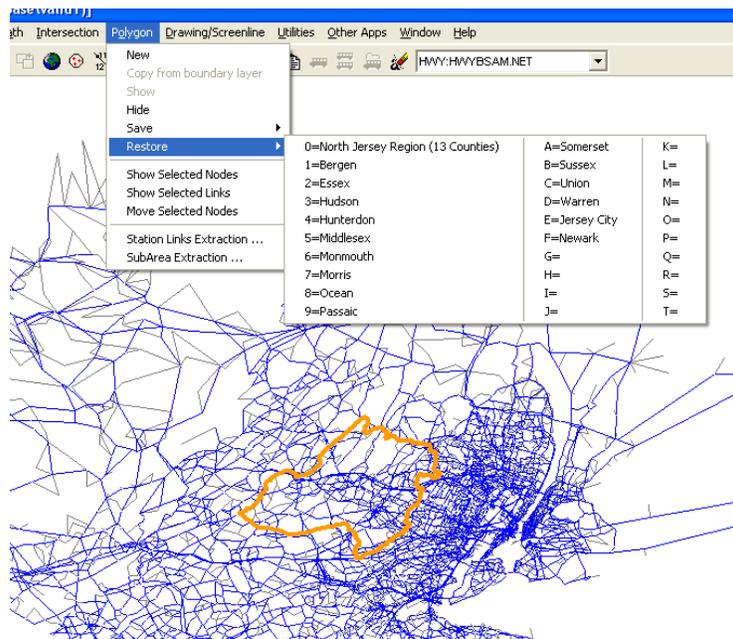


Figure B-10 Example of Polygon Restoring in Support Application “Subarea Processing”



# Appendix C

## Background Layers

Under the GIS directory, the following background layers are provided:

1. County boundary layer
2. Water boundary layer
3. Zonal boundary layer
4. Street layers including street layers for NJ 16 counties only and street layers for NJ+NYC

**Table C-1 Background layer file descriptions**

Files	Description	Type	Notes
intcounty.dat	County Boundary	Body	County boundary layer for the entire model area
intcounty.dbd			
intcounty.dbf			
intcounty.key			
intcounty.sbn			
intcounty.sbx			
intcounty.shp			
intcounty.shx			
intstreet.dbf	Street Layers	Line	Street layers for NJTPA+Mercer+Atlantic+Burlington+New York City.
intstreet.sbn			
intstreet.sbx			
intstreet.shp			
intstreet.shx			
intwater.dat	Water Layers	Body	Water boundaries covering the entire model area.
intwater.dbd			
intwater.dbf			
intwater.key			
intwater.sbn			
intwater.sbx			
intwater.shp			
intwater.shx			
nj16counties.dbf	Street Layers	Line	Street layers for NJTPA+Mercer+Atlantic+Burlington only.
nj16counties.shp			
nj16counties.shx			
NJRTME2015.dbf	Zone Boundary	Body	Zonal boundary layers
NJRTME2015.sbn			
NJRTME2015.sbx			
NJRTME2015.shp			
NJRTME2015.shx			

# Appendix D

## Input Directory File Descriptions

**Table D-2 Description of Files under Network data directory (VAN)**

File Name	Description
access.crd	Access stations prepared for transit station activity summary
access_transit.tb	Access support links for all modes
allmodes.tb	Transit lines of all modes combined. Generated by model.
bus.far	Fare for Bus mode
hwamtp.crd	Turn penalties
hwybu.net	Input base network
line.lin	Transit line file
linesum2.crd	Stops of all transit lines prepared for transit ridership summary
link_transit.tb	Additional transit links
linksum.crd	Used for transit ridership summary at special facilities
lookupcap.dbf	Capacity lookup table (by FT/AT)
lookupfspeed.dbf	Free-flow speed lookup table (by FT/AT)
lookuptolls.dbf	Default toll lookup table (by TOLLCLASS link variable)
trn_node.tb	All addition transit nodes and access nodes combined together.
op_ferry.far	Fares for Ferry in the off-peak period
op_lrt.far	Fares for LRT in the off-peak period
op_ncs.far	Fares for Subway in the off-peak period
op_path.far	Fares for PATH in the off-peak period
op_rail.far	Fares for Rail in the off-peak period
drivebs.fac	Parameters used for drive access path skimming specific to BUS mode
drivefe.fac	Parameters used for drive access path skimming specific to FERRY mode
drivel.fac	Parameters used for drive access path skimming specific to LONG FERRY mode
drivelr.fac	Parameters used for drive access path skimming specific to LIGHT RAIL mode
drivept.fac	Parameters used for drive access path skimming specific to PATH mode
driverl.fac	Parameters used for drive access path skimming specific to RAIL mode
walkbs.fac	Parameters used for walk access path skimming specific to BUS mode
walkfe.fac	Parameters used for walk access path skimming specific to FERRY mode
walklf.fac	Parameters used for walk access path skimming specific to LONG FERRY mode
walklr.fac	Parameters used for walk access path skimming specific to LIGHT RAIL mode
walkpt.fac	Parameters used for walk access path skimming specific to PATH mode
walkrl.fac	Parameters used for walk access path skimming specific to RAIL mode
pk_ferry.far	Fares for Ferry in the peak period
pk_lrt.far	Fares for LRT in the peak period
pk_ncs.far	Fares for Subway in the peak period
pk_path.far	Fares for PATH in the peak period
pk_rail.far	Fares for Rail in the peak period
pno_rail.tb	Park-and-Ride in the off-peak period for Rail
pnp_rail.tb	Park-and-Ride in the peak period for Rail
pnr.far	Fares for Park-and-Ride
pnr_bus.tb	Park-and-Ride for Bus
pnr_fry.tb	Park-and-Ride for Ferry
pnr_lrt.tb	Park-and-Ride for LRT
pnr_nwksub.tb	Park-and-Ride for Newark Subway
pnr_path.tb	Park-and-Ride for PATH

File Name	Description
rider.crd	Input prepared for bus ridership summary
select.crd	Input prepared for ridership summary of selected locations and routes
special.far	Special Bus fares
stopbuffer2.dbf	Stop buffer file. Generated by support application "Access Processing"
stopbuffer2.prj	Stop buffer file. Generated by support application "Access Processing"
stopbuffer2.sbn	Stop buffer file. Generated by support application "Access Processing"
stopbuffer2.sbx	Stop buffer file. Generated by support application "Access Processing"
stopbuffer2.shp	Stop buffer file. Generated by support application "Access Processing"
stopbuffer2.shp.xml	Stop buffer file. Generated by support application "Access Processing"
stopbuffer2.shx	Stop buffer file. Generated by support application "Access Processing"
total.crd	Input for transit ridership summary
trace_controls.crd	Parameters specified for transit path tracing
transpdadjop.dbf	Speed adjustment factors by FT/AT for transit in the off-peak period
transpdadjpk.dbf	Speed adjustment factors by FT/AT for transit in the peak period
usage.far	Fares of usage (NJTPK surcharge)
xbus.far	Fares for Express Bus

**Table D-2 Description of Files under Zonal data directory (VAZ)**

<b>File Name</b>	<b>Description</b>
allmode-walk.dbf	Walk access zonal coverage. Generated by support application "Access Processing"
ctysplit.csv	County to zone split/expand specification
eepatprime.dbf	Primary pattern of external-external truck trips
eepatsecon.dbf	Secondary pattern of external-external truck trips
extstation.dbf	Zones containing external stations for trucks specified
exttrkprod.dbf	External truck counts by mode
hhdist_byinc.dbf	Household distribution by income, derived from Census
hhdist_bysize.dbf	Household distribution by household size, derived from Census
jointdistribution1.dbf	Joint distribution of households, derived from PUMS
lifecycle.dbf	Household distribution by life cycle, from NJTPA
nymtc_od_persontrips.dbf	Trips from NYMTC BPM model. Used by support application "NYMTC Trip Processing"
nymtc_od_person_pct_nys.trp	Mode shares for NYMTC region. Generated by support application "NYMTC Trip Processing"
op_air1.ctl	Mode choice control file for off-peak airport trip mode 1
op_air2.ctl	Mode choice control file for off-peak airport trip mode 2
op_air3.ctl	Mode choice control file for off-peak airport trip mode 3
op_air4.ctl	Mode choice control file for off-peak airport trip mode 4
op_hbo.ctl	Mode choice control file for off-peak HBO trip purpose
op_hbo.trp	Existing off-peak HBO trips by mode
op_hbs.ctl	Mode choice control file for off-peak HBS trip purpose
op_hbs.trp	Existing off-peak HBS trips by mode
op_hbwd.ctl	Mode choice control file for off-peak HBWD trip purpose
op_hbwd.trp	Existing off-peak HBWD trips by mode
op_hbws.ctl	Mode choice control file for off-peak HBWS trip purpose
op_hbws.trp	Existing off-peak HBWS trips by mode
op_nhnw.ctl	Mode choice control file for off-peak NHNW trip purpose
op_nhnw.trp	Existing off-peak NHNW trips by mode
op_wbo.ctl	Mode choice control file for off-peak WBO trip purpose
op_wbo.trp	Existing off-peak WBO trips by mode

File Name	Description
pk_air1.ctl	Mode choice control file for peak airport trip mode 1
pk_air2.ctl	Mode choice control file for peak airport trip mode 2
pk_air3.ctl	Mode choice control file for peak airport trip mode 3
pk_air4.ctl	Mode choice control file for peak airport trip mode 4
pk_hbo.ctl	Mode choice control file for peak HBO trip purpose
pk_hbo.trp	Existing peak HBO trips by mode
pk_hbs.ctl	Mode choice control file for peak HBS trip purpose
pk_hbs.trp	Existing peak HBS trips by mode
pk_hbwd.ctl	Mode choice control file for peak HBWD trip purpose
pk_hbwd.trp	Existing peak HBWD trips by mode
pk_hbws.ctl	Mode choice control file for peak HBWS trip purpose
pk_hbws.trp	Existing peak HBWS trips by mode
pk_nhnw.ctl	Mode choice control file for peak NHNW trip purpose
pk_nhnw.trp	Existing peak NHNW trips by mode
pk_wbo.ctl	Mode choice control file for peak WBO trip purpose
pk_wbo.trp	Existing peak WBO trips by mode
region_opshr.tab	Seed off-peak mode shares. Generated by support application "Transit Shares Seed Processing"
region_pkshr.tab	Seed peak mode shares. Generated by support application "Transit Shares Seed Processing"
sedata00.dbf	Zonal socioeconomic data
trkfacl.dbf	Truck expansion factors
university-data.dbf	University enrollment data
walkacc-overlay.dbf	Walk access zonal coverage. generated by support application "Access Processing"
wkjointdistribution.dbf	Joint distribution of households, derived from PUMS
workerperhh.dbf	Parameters for the worker per household model
zonecosttime.dbf	Zonal parking cost, access/egress time. Used for path building.
zonetpa.asc	Zonal access and parking cost. Generated by support application "Access Processing"
zonetpa.crd	Zonal access and parking cost. Generated by support application "Access Processing"

# Appendix E

## Input File Descriptions

### Table E-3 Input file descriptions

File Name	Directory	Variable List
Allmode-walk.dbf	Network Directory	ZONE: Zone number
		LENGPERC0:
		LENGPERC1:
		AREAPERC0:
		AREAPERC1:
lookupcap.dbf	Network Directory	Rows (12 facility types)
		Columns (6 area types)
lookupffspeed.dbf	Network Directory	Rows (12 facility types)
		Columns (6 area types)
lookuptolls.dbf	Network Directory	Rows (12 toll classes)
transpdadjop.dbf	Network Directory	Rows (12 facility types)
		Columns (6 area types)
transpdadjpk.dbf	Network Directory	Rows (12 facility types)
		Columns (6 area types)
eepatprime.dbf	Zone Directory	ORIGIN: Origin zone
		DEST: Destination zone
		TRIPS: Number of truck trips from primary survey
eepatsecon.dbf	Zone Directory	ORIGIN: Origin zone
		DEST: Destination zone
		TRIPS: Number of truck trips from secondary survey
extstation.dbf	Zone Directory	ZONE: Zone number
		FLAG: Index of external station zone
exttrkprod.dbf	Zone Directory	ZONE: Zone number
		LOCATION: Location of the external station
		EIM: External to internal medium truck trips
		EIH: External to internal heavy truck trips
		EIMCM: External to inter-modal medium truck trips
		EIMCH: External to inter-modal heavy truck trips
		EIEM: External-internal-external medium truck trips
		EIEH: External-internal-external heavy truck trips
		EEM: External to external medium truck trips
		EEH: External to external heavy truck trips
hhdist_byinc.dbf	Zone Directory	INCRATIO: Ratio of zonal average income to regional average income
		INC1: Percentage of households belong to Income Group 1
		INC2: Percentage of households belong to Income Group 2
		INC3: Percentage of households belong to Income Group 3
		INC4: Percentage of households belong to Income Group 4
		INC5: Percentage of households belong to Income Group 5
hhdist_bysize.dbf	Zone Directory	PPHH: Ratio of population to households for a given zone
		HH1:Percentage of households belong to 1 Person Households
		HH2:Percentage of households belong to 2 Person Households
		HH3:Percentage of households belong to 3 Person Households
		HH4:Percentage of households belong to 4 Person Households
		HH5:Percentage of households belong to 5 Person Households
		HH6:Percentage of households belong to 6 Person Households

File Name	Directory	Variable List
jointdistribution1.dbf	Zone Directory	CODE: Household group code (90 groups of households) PCT: Percentage of households for each household group
lifecycle.dbf	Zone Directory	ZONE: Zone number PERCHHWKID: Percentage of households with children PERCHHWRET: Percentage of households with retirees PERCHHNOKI: Percentage of households without children/retirees
nymtc_od_persontrips.dbf	Zone Directory	TPA_ORG/TPA_DEST: Origin county / destination county M1-M7: Indices used for conversion from DBF to Matrix SOV: Trips belong to SOV auto mode HOV2: Trips belong to HOV2 auto mode HOV3: Trips belong to HOV3+ auto mode TRN_WA: Trips belong to walk access to Bus mode TRN_DA: Trips belong to drive access to Bus mode RAIL_WA: Trips belong to walk access to Rail mode RAIL_DA: Trips belong to drive access to Rail mode
sedata00.dbf	Zone Directory	ZONE: zone number DISTRICT: Not used by model. Currently set to 1 AREA: Total area of the zone DEVAREA: Total developable area of the zone AT6: 6-category area type. 1-Manhattan CBD (correspondingly ATPYE=1) 2-CBD/Urban High Density (correspondingly ATPYE=1) 3-Urban (correspondingly ATPYE=2) 4-Surburban High Density (correspondingly ATPYE=3) 5-Surburban (correspondingly ATPYE=3) 6-Rural (correspondingly ATPYE=4) ATYPE:4-category area type, see Appendix F STATE: State code COUNTY: County code from FIPS CINDEX: Model-defined county index POP: Population HH: Number of households INCOME: Zonal average income AMINE: Agriculture & Mining (SIC # 1-14) CONST: Construction (SIC \$ 15-17) MFG: Manufacturing (SIC # 20-39) TRANS: Transportation (SIC # 40-49) WHLS: Wholesale (SIC # 50-51) RETAIL: Retail (SIC # 52-59) FIRE: F.I.R.E. (SIC # 60-67) SERVICE: Service (SIC # 70-79) GOV: Government (SIC # 91-97) MILITARY: Military/Other (SIC # 99) TOTAL: Total employment EMPBASIC: Basic type of employment EMPRETAIL: Retail type of employment EMPSERVICE: Service type of employment DIST_NEWAR: DIST_NEAR: PGRPCODE: Group code for production zone used in mode choice AGRPCODE: Group code for attraction zone used in mode choice

File Name	Directory	Variable List
trkfac1.dbf	Zone Directory	ZONE: zone number TM: Number of terminals WH: Number of warehouses PL: Number of pipelines SP: Number of special generators
university-data.dbf	Zone Directory	ZONE: zone number TOTAL: Total enrollment FULLTIME: Number of full-time students PARTTIME: Number of part-time students ONCAMPUS: Number of live-on-campus students
walkacc-overlay.dbf	Zone Directory	ZONE: zone number WALKCOVER: percentage of walk coverage for transit walk access
wkjointdistribution.dbf	Zone Directory	CODE: Household group code (60 groups of households) PCT: Percentage of households for each household group
workerperhh.dbf	Zone Directory	GROUP: Number of workers per household (1,2,3+) HHSIZE: Coefficients for household size variable LC1-LC3: Coefficients for three life cycle index variables INC1-INC4: Coefficients for income group 1-4 index variables (5th income group serves as the base)
zonecosttime.dbf	Zone Directory	ZONE: Zone number PARKCOST: Parking cost for a given zone ATIME: Access time for a given zone ETIME: Egress time for a given zone
attrwrkbyInc.dbf	Model Directory	ZONE: Zone number WKINC1-WKINC5: Percentage of attractions for each income group
attrwrkbyInc_hbws.dbf	Model Directory	ZONE: Zone number WKINC1-WKINC5: Percentage of attractions for each income group
ctyprodadj.dbf	Model Directory	COUNTY_NAM: Name of county ZONE: County index CPF1-CPF5: Production adjustment factor for HBW purposes by income group CPF6-CPF10: Production adjustment factor for HBSH purpose by income group CPF11-CPF5: Production adjustment factor for HBO purpose by income group CPF16-CPF20: Production adjustment factor for HBU purpose by income group CPF21-CPF25: Production adjustment factor for NHB purposes by income group
ctyatradj.dbf	Model Directory	COUNTY_NAM: Name of county ZONE: County index CPF1-CPF5: Production adjustment factor for HBW purposes by income group CPF6-CPF10: Production adjustment factor for HBSH purpose by income group CPF11-CPF5: Production adjustment factor for HBO purpose by income group CPF16-CPF20: Production adjustment factor for HBU purpose by income group CPF21-CPF25: Production adjustment factor for NHB purposes by income group
eepattripend.dbf	Model Directory	ZONE: Zone number PROD: Productions of external-external truck trips ATTR: Attractions of external-external truck trips

File Name	Directory	Variable List
hboattrinc_coef.dbf	Model Directory	INCGRP: Income group
		CONSTANT: Constant
		ACC1: Coefficient for accessibility within 1 miles
		ACC3: Coefficient for accessibility within 3 miles
		ACC5: Coefficient for accessibility within 5 miles
hbshattrinf_coef.dbf	Model Directory	INCGRP: Income group
		CONSTANT: Constant
		ACC1: Coefficient for accessibility within 1 miles
		ACC3: Coefficient for accessibility within 3 miles
		ACC5: Coefficient for accessibility within 5 miles
hbu_nmpct.dbf	Model Directory	AT: Area type
		NMPCT: Percentage of non-motorized share
mcdmatch.dbf	Model Directory	ZONE: Zone number
		MCD: MCD index
		PCT_X: Split percentage for rows
		PCT_Y: Split percentage for columns
nonmotorized_coef.dbf	Model Directory	CODE: Index
		HBWD/HBWS/HBSH/HBO/HBU/WBO/NHNW: Coefficients for each purpose
		VAR: Variable name
nonmotorized_coef_ny.dbf	Model Directory	CODE: Index
		HBWD/HBWS/HBSH/HBO/HBU/WBO/NHNW: Coefficients for each purpose
		VAR: Variable name
prod_60cat.dbf	Model Directory	CODE: Household group index (60 groups of households)
		HBWD/HBWS/WBO: Trip production rates derived from household survey
prod_90cat.dbf	Model Directory	CODE: Household group index (90 groups of households)
		HBSH/HBO/HBU/NHNW: Trip production rates derived from household survey
prod_ctyinc_adjfactor.dbf	Model Directory	CINDEX: County index
		PURP: Index for trip purpose
		CODE: Combination of CINDEX and PURP
		INC1-INC5: Adjustment factors for income groups from 1 to 5
regionalid.dbf	Model Directory	IDPTR: County index
		REGID: Region name
		CNTYID: County name
tpennodes.dbf	Model Directory	N: Node number
		TPPEN: Turn penalty index
tripattraction_coef_nj.dbf	Model Directory	CODE(1):Index
		AT: Area type
		CODE(2):Combination of CODE(1) and AT
		HBWD/HBWS/HBSH/HBO/WBO/NHNW: Coefficients for each purpose
		VAR: Variable name
tripattraction_coef_ny.dbf	Model Directory	CODE(1):Index
		AT: Area type
		CODE(2):Combination of CODE(1) and AT
		HBWD/HBWS/HBSH/HBO/WBO/NHNW: Coefficients for each purpose
		VAR: Variable name

File Name	Directory	Variable List
trkgenrateadj.dbf	Model Directory	ITR: County Index
		MTADJ: Adjustment factors for medium trucks
		HTADJ: Adjustment factors for heavy trucks
trkspgenerate.dbf	Model Directory	ITR: Special generator index
		TOTTRP:
		TEMP:
		MTPCT: Percentage of medium trucks
		HTPCT: Percentage of heavy trucks
trkstdgenrate.dbf	Model Directory	PTR: Index
		MTTRP:
		HTTRP:
		CTRPMM
		CTRPNY
		CTRPOT:
zonedist55rpd.dbf	Model Directory	ZONE: Zone number
		DIST50: District index
		NZONES: Number of zones in each district
zonal_factor.dbf	Model Directory	Z: Zone number
		POP_DEN: Population density
		EMP_DEN: Employment density
		COM_DEN: Combined density
		INT_DEN: Intersection density
		RESRATIO: Network restrictiveness ratio
		ST_CONN: Street network connectivity
		AT6: Area type
		AUTOPP: Autos per person for a given zone

# Appendix F

## Highway Network Variables

Table F-4 HIGHWAY LINK VARIABLES - PHYSICAL/OPERATIONAL VARIABLES

VARIABLE NAME	DESCRIPTION	UNIT	DEFINITION
A	A Node of a highway link	Integer	
B	B Node of a highway link	Integer	
DISTANCE	Distance of a highway link	Miles	
CAPACITY	Hourly lane capacity	VPH	Define by a look up table, a function of area type and facility type, unless overridden by user via FIXCAP
FT	Facility type	Integer from 1 to 12	FT is divided into 12 categories: 1. Freeway (limited access) 2. Expressway (grade separated at major facilities, signals at minor facilities) 3. Principal arterial divided 4. Principal arterial undivided 5. Major arterial divided 6. Major arterial undivided 7. Minor arterial 8. Collector/local 9. High speed ramp (direct freeway-freeway 55 mph) 10. Medium speed ramp (40 mph) 11. Low speed ramp/jughandle (25 mph) 12. Centroid connector
AT	Area type	Integer from 1 to 4	AT is divided into 5 categories 1. CBD 2. Urban 3. Suburban 4. Rural

VARIABLE NAME	DESCRIPTION	UNIT	DEFINITION
LANESAM	Number of lanes - AM Peak	Integer	Number of lanes in the AM Peak period.
LANESPM	Number of lanes - PM Peak	Integer	Number of lanes in the PM Peak period.
LANESOP	Number of lanes - Off Peak	Integer	Number of lanes in the Off Peak period.
LINKTYPE	Link permission code to utilize the link based on auto mode and toll	Integer from 1 to 16	Linktype is divided into 16 categories: 1. Free - all 2. Free - auto only 3. Free - truck only 4. Urban toll - all 5. Urban toll - auto only 6. Urban toll - truck only 7. Rural toll - all 8. Rural toll - auto only 9. Rural toll - truck only 10. Urban free - HOV only 11. Urban toll - HOV only 12. Urban toll - SOV, free HOV 13. Urban toll, free HOV 14. ETC only - all 15. ETC only - auto only 16. ETC only SOV and truck toll, free HOV
TERTYPE	Terrain Type. Default terrain type is defined based on counties and facility type: - Rolling Terrain: Sussex, Warren, Morris, Passaic, Hunterdon, Somerset, Rockland, Orange, Lackawanna, Wayne, Sullivan, and Luzerne - Mountainous: none - Level: all other counties and highways	Integer from 1 to 3	Tertype is divided into 3 categories: 1. Level 2. Rolling 3. Mountainous
NLTLANE	Number of left turn lanes		Default=0
NRTLANE	Number of right turn lanes		Default=0

VARIABLE NAME	DESCRIPTION	UNIT	DEFINITION
LWIDTH	Lane width	Feet	Default=12 feet
LSHOULD	Standard shoulder available	Flag	0 = Shoulder substandard or missing 1 = Standard shoulder (default)
TCD	Traffic Control Devices	Integer from 1 to 12, 99	TCD is divided into 13 categories: 1. Two-way stop 2. All-way stop 3. Yield 4. Ramp-meter 5. Signal-uncoordinated-actuated 6. Signal-uncoordinated-fixed 7. Signal-coordinated-restricted progression 8. Signal-coordinated-favorable progression 9. Signal-coordinated-maximum progression 10. Freeway diverge point 11. Freeway merge point 12. Uncontrolled - Shape Point 99. Unknown
NSIG	Number of signal in the link	Integer	User-specified, program will assume=1 if the value is not provided and TCD=5-9
SIGCYC	Signal cycle	Secs	User-specified, program default if the value is provided
SIGCOR	Signal coordination	Integer from 0 to 3	SIGCOR is divided into 3 categories: 0. Uncoordinated Signal (Default) 1. Coord-unfavorable 2. Coord-favorable 3. Coord-max
GC	Green time/cycle ratio		Share of green time/cycle
ALCOEF	Alpha coefficient for Volume Delay Function in assignment		Calculated by program
BTCOEF	Beta coefficient for Volume Delay Function in assignment		Calculated by program

VARIABLE NAME	DESCRIPTION	UNIT	DEFINITION
JFACT	Delay factor in HCM approximation of TCD-related delay		Calculated by program
JFACT	Delay factor for Akcelik Formula		Calculated by program
ACCP	Number of access point		Program will provide default based on area type and facility type.
FIXCAP	Fix capacity	Flag	0 = not fixed (default) 1 = fixed capacity to specific value, retains settings of TCD, GC
FIXTIME	Fix Time	Flag	0 = not fixed (default) 1 = fixed
TOLL	Toll values - actual placement	Dollars	For toll diversion highway assignment
MCTOLL	Scaled toll values to balance by direction	Flag	0 = no toll (default) 1 = non-directional toll -0.5 and 0.5 = directional toll
TOLLAPC	Toll applied to vehicle types	Flag	0 = default 1 = set HOV toll to 0 2 = set truck toll to 0
TOLLCLASS	Toll class for lookup system	Integer from 0-99	0= no toll (default) 1-98 = obtained from lookup table 99 = toll value coded on link directly
TOLLFACAM	Base toll factor for AM Period		default =1
TOLLFACPM	Base toll factor for PM Period		default =1
TOLLFACMD	Base toll factor for Mid-Day Period		default =1
TOLLFACNT	Base toll factor for Night Period		default =1
FIXTOLL	Fix Toll	Flag	0 = not fixed 1 = fixed toll (default)
PARK	Parking permission code	Flag 0 or 1	PARK is divided into 2 categories: 1. Permitted parking - default values for FT=7 and AT=1,2; FT=8 and AT=1,2,3 0. Not permitted - default for others

VARIABLE NAME	DESCRIPTION	UNIT	DEFINITION
QUEFLG	Flag for queueing function	Flag	1 = additional queueing function is permitted in the volume delay function 0 = no additional queueing function is used
ZDELAY	Initial delay due to TCD		Calculated by program
ADDDELAY	Additional delay applied to the link	Mins	Optional field - NJ Transit (not used)
SPEED	Link speed		Calculated by program, but user can override
T0	Free-flow travel time	Mins	Calculated by program, but user can override via FIXTIME parameter
TCODEAM	Transit travel time flag for AM Peak	Flag	0 = standard roadway (default) 1 = XBL 2= bus queue jump 9= exclusive bus link (BRT) Other codes available
TCODEOP	Transit travel time flag for Off Peak	Flag	0 = standard roadway (default) 1 = XBL 2= bus queue jump 9= exclusive bus link (BRT) Other codes available
TADDAM	Added time penalty to transit - AM	Mins	Link specific adjustment transit time - AM
TADDOP	Added time penalty to transit - OP	Mins	link specific adjustment transit time - OP
TSCALEAM	Transit time scaling factor - AM		Systematic adjustment factor - AM
TSCALEOP	Transit time scaling factor - OP		Systematic adjustment factor - OP
NONWALK	Index of non-walkable link	Flag 0 or 1	0-Walkable and pedestrian friendly 1-Non-walkable

**NOTE:**

Calculated by the program if their default values are not provided  
 To be maintained by the users

**Table F-5 HIGHWAY LINK VARIABLES - IDENTIFICATION VARIABLES**

VARIABLE NAME	DESCRIPTION	UNIT	DEFINITION
NAME	Road name	String	Example: "New Jersey Turnpike"
SRI	State road identification	String	Example: "00000095" for New Jersey Tu
BEGIN_MP	Mile post of the beginning of the link	Miles	
END_MP	Mile post of the end of the link	Miles	
RT_LTR	Route lettering	String	Example: "I-95" for New Jersey Turnpike
COUNTY	County FIPS code	Integer	
PROJN	Conformity based project ID # obtained from NJTPA	Integer	
REFZONE	Zone where the link resides	Integer	

**Table F-6 HIGHWAY LINK VARIABLES - PERFORMANCE/USE VARIABLES**

VARIABLE NAME	DESCRIPTION	UNIT	DEFINITION
COUNT1	The first set of counts	Integer	Final counts
YEARCT1	The year of the first set of counts	Integer	Year of counts
COUNT2	The second set of counts	Integer	Reserved for future use
YEARCT2	The year of the second set of counts	Integer	Reserved for future use
COUNT3	The third set of counts	Integer	Reserved for future use
YEARCT3	The year of the third set of counts	Integer	Reserved for future use

# Appendix G

## Zone and Node Allocation Reference

Table G-1 lists the ranges of usage of node numbers.

**Table G-7 RESERVED RANGE**

<b>Usage</b>	<b>Node Number Range</b>
Zone Centroids	1-2900
Existing Highway Nodes	4300 – 39999
Reserved for Transit Use:	20000 – 33999
Reserved for Conformity Use	40000-47999
Unreserved (Agency/Consultant Use)	48000 – Voyager Limit

In addition, Table G-2 lists the correspondence between counties and ranges of node numbers for NJTRM Model, NJTDFM Model and NJRTM-E Model. Note that the zonal information for the NJTDFM Model is retrieved from Northern Jersey Travel Demand Forecasting Model: Methods Report (Draft). Note that the area surrounding NJTPA region is aggregate and consequently, zones in counties outside of NJTPA region are much larger. A table with more detailed zone-to-zone correspondence is included in the model data directory.

**Table G-2 TAZ System**

Region	County	Zone Type (Majority of TAZs)	NJRTM-E TAZs		RESERVED TAZs	
			Zone Numbers	No. of Zones	Zone Numbers	No. of Zones
New Jersey	Atlantic	MCD	1 - 25	25		0
	Bergen	Census Tract+Block Group	26 - 236	211	237 - 246	10
	Burlington	MCD+Census Tract	247 - 387	141	388 - 389	2
	Essex	Census Tract+Block Group	391 - 620	230	623 - 632	10
	Hudson	Census Tract+Block Group	633 - 829	197	830 - 863	34
	Hunterdon	Census Tract+Block Group	864 - 899	36	900 - 909	10
	Mercer	Census Tract+Block Group	910 - 1033	124	1034 - 1042	9
	Middlesex	Census Tract+Block Group	1043 - 1262	220	1263 - 1272	10
	Monmouth	Census Tract+Block Group	1273 - 1437	165	1438 - 1447	10
	Morris	Census Tract	1448 - 1559	112	1560 - 1569	10
	Ocean	Census Tract+Block Group	1570 - 1725	156	1726 - 1735	10
	Passaic	Census Tract	1736 - 1856	121	1857 - 1866	10
	Somerset	Census Tract+Block Group	1867 - 1952	86	1953 - 1962	10
	Sussex	Census Tract+Block Group	1963 - 2007	45	2008 - 2017	10
	Union	Census Tract+Block Group	2018 - 2143	126	2145 - 2160	16
Warren	Census Tract+Block Group	2161 - 2187	27	2188 - 2197	10	
New York	Bronx	District	2198 - 2203	6	-	0
	Dutchess	District	2204 - 2205	2	-	0
	Kings	District	2206 - 2223	18	-	0
	Nassau	District	2224 - 2225	2	-	0
	New York (Manhattan)	Census Tract	2226 - 2515	290	-	0
	Orange	District	2516 - 2543	28	-	0
	Putnam	District	2544 - 2544	1	-	0
	Queens	District	2545 - 2555	11	-	0
	Richmond	District	2556 - 2606	51	2607 - 2615	9
	Rockland	Census Tract	2616 - 2680	65	-	0
	Suffolk	County	2681 - 2681	1	-	0
	Sullivan	District	2682 - 2682	1	-	0
Westchester	District	2683 - 2709	27	-	0	

Region	County	Zone Type (Majority of TAZs)	NJRTM-E TAZs		RESERVED TAZs	
			Zone Numbers	No. of Zones	Zone Numbers	No. of Zones
Pennsylvania	Bucks	Multiple Block Groups	2710 - 2780	71	-	0
	Carbon	County	2781 - 2781	1	-	0
	Lackawanna	MCD	2782 - 2822	41	-	0
	Lehigh	MCD	2823 - 2849	27	-	0
	Luzerne	MCD	2850 - 2925	76	-	0
	Monroe	MCD	2926 - 2945	20	-	0
	Northampton	MCD	2946 - 2983	38	-	0
	Pike	MCD	2984 - 2996	13	-	0
	Wayne	MCD	2997 - 3024	28	-	0
Connecticut	Bridgeport	MCD	3025 - 3025	1	-	0
	Fairfield Co. Other	District	3026 - 3026	1	-	0
Special Generators / Externals	EWR (Essex County)		621	1		
	Port Newark (Essex County)		622	1		
	Port Elizabeth (Union County)		2144	1		
	NJTPK Southern Terminus		390	1		
	I-78 Western Terminus (PA)		3027	1		
	I-80 Western Terminus (PA)		3028	1		
<b>Total</b>				<b>2848</b>		<b>180</b>
<b>Total Zones</b>						<b>3028</b>

**Table G-3 TRANSIT DETAIL RANGES**

TRANSIT SYSTEM SERVICE	NODE GROUP ALLOCATION	STATION NODES	WALK ACCESS NODES	DRIVE ACCESS NODES
NJ Coastline/NEC Rail	Allocated Range	20000 - 20999	21000 - 21099	22000 - 22099
	Unused/Available - NJC	20020 - 20049	21020 - 21049	22020 - 22049
	Unused/Available - NEC	20060 - 20089	21060 - 21089	22060 - 22089
Raritan Valley Rail	Allocated Range	20100 - 20199	21100 - 21199	22100 - 22199
	Unused/Available	20118 - 20198	21118 - 21198	22118 - 22198
Morris & Essex Rail	Allocated Range	20200 - 20299	21200 - 21299	22200 - 22299
	Unused/Available (Boonton, West of Dover)	20207 - 20210	21207 - 21210	22207 - 22210
	Unused/Available (Boonton, East of Dover)	20227 - 20230	21227 - 21230	22227 - 22230
	Unused/Available (Morristown, East of Dover)	20241 - 20245	21241 - 21245	22241 - 22245
	Unused/Available (Gladstone)	20258 - 20260	21258 - 21260	22258 - 22260
	Unused/Available (General)	20272 - 20296	21272 - 21296	22272 - 22296
Main/Bergen/Port Jervis Rail	Allocated Range	20300 - 20399	21300 - 21399	22300 - 22399
	Unused/Available (General)	20381 - 20395	21381 - 21395	22381 - 22395
	Unused/Available (North of Glen Rock)	20329 - 20340	21329 - 21340	22329 - 22340
	Unused/Available (Main Line Only)	20349 - 20360	21349 - 21360	22349 - 22360
	Unused/Available (Bergen Line Only)	20368 - 20380	21368 - 21380	22368 - 22380
	Unused/Available (Port Jervis Only)	20308 - 20320	21308 - 21320	22308 - 22320
Pascack Valley Rail	Allocated Range	20400 - 20499	21400 - 21499	22400 - 22499
	Unused/Available	20416 - 20497	21416 - 21497	22416 - 22497
SEPTA Rail Services	Allocated Range	20500 - 20550	21500 - 21550	22500 - 22550
	Unused/Available	20506 - 20550	21506 - 21550	22506 - 22550
Metro North Rail Services	Allocated Range	20551 - 20599	21551 - 21599	22551 - 22599
	Unused/Available	20556 - 20598	21556 - 21598	22556 - 22598
Newark City Subway	Allocated Range	20600 - 20649	21600 - 21649	22600 - 22649
	Unused/Available	20611 - 20648	21611 - 21648	22611 - 22648
Staten Island Rail	Allocated Range	20650 - 20699	21650 - 21699	22650 - 22699
	Unused/Available	20672 - 20699	21672 - 21699	22672 - 22699
Hudson Bergen Light Rail	Allocated Range	20700 - 20799	21700 - 21799	22700 - 22799
	Unused/Available	20717 - 20799	21717 - 21799	22717 - 22799
PATH System	Allocated Range	20800 - 20849	21800 - 21849	22800 - 22849
	Unused/Available	20815 - 20849	21815 - 21849	22800 - 22849
Ferry Services	Allocated Range	20850 - 20899	21850 - 21899	22850 - 22899
	Unused/Available (West of Hudson)	20860 - 20874	21861 - 21874	22861 - 22874
	Unused/Available (East of Hudson)	20882 - 20899	21882 - 21899	22882 - 22899
NYC Subway	Allocated Range	30069 - 30573	31069 - 31573	
	Unused/Available	30000 - 30068	31000 - 31068	
		30574 - 30999	31574 - 31999	
Express Bus Lane (XBL)/ PABT/GWBT/HT	Allocated Range	20900 - 20921	21900 - 21921	22900 - 22921
	Unused/Available			
Bus Park and Rides	Allocated Range			19000 - 19499
	Unused/Available			19109 - 19499

# Appendix H

## Output File Reference

Table H-1 Reference of major model output files

Filename	Module	Description
hwybsam.net	Highway Network Edit and Preprocess	Input network for AM period
hwybspm.net	Highway Network Edit and Preprocess	Input network for PM period
hwybsop.net	Highway Network Edit and Preprocess	Input network for mid-day and night periods
hwyuncsmc.skm	Highway Path Building	Uncongested skims used for mode choice
hwyuncstp.skm	Highway Path Building	Uncongested skims used for trip distribution
hwycssov.skm	Highway Path Building	Congested skims of SOV mode for mode choice
hwycshov.skm	Highway Path Building	Congested skims of HOV mode for mode choices
hwycstp.skm	Highway Path Building	Congested skims for trip distribution
hwcst.net	Highway Path Building	Congested highway network with tolls prepared
hwucst.net	Highway Path Building	Uncongested highway network with tolls prepared
genfprod_bal.dat	Zonal Data And Trip Generation	Trip productions by trip purpose by income group
genfattr_bal.dat	Zonal Data And Trip Generation	Trip attractions b y trip purpose by income group
trkprod.dbf	Zonal Data And Trip Generation	Truck trip productions (except external to external type)
trkattr.dbf	Zonal Data And Trip Generation	Truck trip attractions (except external to external type)
eetrkfinal.trp	Zonal Data And Trip Generation	External-external truck trip table
eedirtrp.dbf	Zonal Data And Trip Generation	External-external truck trip productions and attractions
hbu_padir.trp	Zonal Data And Trip Generation	HBU trip distribution table
utrips_p.dbf	Zonal Data And Trip Generation	HBU trip productions
utrips_a.dbf	Zonal Data And Trip Generation	HBU trip attractions
hwytnmop.net	Transit Network Edit And Preprocess	Off-peak transit highway network
hwytnmam.net	Transit Network Edit And Preprocess	Peak transit highway network
pathpkwksum.prn	Transit Network And Path Building	Summary statistics of peak path building for walk access submode
pathpkdrsum.prn	Transit Network And Path Building	Summary statistics of peak path building for drive access submode
pk_wk.skm	Transit Network And Path Building	Peak transit skims for walk access submode
pk_dr.skm	Transit Network And Path Building	Peak transit skims for auto access submode

Filename	Module	Description
pathopwksum.prn	Transit Network And Path Building	Summary statistics of off-peak path building for walk access submodule
pathopdrsum.prn	Transit Network And Path Building	Summary statistics of off-peak path building for drive access submodule
op_wk.skm	Transit Network And Path Building	Off-peak transit skims for walk access submodule
op_dr.skm	Transit Network And Path Building	Off-peak transit skims for auto access submodule
pkcompimp.skm	Create Composite Impedance	Peak composite impedance
opcompimp.skm	Create Composite Impedance	Off-peak composite impedance
hbwdptrp.trp	Perform Trip Distribution	Trip distribution table for HBWD purpose
hbwsptrp.trp	Perform Trip Distribution	Trip distribution table for HBWS purpose
hbsptrp.trp	Perform Trip Distribution	Trip distribution table for HBSH purpose
hboptrp.trp	Perform Trip Distribution	Trip distribution table for HBO purpose
wboptrp.trp	Perform Trip Distribution	Trip distribution table for WBO purpose
nhnwptrp.trp	Perform Trip Distribution	Trip distribution table for NHNW purpose
hbwdmsa.trp	Perform Trip Distribution	Trip distribution table after MSA adjustment for HBWD purpose
hbwsmsa.trp	Perform Trip Distribution	Trip distribution table after MSA adjustment for HBWS purpose
inttruck.trp	Perform Trip Distribution	Truck trip table by truck type
trktype.trp	Perform Trip Distribution	Truck trip table by truck mode
airtrips.trp	Perform Trip Distribution	Airport trip table
pk_air1.trp	Perform Trip Distribution	Peak airport trip table for airport travel mode 1
pk_air2.trp	Perform Trip Distribution	Peak airport trip table for airport travel mode 2
pk_air3.trp	Perform Trip Distribution	Peak airport trip table for airport travel mode 3
pk_air4.trp	Perform Trip Distribution	Peak airport trip table for airport travel mode 4
op_air1.trp	Perform Trip Distribution	Off-peak airport trip table for airport travel mode 1
op_air2.trp	Perform Trip Distribution	Off-peak airport trip table for airport travel mode 2
op_air3.trp	Perform Trip Distribution	Off-peak airport trip table for airport travel mode 3
op_air4.trp	Perform Trip Distribution	Off-peak airport trip table for airport travel mode 4
njtparegpa.trp	Perform Trip Distribution	Trips of NJT controlled region by trip purpose by income group
nymtcregpa.trp	Perform Trip Distribution	Trips of NYMTC controlled region by trip purpose by income group

Filename	Module	Description
hbwd_pk.trp	Perform Trip Distribution	Peak HBWD trips in NJT controlled region
hbws_pk.trp	Perform Trip Distribution	Peak HBWS trips in NJT controlled region
hbs_pk.trp	Perform Trip Distribution	Peak HBS trips in NJT controlled region
hbo_pk.trp	Perform Trip Distribution	Peak HBO trips in NJT controlled region
wbo_pk.trp	Perform Trip Distribution	Peak WBO trips in NJT controlled region
nhnw_pk.trp	Perform Trip Distribution	Peak NHNW trips in NJT controlled region
hbwd_op.trp	Perform Trip Distribution	Off-peak HBWD trips in NJT controlled region
hbws_op.trp	Perform Trip Distribution	Off-peak HBWS trips in NJT controlled region
hbs_op.trp	Perform Trip Distribution	Off-peak HBS trips in NJT controlled region
hbo_op.trp	Perform Trip Distribution	Off-peak HBO trips in NJT controlled region
wbo_op.trp	Perform Trip Distribution	Off-peak WBO trips in NJT controlled region
nhnw_op.trp	Perform Trip Distribution	Off-peak NHNW trips in NJT controlled region
pk_hbwd.trp	Perform Mode Choice	Peak HBWD trips in NJT controlled region by mode
pk_hbws.trp	Perform Mode Choice	Peak HBWS trips in NJT controlled region by mode
pk_hbs.trp	Perform Mode Choice	Peak HBS trips in NJT controlled region by mode
pk_hbo.trp	Perform Mode Choice	Peak HBO trips in NJT controlled region by mode
pk_wbo.trp	Perform Mode Choice	Peak WBO trips in NJT controlled region by mode
pk_nhnw.trp	Perform Mode Choice	Peak NHNW trips in NJT controlled region by mode
op_hbwd.trp	Perform Mode Choice	Off-peak HBWD trips in NJT controlled region by mode
op_hbws.trp	Perform Mode Choice	Off-peak HBWS trips in NJT controlled region by mode
op_hbsp.trp	Perform Mode Choice	Off-peak HBS trips in NJT controlled region by mode
op_hbo.trp	Perform Mode Choice	Off-peak HBO trips in NJT controlled region by mode
op_wbo.trp	Perform Mode Choice	Off-peak WBO trips in NJT controlled region by mode
op_nhnw.trp	Perform Mode Choice	Off-peak NHNW trips in NJT controlled region by mode
nymtcreg_pa_hbwmode.trp	Perform Mode Choice	PA format of HBW vehicle trips in NYMTC controlled region
nymtcreg_od_hbwmode.trp	Perform Mode Choice	OD format of HBW vehicle trips in NYMTC controlled region by time-of-day
fb_pkshr.tab	Perform Mode Choice	Peak transit share table for model feedback loop

Filename	Module	Description
nymtcreg_pa_nhbwmode.trp	Perform Mode Choice	PA format of NHBW vehicle trips in NYMTC controlled region
nymtcreg_od_nhbwmode.trp	Perform Mode Choice	OD format of NHBW vehicle trips in NYMTC controlled region by time-of-day
airtodveh.trp	Prepare Time-of-day Trip Tables	Airport vehicle trips
hwyamvtrp.mat	Prepare Time-of-day Trip Tables	Vehicle trips in AM period by mode
hwymdvtrp.mat	Prepare Time-of-day Trip Tables	Vehicle trips in mid-day period by mode
hwypmvtrp.mat	Prepare Time-of-day Trip Tables	Vehicle trips in PM period by mode
hwynpvtrp.mat	Prepare Time-of-day Trip Tables	Vehicle trips in night period by mode
hwyfbnet.net	Perform Highway Assignment	AM loaded highway network for model feedback loop
amhwyload.net	Perform Highway Assignment	AM loaded highway network
mdhwyload.net	Perform Highway Assignment	Mid-day loaded highway network
pmhwyload.net	Perform Highway Assignment	PM loaded highway network
nthwyload.net	Perform Highway Assignment	Night loaded highway network
modelcon1vinfoa.prn	Perform Highway Assignment	Coincidence ratio summary for model convergence
modelcon1vinfob.prn	Perform Highway Assignment	Coincidence ratio summary for model convergence
modconv2info.prn	Perform Highway Assignment	RMSE summary for model convergence
trnpkwk.trp	Perform Transit Assignment	Peak transit trips for walk access submode
trnpkdr.trp	Perform Transit Assignment	Peak transit trips for drive access submode
trnopwk.trp	Perform Transit Assignment	Off-peak transit trips for walk access submode
trnopdr.trp	Perform Transit Assignment	Off-peak transit trips for drive access submode
riders.asc	Perform Transit Assignment	Ridership summary program ASCII file
boarding.asc	Perform Transit Assignment	Boarding summary program ASCII file

# Appendix I

## Output Link Variable Reference

Table I-1 Reference of output link variables

VARIABLE NAME	DESCRIPTION	UNIT	DEFINITION
TR	Time reserved field		Temporary variable using by model
SOVTOLL	SOV tolls on the link	Dollars	Used by assignment process
HOVTOLL	HOV tolls on the link	Dollars	Used by assignment process
TRKTOLL	Truck tolls on the link	Dollars	Used by assignment process
PKTRN	Peak transit person trips		
OPTRN	Off-peak transit person trips		
ONEWAY	Transit-mode one-way link		
V_1	The total assigned link volume	Vehicles	Generated by highway assignment process
TIME_1	Actual link travel time	Minutes	Generated by highway assignment process
VC_1	Volume/capacity ratio		Generated by highway assignment process
CSPD_1	Congested travel speed	mph	Generated by highway assignment process
VDT_1	Vehicle-distance travelled		Generated by highway assignment process
VHT_1	Vehicle-hours of travel		Generated by highway assignment process
V1_1	Loaded volume (SOV free pass)	Vehicles	Generated by highway assignment process
V2_1	Loaded volume (SOV toll by cash)	Vehicles	Generated by highway assignment process
V3_1	Loaded volume (SOV toll by ETC)	Vehicles	Generated by highway assignment process
V4_1	Loaded volume (HOV free pass)	Vehicles	Generated by highway assignment process
V5_1	Loaded volume (HOV toll by cash)	Vehicles	Generated by highway assignment process
V6_1	Loaded volume (HOV toll by ETC)	Vehicles	Generated by highway assignment process
V7_1	Loaded volume (truck free pass)	Vehicles	Generated by highway assignment process
V8_1	Loaded volume (truck toll by cash)	Vehicles	Generated by highway assignment process
V9_1	Loaded volume (truck toll by ETC)	Vehicles	Generated by highway assignment process
VT_1	Two-way loaded volume	Vehicles	Generated by highway assignment process
V1T_1	Two-way volume (SOV free pass)	Vehicles	Generated by highway assignment process
V2T_1	Two-way volume (SOV toll by cash)	Vehicles	Generated by highway assignment process

VARIABLE NAME	DESCRIPTION	UNIT	DEFINITION
V3T_1	Two-way volume (SOV toll by ETC)	Vehicles	Generated by highway assignment process
V4T_1	Two-way volume (HOV free pass)	Vehicles	Generated by highway assignment process
V5T_1	Two-way volume (HOV toll by cash)	Vehicles	Generated by highway assignment process
V6T_1	Two-way volume (HOV toll by ETC)	Vehicles	Generated by highway assignment process
V7T_1	Two-way volume (truck free pass)	Vehicles	Generated by highway assignment process
V8T_1	Two-way volume (truck toll by cash)	Vehicles	Generated by highway assignment process
V9T_1	Two-way volume (truck toll by ETC)	Vehicles	Generated by highway assignment process
LWCAPACITY	Adjusted period capacity to model peak spreading. The capacity will be adjusted if V/C ratio > 0.9 and FIXCAP=0.	Vehicles	Generated by highway assignment process
VC_AM	AM period volume/capacity ratio		Generated by support application "Daily Network Statistics"
VC_MD	Midday period volume/capacity ratio		Generated by support application "Daily Network Statistics"
VC_PM	PM period volume/capacity ratio		Generated by support application "Daily Network Statistics"
VC_NT	Night period volume/capacity ratio		Generated by support application "Daily Network Statistics"
CTIME_AM	AM congested travel time	Minutes	Generated by support application "Daily Network Statistics"
CTIME_MD	Midday congested travel time	Minutes	Generated by support application "Daily Network Statistics"
CTIME_PM	PM congested travel time	Minutes	Generated by support application "Daily Network Statistics"
CTIME_NT	Night congested travel time	Minutes	Generated by support application "Daily Network Statistics"
CSPD_AM	AM congested travel speed	mph	Generated by support application "Daily Network Statistics"
CSPD_MD	Midday congested travel speed	mph	Generated by support application "Daily Network Statistics"
CSPD_PM	PM congested travel speed	mph	Generated by support application "Daily Network Statistics"
CSPD_NT	Night congested travel speed	mph	Generated by support application "Daily Network Statistics"
VAM	AM loaded volume	Vehicles	Generated by support application "Daily Network Statistics"
VMD	Midday loaded volume	Vehicles	Generated by support application "Daily Network Statistics"
VPM	PM loaded volume	Vehicles	Generated by support application "Daily Network Statistics"
VNT	Night loaded volume	Vehicles	Generated by support application "Daily Network Statistics"
VHT_AM	AM vehicle hours of travel (VHT)		Generated by support application "Daily Network Statistics"
VHT_MD	Midday vehicle hours of travel (VHT)		Generated by support application "Daily Network Statistics"
VHT_PM	PM vehicle hours of travel (VHT)		Generated by support application "Daily Network Statistics"
VHT_NT	Night vehicle hours of travel (VHT)		Generated by support application "Daily Network Statistics"

VARIABLE NAME	DESCRIPTION	UNIT	DEFINITION
VMT_AM	AM vehicle miles of travel (VMT)		Generated by support application "Daily Network Statistics"
VMT_MD	Midday vehicle miles of travel (VMT)		Generated by support application "Daily Network Statistics"
VMT_PM	PM vehicle miles of travel (VMT)		Generated by support application "Daily Network Statistics"
VMT_NT	Night vehicle miles of travel (VMT)		Generated by support application "Daily Network Statistics"
VTRKTT	Total truck volume		Generated by support application "Daily Network Statistics"
VMTRK	Truck vehicle miles of travel		Generated by support application "Daily Network Statistics"
DLYVOL	Daily loaded volume		Generated by support application "Daily Network Statistics"
VMT	Vehicle miles of travel		Generated by support application "Daily Network Statistics"
VHT	Vehicle hours of travel		Generated by support application "Daily Network Statistics"
PAM	AM auto-mode person trips		Generated by support application "Daily Network Statistics"
PMD	Midday auto-mode person trips		Generated by support application "Daily Network Statistics"
PPM	PM auto-mode person trips		Generated by support application "Daily Network Statistics"
PNT	Night auto-mode person trips		Generated by support application "Daily Network Statistics"
PAUTO	Auto-mode daily person trips		Generated by support application "Daily Network Statistics"
PHT_AM	AM auto-mode person hours of travel		Generated by support application "Daily Network Statistics"
PHT_MD	Midday auto-mode person hours of travel		Generated by support application "Daily Network Statistics"
PHT_PM	PM auto-mode person hours of travel		Generated by support application "Daily Network Statistics"
PHT_NT	Night auto-mode person hours of travel		Generated by support application "Daily Network Statistics"
PMT_AM	AM auto-mode person miles of travel		Generated by support application "Daily Network Statistics"
PMT_MD	Midday auto-mode person miles of travel		Generated by support application "Daily Network Statistics"
PMT_PM	PM auto-mode person miles of travel		Generated by support application "Daily Network Statistics"
PMT_NT	Night auto-mode person miles of travel		Generated by support application "Daily Network Statistics"
PHT_AUTO	Auto-mode person hours of travel		Generated by support application "Daily Network Statistics"
PMT_AUTO	Auto-mode person miles of travel		Generated by support application "Daily Network Statistics"
PTRN	Transit-mode daily person trips		Generated by support application "Daily Network Statistics"
PDAILY	Daily person trips		Generated by support application "Daily Network Statistics"
PMT	Daily person miles of travel		Generated by support application "Daily Network Statistics"