HAMPTON ROADS MODEL
User's Guide
(Ver.1.0)

VDOT Project Number: 30681-01-02

Prepared for

Transportation & Mobility Planning Division
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By

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GLOSSARY OF ACRONYMS

ADT = Average Daily Traffic

AAWDT = Annual Average Weekday Daily Traffic

AQ = Air Quality Conformity

AWDT = Average Weekday Daily Traffic

CBD = Central Business District

COA = Comprehensive Operations Analysis

CTPP = Census Transportation Planning Package

E-E = External-External Trips

E-I = External-Internal Trips

FF = Friction Factor

FHWA = Federal Highway Administration

FTA = Federal Transit Administration

GIS = Geographic Information System

HBW = Home Based Work

HBO = Home Based Other

HBS = Home Based Shopping

HBSR = Home Based Social/Recreation

HCM = Highway Capacity Manual

HOV = High Occupancy Vehicle

HRT = Hampton Roads Transit

HRTPO = Hampton Roads Transportation Planning Organization

HTS = Household Travel Survey

I-E = Internal-External Trips

I-I = Internal-Internal Trips

ITS = Intelligent Transportation System

IVTT = In Vehicle Travel Time

LOS = Level of Service

LUD = Land Use Density

MPO = Metropolitan Planning Organization

MSA = Method of Successive Averages

NAAQS = National Ambient Air Quality Standards

NAICS = North American Industry Classification System

NCHRP = National Cooperative Highway Research Program

NCRTPB = National Capital Region Transportation Planning Board

NHB = Non-Home Based

NHBO = Non Home Based Other

NHBW = Non Home Based Work

NHI = National Highway Institute

NHTS = National Household Transportation Survey

NTD = National Transit Database

O-D = Origin-Destination

OVTT = Out of Vehicle Travel Time

P-A = Production-Attraction

PDC = Planning District Commission

PNR = Park N Ride

PT = Public Transportation

RMSE = Root Mean Square Error

SOV = Single Occupant Vehicle

TAZ = Transportation Analysis Zone

TIP = Transportation Improvement Program

TLFD = Trip Length Frequency Distribution

TMIP = Travel Model Improvement Program

TMS = Traffic Monitoring System. Serves as the Virginia Department of Transportation's official traffic database.

ToD = Time of Day

TRB = Transportation Research Board

TDFM = Travel Demand Forecasting Model

TWLTL = Two Way Left Turn Lane

V/C = Volume/Capacity

VDF = Volume Delay Function

VDOT = Virginia Department of Transportation

VEC = Virginia Employment Commission

V/C = Volume to Capacity Ratio

VHT = Vehicle Hours of Travel

VMASC = Virginia Modeling, Analysis and Simulation Center

VMT = Vehicle Miles of Travel

VOT = Value of Time

VTM = Virginia Transportation Modeling

VSM = Virginia Statewide Travel Demand Model

WATA = Williamsburg Area Transit Authority

1 Introduction

This document describes the installation and application of the Hampton Roads Travel Demand Model. The latest model is an advanced practice four step model that includes trip generation, trip distribution, mode choice, and assignment steps. A full feedback loop is provided in the model to better represent the effects of highway congestion on the trip distribution process. This version of the model has enhancements to reflect the current best practices of modeling. The model enhancements include:

- The highway network has been enhanced and provides significantly more detail in terms of streets and their alignments. The freeway interchanges are micro-coded in the network (i.e., coded more closely to the way they actually exist on the ground).
- The transit networks and their processes were converted into CUBE Public Transport (PT) module. The networks were updated to accurately reflect 2009 Hampton Roads Transit (HRT) and Williamsburg Area Transit Authority (WATA) transit services.
- The coding of attributes in the highway network follows the Virginia Transportation Modeling (VTM) Policies and Procedures Manual, Version 1.3, May 2009.
- The model has been refined to conduct full time-of-day modeling. The first three steps in the model (trip generation, trip distribution and mode choice) are stratified for the peak period and the off-peak period separately. The highway assignments are further stratified into four time periods – AM peak, Midday, PM peak and Night.
- The refined trip generation and distribution models make extensive use of the 2009 National Household Travel Survey (NHTS) Virginia Add-On. Key relationships such as trip rates by purpose, average trip lengths, and trip frequency distributions are based on that survey.
- An FTA compatible mode choice model was developed using a variety of data sources. These include the Comprehensive Operations Analysis (COA) survey, NHTS data (automobile occupancy) and model parameters from FTA "national experience". The mode choice model is executed using the CUBE XCHOICE module.
- The highway assignment procedures include a variety of enhancements. These include the use of Conical Volume-Delay functions built up on the VDF optimization research done by Virginia Modeling, Analysis and Research Center (VMASC) at Old Dominion University (Source: Evaluation of Volume-Delay Functions and Their Implementation in VDOT Travel Demand Models, May 2011). The enhancements also include refinements to the speed-capacity tables and the use of enhanced toll procedures.
- A new heavy truck model was developed and validated.
- The model has been updated to include a feedback loop, which ensures that speeds from the resulting highway assignments are fed back through the forecasting process.
- The model has been generally calibrated and validated to the standards defined in the VTM Policies and Procedures Manual.
- A new reporting application has been created to display the model statistics and validation results in a user friendly format.

The model has been validated to year 2009 conditions. The remainder of this document covers model installation and an overview of each model step. The document has 4 main sections:

- Section 1 covers model application installation.
- Section 2 explains the model interface and the catalog structure.
- Section 3 explains the steps to run the Base Year Scenario. This includes explanation about the input and output files.
- Section 4 covers the steps involved in creating a new scenario. This section includes explanation about the keys, calibration files and files associated with the new scenario.
- Section 5 explains the coding rule for the highway network attributes.

For additional details about the methodology adopted in each step, please refer to the Hampton Roads Model Methodology Report Version.

Note: A separate version of the Hampton Roads Travel Demand Model labeled "HRT Version" is also created. This version of the model includes, at the time of writing this report, the changes made by Hampton Roads Transit (HRT) to the HR model for the TIDE rail corridor validation, as part of the ongoing Virginia Beach Transit Extension Study (VBTES). This document notes the changes made for this version of catalog in the sections below wherever applicable.

1.1 Model Software Installation

The model is written in the Voyager script language and executed through Cube software, a widely-used proprietary modeling platform developed by Citilabs (www.citilabs.com). The model runs on Version 5.1.3. The user needs administrator privileges on the machine where the model is run.

Before the model can be run, the Citilabs Cube software must be installed. At a minimum, the user should install the Cube Base package and the Cube Voyager script environment. Citilabs can provide information on obtaining the software and a suitable license, as well as instructions on installing the package.

Citilabs (Source: Cube Voyager Help Menu) gives the following information on the system requirements to install and run Cube Voyager:

Cube Voyager requires a Windows 95/98/NT/2000/XP/7 environment in which to function. The system utilizes RAM as needed; most applications will not require any special RAM considerations. The exact amount of RAM required cannot be determined until an application actually runs and the combination of user options is diagnosed. It is fairly safe to state that if a computer can run Windows, it has enough RAM to run Cube Voyager. Cube Voyager is designed to run in a multitasking environment. In such an environment, there is a possibility that several simultaneous applications could try to access the same data files simultaneously. This could possibly cause problems if one application is trying to update a file while other applications are accessing it.

The specifications of the model development machine are as follows:

Quad Core Intel Xeon CPU @ 2.66 GHz, 4 GB RAM and a 7200 rpm SATA Hard Disk.

Certain agencies are eligible to obtain a licensed copy of the Cube platform under the Virginia Department of Transportation statewide license. Contact VDOT's travel demand modeling group for more information:

http://www.virginiadot.org/projects/vtm/vtm.asp.

1.2 Model Support

The support for the Hampton Roads Travel Demand Model is provided by VDOT and the staff of the Hampton Roads Transportation Planning Organization (HRTPO). Contact information is available through the VDOT travel demand modeling website:

http://www.virginiadot.org/projects/vtm/hampton_roads.asp.

Before seeking support, please familiarize yourself with this User Manual, and the model's Technical Documentation.

1.3 Model Package Installation

The model is distributed as a single ZIP archive (or as an uncompressed set of file folders). To install the model, the user extracts (or copies) the model files into an empty folder, preserving the folder hierarchy.

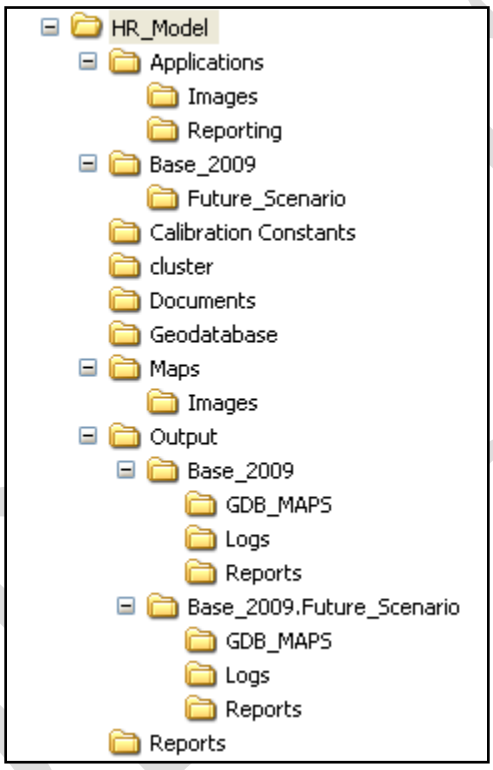
In a standard Cube/Voyager installation, the model setup screen may be opened by double-clicking the catalog file (**HR_Model.cat**), located in the root folder of the model hierarchy. Alternatively, the user may start Cube and then use the "Open Catalog" function to open the catalog file. The first time the catalog file is opened, Cube will offer to adjust paths for all the scripts and files in the model to match the installed location. The user should permit this operation by choosing "Yes" in the initial dialog. The section on "Cube Catalog Overview" of this report explains this in detail. The model will open in "Applier" mode by default. At a minimum, the user should be familiar with the model's Technical Documentation.

2 Model Interface

This section describes the model folder structure and introduces Cube Catalog and Application environment.

The model installation creates the necessary folder structure assumed in the model setup. The folder structure is illustrated in Figure 2.1.

Figure 2.1: Model Folder Structure



The main model folder contains the Cube Catalog file (HR_Model.cat) that has the model setup. Sub-folders contain various elements of the model, its input files, and its output files. These folders are typically manipulated through the Cube interface, but certain input files must be created manually for new scenarios, as described in detail below. Explanations of each sub-folder follow:

- HR_Model – The folder in which the model is installed. Note that this folder name is used as an example here and can be chosen by the user. The folder name will be recorded in the Cube Catalog when it is first opened.
    - Applications – Contains script files and application groups for the model.
    - Images – Contains bitmap used in displaying the model interface.

  The names of the sub-folders inside HR_Model are fixed and cannot be changed without re-architecting the Cube Catalog setup.

- Base_2009 – Contains input files for the 2009 base validation run.
    - <Child Scenario> - As an example, the child scenario is shown as Future_Scenario in the above figure. In general, the name of this folder depends on the scenario name. Note that Future_Scenario is shown only for the purposes of showing the model structure and does not exist in the model catalog as of this writing.

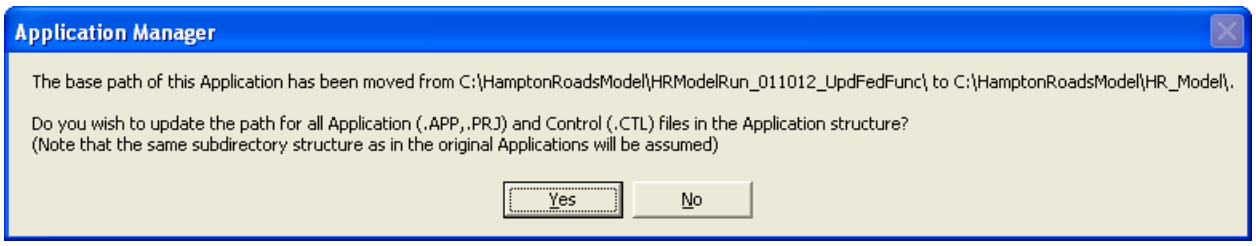
  Base_2009 contains the input files for Base 2009 scenario. The child scenario (eg: Future_Scenario) contains input files for that scenario. The input files can be manually edited by the user.
- Calibration Constants – Contains model parameters and files that do not vary from one scenario to another.
- Documents – Contains model documentation files, including this user guide.
- Reports – Contains the cube report files used for displaying the model statistics.
- Maps – contains the ArcGIS maps used to display model statistics.
- Geodatabase – contains the empty geodatabase for storing the model network and TAZ shapefile.
- Output – This folder contains a sub-folder for each scenario. Note that unlike the input files, these subfolders have a flattened structure, rather than a hierarchical one. Each scenario folder contains only the files associated with that scenario.
    - Base_2009 – Contains output files generated for the 2009 base validation run.
        - Reports – Contains summary reports of various model results.
        - Logs – Contains script run reports for each script in the model; these files contain technical information on the model runs that is of interest during model development and validation.
        - GDB Maps - contains the scenario specific ArcGIS maps.
    - Base_2009.<Scenario Name> - This name is built from the parent scenario using a period as the separator. In the example above, it is shown as Base_2009.Future_Scenario. It contains output files for that scenario. Each Scenario folder contains "Logs" and "Reports" sub-folders.

  The Output folder may not be delivered with all model transmittals as the model output is voluminous. If the Output folder and the necessary sub-folders do not exist when a model scenario is run, they will be created automatically during first few minutes of the model run.

2.1 Cube Catalog Overview

The model can be started by opening the Cube interface and using the Open Catalog option on the File menu, or simply by double clicking the **HR_Model.cat** file. It is important, after a new installation, that the user permit Cube to update the model paths to the folder location in which the model has been installed. If the model path is not up to date, a dialog will appear similar to the one shown in Figure 2.2, and the user should select "Yes".

Figure 2.2: File Path Update Following New Installation



The Cube Catalog interface is documented in detail by Citilabs. The interface is somewhat intuitive, and a brief overview is provided here to enable model users to start working with minimal training. The elements of the Cube Catalog interface are as follows and shown in Figure 2.3. The figure is shown in 4 different parts to cover the entire Application Flowchart from top to bottom.

- Scenario Window – The scenario window contains the information about the current scenarios of the model, and allows the user to create new scenarios. For example the Base scenario for Hampton Roads model is defined as Base_2009 and any new scenario would be added as a child of the base scenario.
- Application Window – The application window displays in a tree structure the logical modules ("application groups") that make up the overall model. For example the application group "HNET00.app" named as "Highway Net" includes all the programs and procedures for preparing highway network to run a scenario.
- Data Window – The data flowchart provides quick access to all important input and output files.
- Catalog Keys – The keys contain parameterized inputs and file paths for the input files in the model.
- Application Flowchart – The application flowchart displays the detailed relationships between the scripts that comprise each application group. This window will be empty until the user selects a particular application group from the Application Window. This is done by double clicking on the Application name in the Application Window. The number on each application module box represents the execution order of the application when the entire model is run. For example the "SETUP" application is run prior to "HIGHWAY NET" application. The outputs from one application could be added as inputs to any application with higher execution order. For example the output files from Trip Generation application are linked to the input files for peak and off-peak Trip Distribution applications.

The Hampton Roads model also employs loops within the model stream. Loops are designed to link together steps in the modeling process that are run iteratively. As shown in Figure 2.3 the Hampton Roads model has peak and off-peak Feedback loops to feed the congested travel times from highway assignment back to trip distribution and mode choice until the convergence criteria are met. The maximum number of iteration for the peak and off-peak feedback loop are set to 10. The highway network with free-flow speeds is defined as initial network for both peak and off-peak loop controls. The AM and MD highway assignment networks are defined as feedback networks for peak and off-peak loop controls. The User can edit the loop by right-clicking the circle box and selecting the properties to update.

Figure 2.3: Cube Catalog Window, Displaying Application Flowchart

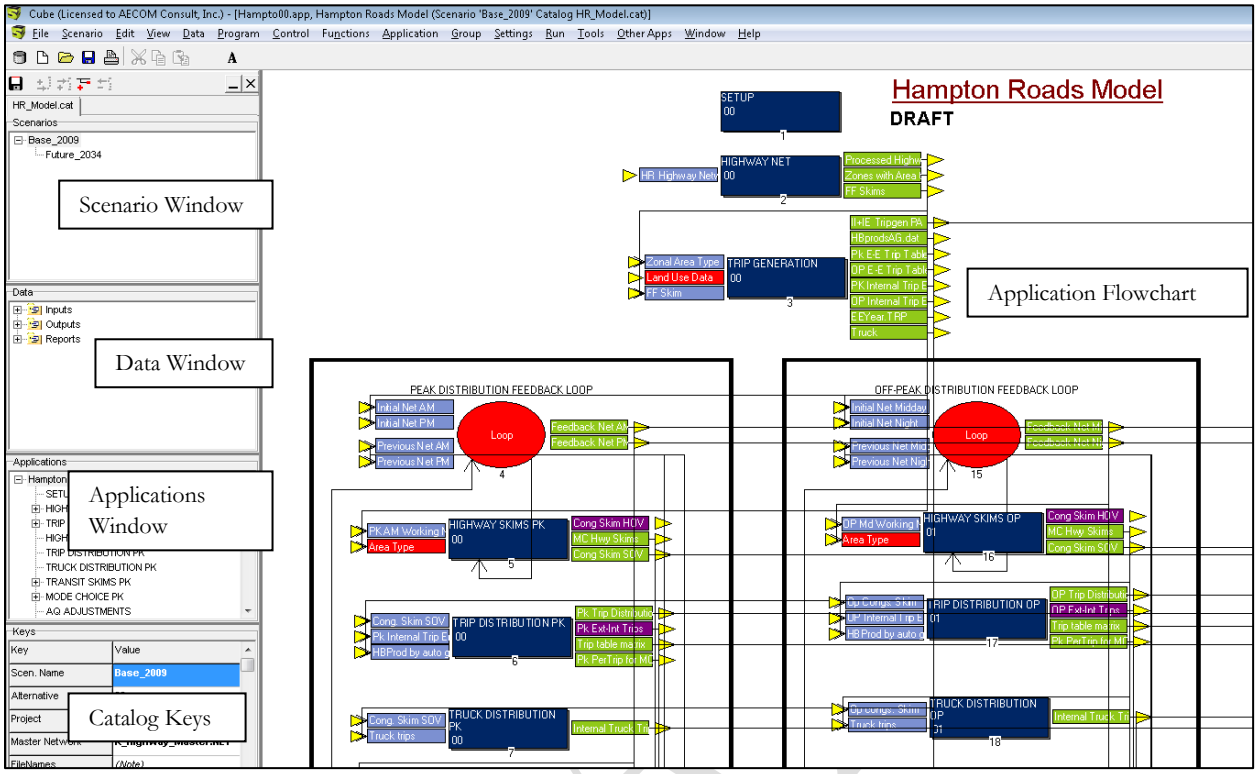


Figure 2.3: Cube Catalog Window, Displaying Application Flowchart (HRT Version)

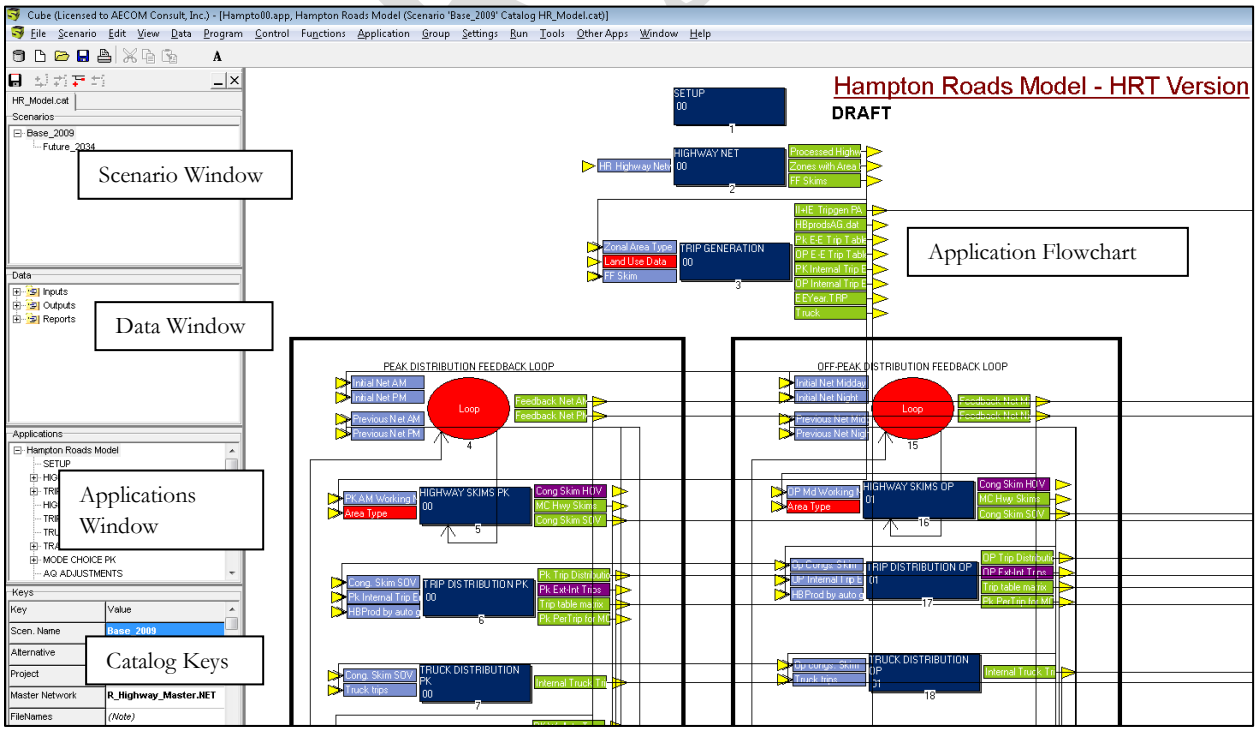


Figure 2.3: Cube Catalog Window, Displaying Application Flowchart (Cont.)

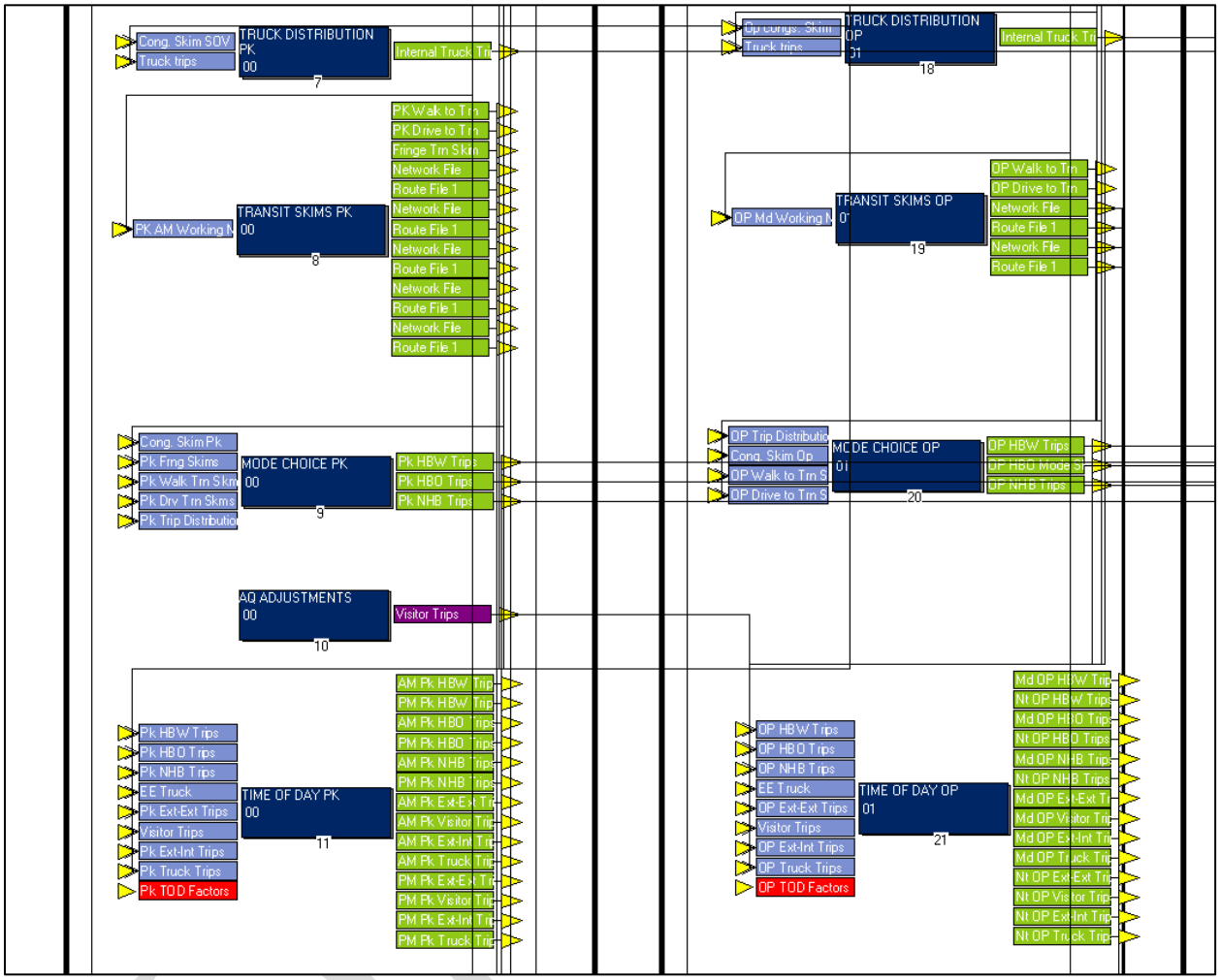


Figure 2.3: Cube Catalog Window, Displaying Application Flowchart… Continued

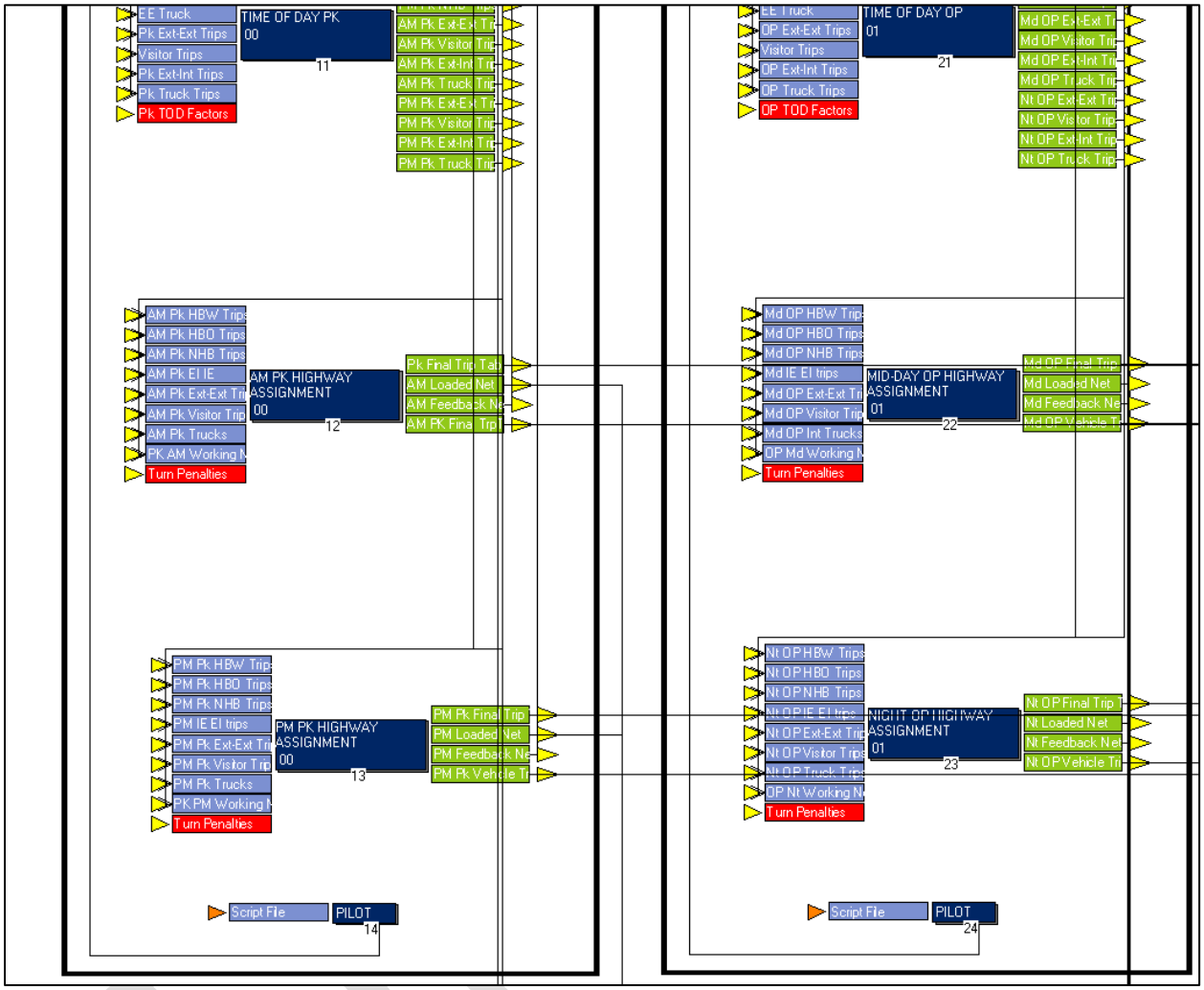
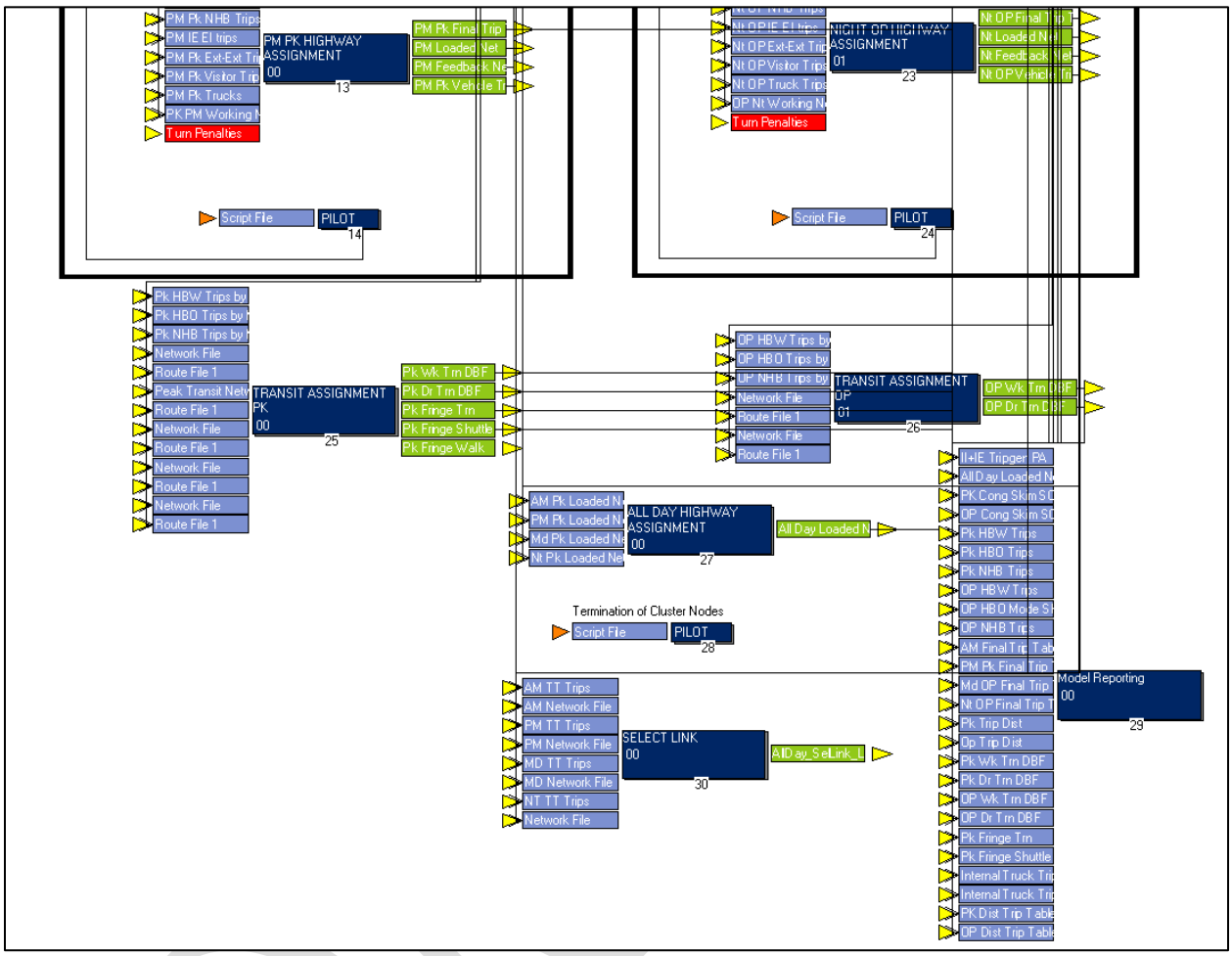


Figure 2.3: Cube Catalog Window, Displaying Application Flowchart (Cont.)



When the user opens a scenario by double-clicking in the Scenario Window, Cube will open the "Scenario Edit/Run Dialog" as shown in Figure 2.4. The user may use this dialog to adjust values in the Catalog Keys that identify the model input files and other operating parameters for the scenario. The input files and model operating parameters are discussed in detail later in this document. To save changes without running the scenario, choose the Save button. To start a model run for this scenario, choose the Run button.

Note: The Catalog keys highlighted with a red color border were added/updated in the HRT version of the HR model.

Important: Users are encouraged to leave the model in "Applier Mode" (as it is delivered). Modification to the internal model structures may violate the calibration of the model.

Figure 2.4: Edit/Run Scenario Dialog

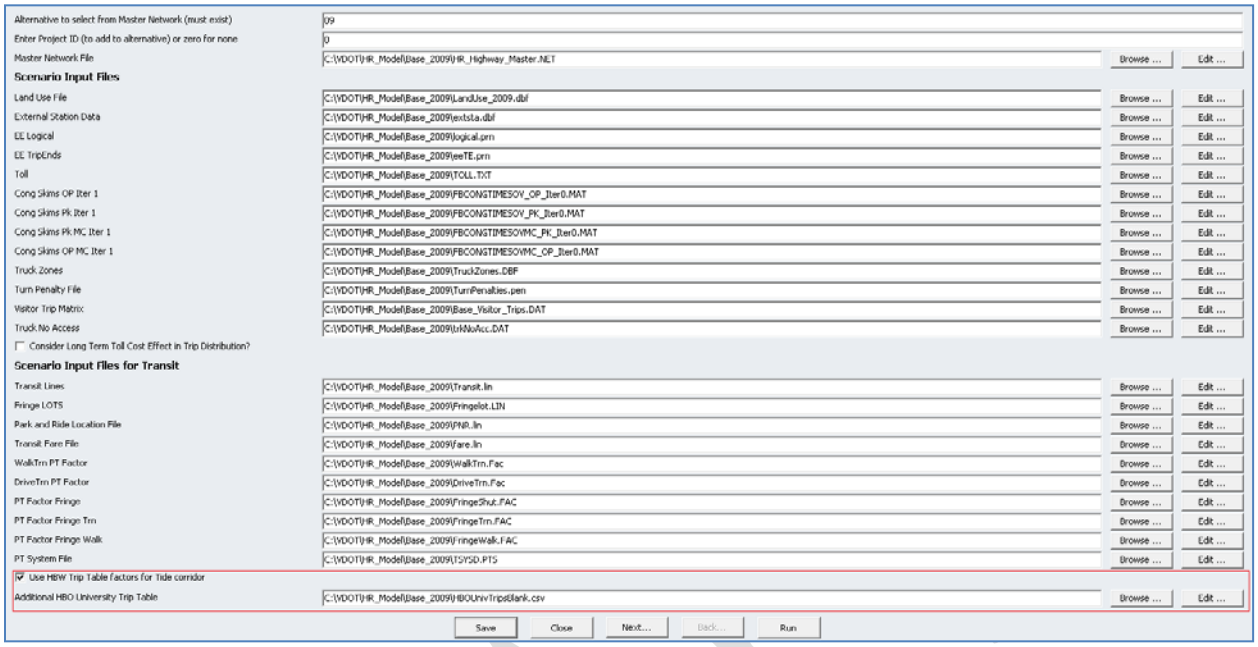


Figure 2.4: Edit/Run Scenario Dialog(Cont.)

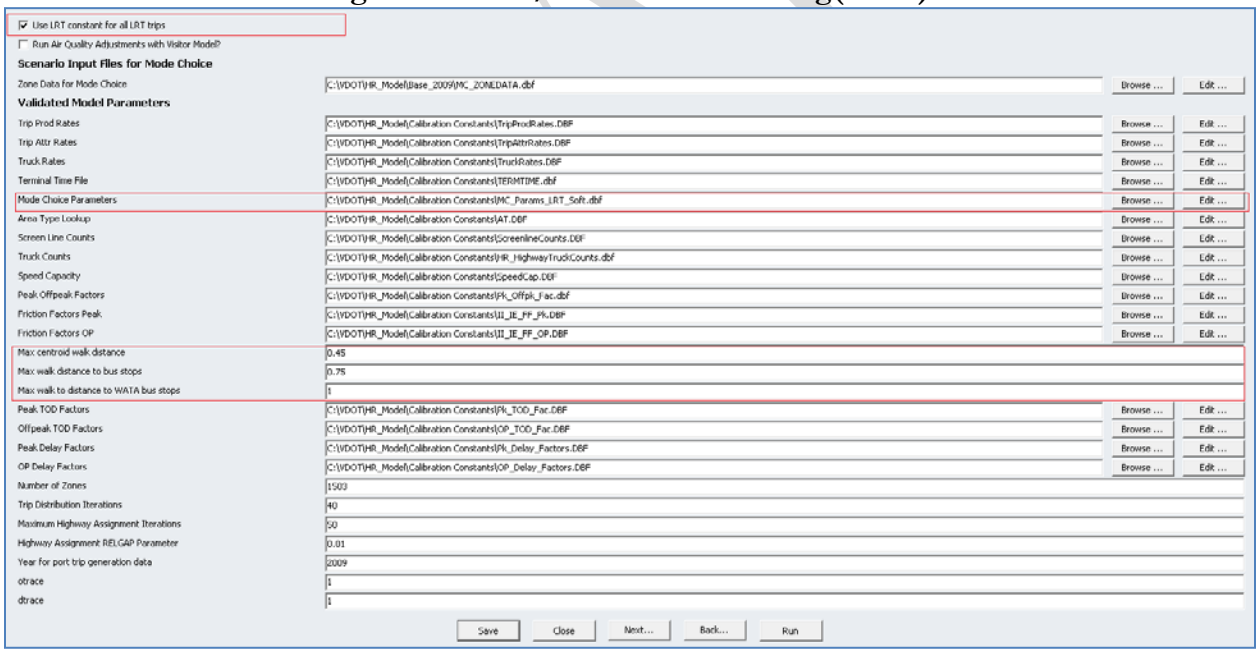
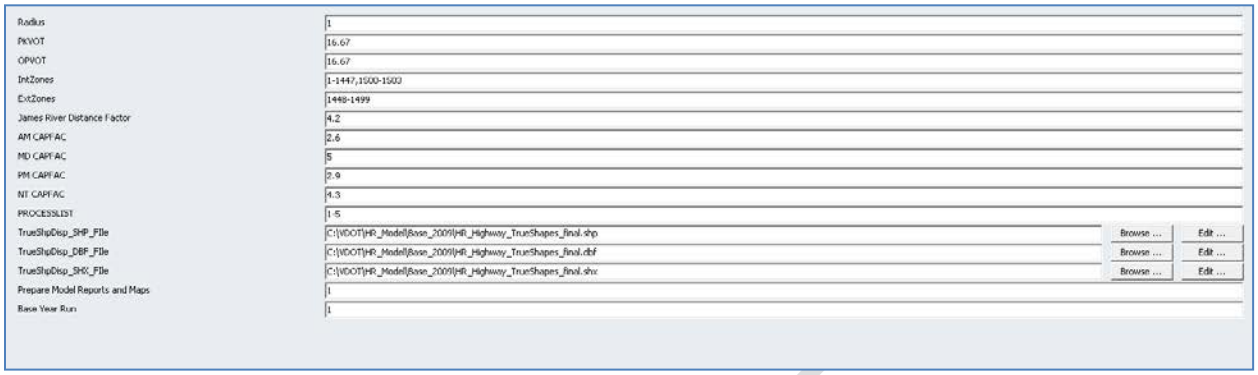


Figure 2.4: Edit/Run Scenario Dialog(Cont.)



2.2 Scenario Keys

The Scenario Edit/Run Dialog is used to specify input files and parameters for the model (Figure 2.4). Table 2.1 lists the elements ("keys") of the Scenario Edit/Run Dialog. When a new scenario is created, the new scenario keys are copied from the parent scenario. The input scenario files are thus copied to the new scenario folder. The user may edit those copied files, or create new files and set the key to the new file name. It is recommended that the files be kept in the Scenario folder, as correct model performance in subsequent scenarios cannot otherwise be ensured.

Table 2.1: Scenario Edit/Run Dialog Parameters

Required Scenario Input Files	
Master Network File	Highway Network File
Land Use File	Land Use File
External Station Data	Auto and Truck Counts
EE Seed Matrix Generation Files	Input files to generate EE Seed matrix for scenario year
Toll	Input Toll Data
Cong Skims Pk Iter 1	Peak Congested Time for Iter 1 Feedback Loop
Cong Skims OP Iter 1	OP Congested Time for Iter 1 Feedback Loop
Cong Skims Pk MC Iter 1	Peak Congested Time for Iter 1 Feedback Loop for Mode Choice
Cong Skims OP MC Iter 1	OP Congested Time for Iter 1 Feedback Loop for Mode Choice
Truck Zones	Truck Zones
Turn Penalty File	Turn Penalties
Visitor Trip Matrix	Base Year Visitor Trips – Not updated during Base Year Validation
Truck No Access	List of Zones with no accessibility for Trucks
Long Term Toll in Trip Distribution	Flag (0/1) to include Toll Cost for HBW Trip Distribution impedance
Transit Related Input Files	
Transit Line File	Transit Files
Fringe LOTS	Transit Files
Park and Ride Location File	Transit Files

Transit Fare File	Transit Files
PT Factor File Walk Trn	Transit Files
PT Factor File Drive Trn	Transit Files
PT Factor File Fringe Transit	Transit Files
PT Factor File Fringe Shuttle	Transit Files
PT Factor File Fringe Walk	Transit Files
PT System File	Transit Files
Run Air Quality Adjustments with Visitor Model?	
Mode Choice Related Input Files	
Zone Data for Mode Choice	Mode Choice File
Calibration Constants Files	
Trip Production Rates	Production Rates
Trip Attraction Rates	Attraction Rates
Truck Rates	Truck Rates
Terminal Time File	Terminal Times
Mode Choice Parameters	Coefficients/Constants for Mode Choice (Updated for HRT Version Catalog)
Area Type Lookup	Area Type Lookup Based on Population/Employment Densities
Screen Line Counts	Screen Line Counts for Base Year
Speed Capacity	Speed-Capacity Lookup Table
Peak Offpeak Factors	Peak and Offpeak Factors to split trips after Trip Generation
Friction Factors Peak	Friction Factors for Trip Distribution in Peak Period
Friction Factors Offpeak	Friction Factors for Trip Distribution in Offpeak Period
Peak TOD Factors	Time Of Day Factors to split Peak into AM and PM
Offpeak TOD Factors	Time Of Day Factors to split Offpeak into Midday and Night
Peak Delay Factors	Delay in minutes/mile to be applied to Transit Times in Peak Period
OP Delay Factors	Delay in minutes/mile to be applied to Transit Times in Offpeak Period
Number of Zones	Maximum Number of TAZs
Trip Distribution Iterations	# Iterations in Distribution Process
Maximum Highway Assignment Iterations	# Iterations in Highway Assignment Process (This is not same as Feedback parameter)
Highway Assignment Relative Gap	Relative Gap (RELGAP) parameter for highway assignment convergence.
Radius	Radial Distance in miles used in Area Type Calculations
PKVOT	Peak Value of Time in cents/minute
OPVOT	Off-Peak Value of Time in cents/minute
IntZones,ExtZones	List of Internal and External zones
James River Distance Factor	Psychological barrier factor applied in non-work trip distribution.
AM CAPFAC	Capacity Factor in AM
PM CAPFAC	Capacity Factor in PM
MD CAPFAC	Capacity Factor in MD
NT CAPFAC	Capacity Factor in NT
PROCESSLIST	Parameter specified for Cube Cluster.

	Default set to 1-7
TrueShpDisp_SHP_File, DBF_File, SHX_File	Highway Network Shape File to display true shape display
Prepare Reports and Maps	To prepare model reports or maps
Base Year Run	Identify calibration (base year) run
"HRT Version Catalog" Additional Keys	
FactorTrips	Flag (0 or 1) to factor HBW Trips
Additional HBO University Trip Table	Add On University Trip Table in HBO Mode Choice
ALL_LRT	LRT flag for scenario used in Mode Choice
BusMaxWalk	Max walk distance for non-transit legs
WATAMaxWalk	Max walk distance for WATA buses
MaxCentWalkDist	Max Cap on zonal centroid walk distance

3 Running the Base Year Model

This section explains the steps involved in running the Base Year Scenario from the Catalog, accessing files associated with it, and information on the contents of the input and output files.

When the model is first installed on a computer, it is a good test to run the base year scenario to ensure that the Cube software and the model application files have been successfully installed. As shown in Figure 2.3, the base year scenario is identified as Base_2009 in the Scenario Window.
The Base Year Scenario can be run using the following steps:

1. Start Cube and use either the File Center or the File/Open Catalog menu option to select the file **HR_Model.cat** (Catalog File Type) file from the folder where you installed the model. Alternatively, you can open the installation folder and double-click the **HR_Model.cat** file in Windows Explorer. Please see the instructions associated with Figure 2.2 if you are opening the catalog for the first time.
2. The user will see four panes: Scenarios, Applications, Data, and Keys as shown in Figure 2.3. In order to see the Application Flowchart as shown in Figure 2.3, the user should double-click the application name "Hampton Roads Model" in the Applications Window.
3. Select **Base_2009** in the Scenario Window by double-clicking on it. The Scenario Edit/Run Dialog will open, and the Cube window should resemble Figure 2.4.
4. To run the Base Year Scenario, simply click the "Run" button at the bottom of the dialog. Alternatively, the user can single-click the Scenario Base_2009, click on Application in the File menu, followed by a click on Run Application. The Run Application window appears as shown in Figure 3.1. In order to run the entire model, select the option of "Run Application now from Task Monitor" as shown in Figure 3.1.

Figure 3.1: Run Application Window

In general, the Catalog Keys for the Base_2009 scenario should not be changed. Doing so may invalidate the model for the base year. If the user is interested in testing a scenario by editing a few inputs for the base year scenario, it is recommended that they do it by creating Child Scenario, explained in the section "Scenario Example".

3.1 Model Run Time

The running time for the Hampton Roads Model Base 2009 scenario can be anywhere between 2 hours to 6 hours, depending on the speed of the computer and whether Cube Cluster is utilized. The run times on the model development machine utilizing three additional Cube Cluster nodes averaged around 3 hours. The specifications of the model development machine are: Quad Core Intel Xeon CPU @ 2.66 GHz, 4 GB RAM and a 7200 rpm SATA Hard Disk. The model is designed to utilize the Cube Cluster by default and the "PROCESSLIST" is set to 1-7. The model runs on both 32-bit and 64-bit versions of Windows. Note that there could be variations in the results during clustering depending on the number of cluster nodes and also the number of cores available on the modeling machine.

3.2 Accessing Files

The model results can be accessed in several ways – using Cube's Data Window, or from the Application Flowchart, or directly from the disk from the relevant scenario folder. All of these methods are discussed below.

3.2.1 Accessing Files through the Data Window

Cube's Data Window contains direct links to "important" input and output files.

Important: The files selected in the Data Window correspond to the currently selected scenario(s).In order to open the correct file, the user must first select the desired scenario in the Scenario Window (or through the context menu that appears when right-clicking a file in the Data Window). If the scenario has not previously been run, output files will not exist and an error message will appear stating that the file does not exist. If a missing file message appears after the scenario was run, it indicates that some error condition (typically a missing or incorrect input file) prevented the model from running to completion. The user may inspect the output files and log files to determine where the error occurred. A missing file message can also occur if the file path indicated in the Keys is not consistent with the file path in the Data Window.

The model's Data Window contains three sections: Inputs, Outputs and Reports. Input files and their formats are discussed in detail in the next section, "Constructing New Scenarios". The files listed in the Data Window are discussed in the following sections. The files can be opened with a double-click on the file entry in the Data Window. The file will open in Cube, and may be exported to other formats through the Cube interface for analysis in outside programs. The Data window also supports convenient access to the Cube Reports package to create reports that may be saved and re-run on other scenarios. See the Cube Reports documentation (Section 3.4) for further details. The column "Execution order in catalog" in Table 3.1 shows the corresponding order in the application flowchart.

Table 3.1: Data Window Files – Base 2009 Scenario

Sub-Section	Execution Order in Catalog	Name in Data Window	Description
Inputs			
Highway Network	2		
		Master_Network	Master Network used in the model
		Turn Penalties	Turn Penalties associated with the highway network
		Terminal Times	Auto terminal times by area type
Trip Generation	3		
		Land Use Data	Population, Employment etc. by zone
		External Station Counts	Counts at the external stations
		Seed EE Trip Table	Base year auto and truck External-External trip table
		Trip Production Rates	Trip rates for productions from National Household Travel Survey (NHTS)
		Trip Attraction Rates	Trip rates for attractions from NHTS
		Truck Zones	List of zones with significant truck trips
		Truck Rates	Trip rates for trucks
Trip Distribution	6 (Pk), 17 (OP)		
		Peak Friction Factors	Peak curves by purpose
		Offpeak Friction Factors	Offpeak curves by purpose
		Peak HBW 0 car HH Attr Splits	Home Based Work 0 car attraction splits by district for peak
		Peak HBO 0 car HH Attr Splits	Home Based Other 0 car attraction splits by district for peak
		Peak HBS 0 car HH Attr Splits	Home Based Shopping 0 car attraction splits by district for peak
		Offpeak HBW 0 car HH Attr Splits	Home Based Work 0 car attraction splits by district for offpeak
		Offpeak HBO 0 car HH Attr Splits	Home Based Other 0 car attraction splits by district for offpeak
		Offpeak HBS 0 car HH Attr Splits	Home Based Shopping 0 car attraction splits by district for offpeak
		Truck Peak Friction Factors	Peak curves by purpose for truck trips
		Truck Offpeak Friction Factors	Offpeak curves by purpose for truck trips
		Factor Districts	Flag to factor the Peak and Off-Peak HBW Trips. Note: Added for "HRT Version"
Transit	8 (Pk), 19 (OP)		
		Transit Network	Local, Express, Premium Bus PT transit lines
		Transit Fares	Transit fare file
		Park and Ride	File with list of park & ride lots in the model region

Sub-Section	Execution Order in Catalog	Name in Data Window	Description
		Factor File – Walk Transit	Path parameters for walk to transit
		Factor File – Drive Transit	Path parameters for drive to transit
		System File – Walk and Drive to Transit, and Fringe	Transit system parameters
		Factor File – Fringe Transit	Path parameters for Fringe Transit
		Factor File – Fringe Shuttle	Path parameters for Fringe Shuttle
		Factor File – Fringe Walk	Path parameters for Fringe Walk
Mode Choice	9 (Pk), 20 (OP)		
		Mode Choice Zone Data	Terminal times and parking costs data
		Mode Choice Parameters	Coefficients and constants by purpose
		University Add On Trips in HBO Purpose	Additional HBO University Trips Note: Added for the "HRT Version"
Outputs			
Highway Network	2		
		Area Type by Zones	Zonal Area Type calculated using land use data
Trip Generation	3		
		Peak Internal Trip Ends	Internal trip productions and attractions by zone for peak period
		Offpeak Internal Trip Ends	Internal trip productions and attractions by zone for off-peak period
		Peak E-E Matrix	External-External trip matrix for peak period
		Offpeak E-E Matrix	External-External trip matrix for off-peak period
		EE Trucks	External-External auto and truck trip tables
		II and IE Trucks	Truck trip ends
Highway Network Skims	5 (Pk), 16 (OP)		
		Peak Feedback Congested Skims – SOV	Zone-to-zone shortest level of service data for single occupancy and high occupancy vehicles for peak and off-peak periods
		Peak Feedback Congested Skims – HOV	
		Offpeak Feedback Congested Skims – SOV	
		Offpeak Feedback Congested Skims – HOV	
		Peak Highway skims for Mode Choice	Highway skims without terminal times for peak
		Offpeak Highway skims for Mode Choice	Highway skims without terminal times for offpeak
Trip Distribution	6 (Pk), 17 (OP)		
		Peak Internal Person Trips	Internal-Internal trips matrices for peak and off-peak periods
		Offpeak Internal Person Trips	
		Peak External-Internal Trips	External-Internal trips matrices for peak and off-peak periods
		Offpeak External-Internal Trips	

Sub-Section	Execution Order in Catalog	Name in Data Window	Description
Truck Distribution	7 (Pk), 18 (OP)		
		Peak Truck Trips	Internal-Internal and External-Internal truck trips matrices for peak and off-peak periods
		Offpeak Truck Trips	
Transit Skims	8 (Pk), 19 (OP		
		Peak Walk to Transit Matrix	Peak and offpeak zone-to-zone shortest path level of service data for walk-to-transit, drive-to-transit and fringe transit (only peak)
		Peak Drive to Transit Matrix	
		Peak Fringe to Transit Matrix	
		OP Walk to Transit Matrix	
		OP Drive to Transit Matrix	
Mode Choice	9 (Pk), 20 (OP)		
		Peak HBW Trips by Mode	Zone-to-zone person trips by mode for peak period
		Peak HBO Trips by Mode	
		Peak NHB Trips by Mode	
		Offpeak HBW Trips by Mode	Zone-to-zone person trips by mode for off-peak period
		Offpeak HBO Trips by Mode	
		Offpeak NHB Trips by Mode	
Highway Assignment	12 (AM), 13 (PM), 22 (Md), 23 (Nt)		
		Peak AM Loaded Network	Loaded highway networks from highway assignments for AM peak, Midday, PM peak and Overnight periods
		Peak PM Loaded Network	
		Off Peak MD Loaded Network	
		Off Peak NT Loaded Network	
		Peak Feedback Network	Highway networks used in the next feedback iteration for peak and off-peak periods
		Off-Peak Feedback Network	
Transit Assignment	25 (Pk), 26 (OP)		
		Peak Walk to Transit Line Volumes	Transit assignment results for peak and off-peak walk/drive to transit.
		Offpeak Walk to Transit Line Volumes	
		Peak Drive to Transit Line Volumes	
		Offpeak Drive to Transit Line Volumes	
		Peak Fringe Walk	Transit assignment results for peak fringe paths
		Peak Fringe Transit	
		Peak Fringe Shuttle	
Summaries	12 (AM), 13 (PM), 22 (Md), 23 (Nt)		
		Peak AM Screen Line summary	Observed vs. Modeled volumes summary for Screenlines for four time periods
		Peak PM Screen Line summary	
		Offpeak MD Screen Line summary	
		Offpeak NT Screen Line summary	
Air Quality			Visitor trips matrix used for air quality analysis
		Visitor OD Trips	

INPUT FILES

The file names listed in this section refer to the Base 2009 validation scenario. Some of the file names are likely to be different for other years or scenarios depending on how they are named. A list of input files in the base year scenario and which are required to define a new scenario are listed in Section 4.2, Table 4.1.

Trip Generation

- Landuse Data (LandUse_2009.dbf) – Population, employment and other socio-economic data by Traffic Analysis Zones (TAZs) as derived from the HRTPO's 2009 Socioeconomic Data report.
- External Station Counts (extsta.dbf) – Observed counts data at the external stations for the validation year (2009) from VDOT.
- Seed EE trip table (EE2009.trp) – External-External trips matrix for base year, also used as a seed to estimate future year trips. Derived using facility types and counts at the external stations.
- Trip Production Rates (TripProdRates.dbf) – Factors from NHTS by purpose, household size and auto ownership to estimate trip productions at each zone.
- Trip Attraction Rates (TripAttrRates.dbf) – Factors from NHTS by purpose to estimate trip attractions to each zone.
- Truck Zones (TruckZones.dbf) – List of zones where truck facilities exist or truck trips have significant share as identified by VDOT and HRTPO.
- Truck Rates (TruckRates.dbf) – Trip rates to estimate truck trips at each zone. Truck rates were derived during base year validation (details in Hampton Roads Methodology Report).

Highway Network

- Base Network (Extract_HR_Net.net) – The base highway network. This has standard link attributes as defined in Policies and Procedures Manual and is extracted from the Master Network.
- Turn Penalties (TurnPenalties.pen) – Scenario specific turn penalties in Voyager format. These penalties should be compatible with the highway network that will be used for the model run. Penalties were derived by HRTPO and VDOT.
- Terminal Times (TermTime.dbf) – Auto origin-to-parking and parking-to-destination times by area type. These times are used to update the land use file for mode choice after the area type procedure calculates the zonal area type. Terminal Times are taken from the old (prior) Hampton Roads model.

Trip Distribution

The factors in the following files were developed as part of calibration and validation of the base year model.

- Peak Friction Factors (II_IE_FF_PK.dbf) - Friction factor curves used in the gravity model for peak purposes.

- Offpeak Friction Factors (II_IE_FF_OP.dbf) - Friction factor curves used in the gravity model for offpeak purposes.
- Peak HBW 0 Car HH Attr Splits (hbwpk_attrsplt.dat) – Attraction splits for estimating 0 car home based work trips for peak.
- Peak HBS 0 Car HH Attr Splits (hbspk_attrsplt.dat) – Attraction splits for estimating 0 car home based shopping trips for peak.
- Peak HBO 0 Car HH Attr Splits (hbopk_attrsplt.dat) – Attraction splits for estimating 0 car home based other trips for peak.
- Offpeak HBW 0 Car HH Attr Splits (hbwop_attrsplt.dat) – Attraction splits for estimating 0 car home based work trips for offpeak.
- Offpeak HBS 0 Car HH Attr Splits (hbsop_attrsplt.dat) – Attraction splits for estimating 0 car home based shopping trips for offpeak.
- Offpeak HBO 0 Car HH Attr Splits (hboop_attrsplt.dat) – Attraction splits for estimating 0 car home based other trips for offpeak.
- Truck Peak Friction Factors (Truck_FF_PK.dbf) - Friction factor curves used in the gravity model for peak truck trips.
- Truck Offpeak Friction Factors (Truck_FF_OP.dbf) - Friction factor curves used in the gravity model for offpeak truck trips.

Transit

- Transit Network – (Transit.lin) – Transit line file in Public Transport format with local, express, premium buses. The service plans are from Hampton Roads Transit (HRT), Williamsburg Area Transit Authority (WATA) and HRTPO.
- Transit Fares (Fare.lin) – Transit fare definition file. Fares are taken from the transit agency websites.
- Park and Ride (PNR.lin) – List of park & ride lots in the model region from the transit agency websites.
- Factor File – Walk Transit (WalkTrn.fac) – Path parameters such as runtime factors, initial wait time, transfer penalties, available modes etc., for peak and offpeak walk to transit paths.
- Factor File – Drive Transit (DriveTrn.fac) – Path parameters such as runtime factors, initial wait time, transfer penalties, available modes etc., for peak and offpeak drive to transit paths.
- System File – Walk and Drive to Transit (TSYSD.pts) – System wide transit parameters such as mode definitions, wait time curves, fares for peak and offpeak walk and drive to transit paths.
- Factor File – Fringe Transit (FringeTrn.fac) – Path parameters such as runtime factors, initial wait time, transfer penalties, available modes etc., for peak fringe transit paths.
- Factor File – Fringe Shuttle (FringeShut.fac) – Path parameters such as runtime factors, initial wait time, transfer penalties, available modes etc., for peak fringe shuttle paths.
- Factor File – Fringe Walk (FringeWalk.fac) – Path parameters such as runtime factors, initial wait time, transfer penalties, available modes etc., for peak fringe walk path.

Note: All the transit related input files and path parameter files are updated for the "HRT Version". The transit line files are kept the same as HR Model with only change of new mode 11 for LRT.

Mode Choice

- Mode Choice Land Use (MC_ZoneData.dbf) – Terminal times and parking costs for auto trips by TAZ. The data is taken from the old (prior) Hampton Roads model.
- Mode Choice Parameters (MC_Params.dbf) – Coefficients and constants used for all purposes for all time periods. The constants are the result of model calibration and should not be changed for any model run based on the base year model.

Note: The Mode Choice Parameter file is changed for the "HRT Version".

OUTPUT FILES

Trip Generation

- Peak Internal Trip Ends (PK_II.dbf) – Productions and Attractions by TAZ that are estimated by the trip generation step. This file has data for productions and attractions of internal-internal trips in the peak period, productions of internal-external trips in the peak period and attractions of external-internal trips in the peak period.
- Offpeak Internal Trip Ends (OP_II.dbf) – Productions and Attractions by TAZ that are estimated by the trip generation step. This file has data for productions and attractions of internal-internal trips in the offpeak period, productions of internal-external trips in the offpeak period and attractions of external-internal trips in the offpeak period.
- Peak E-E Matrix (PK_EE_Trips.mat) –Matrix with zone-to-zone estimate of external-external trips for peak period.
- Offpeak E-E Matrix (OP_EE_Trips.mat) –Matrix with zone-to-zone estimate of external-external trips for off-peak period.
- E-E Trucks (EEYear.trp) – Estimated auto and truck external-external trips for average weekday for the model year.
- I-I and E-E Trucks (Truck_PA_ALL.dbf) – Truck trip ends for both internal and external destinations.

Highway Network Skims

- Peak Feedback Congested Skims – SOV (PkSkimSOV.mat) – Binary Voyager matrix containing peak congested level of service data for single occupancy vehicles and trucks - Time, Distance and Generalized cost (time including toll value of time).
- Peak Feedback Congested Skims – HOV (PkSkimHOV.mat) – Binary Voyager matrix containing peak congested level of service data for high occupancy vehicles - Time, Distance and Generalized cost (time including toll value of time).
- Offpeak Feedback Congested Skims – SOV (OpSkimSOV.mat) – Binary Voyager matrix containing off-peak congested level of service data for single occupancy vehicles and trucks - Time, Distance and Generalized cost (time including toll value of time).
- Offpeak Feedback Congested Skims – HOV (OpskimHOV.mat) – Binary Voyager matrix containing peak congested level of service data for high occupancy vehicles - Time, Distance and Generalized cost (time including toll value of time).

- Peak Highway Skims for Mode Choice (PkHwySkims.mat) – Highway times without terminal times for use in peak mode choice.
- Offpeak Highway Skims for Mode Choice (OpHwySkims.mat) – Highway times without terminal times for use in offpeak mode choice.

Trip Distribution

- Peak Internal Person Trips (Pk_Person_TripTable.mat) – Trip-table matrix, containing five tables: home-based work trips by persons in zero-car households, home-based-work trips by persons where a car is available in the household, home-based other by persons in zero-car households, home-based other trips by persons where a car is available in the household, and non-home based trips. These trips represent travel in the peak period.
- Peak External-Internal Trips (EITdist_pk.mat) – Trip-table matrix, with all External-Internal trips for the peak period from the trip distribution gravity model.
- Offpeak Internal Person Trips (Op_Person_TripTable.mat) – Trip-table matrix, containing five tables: home-based work trips by persons in zero-car households, home-based-work trips by persons where a car is available in the household, home-based other by persons in zero-car households, home-based other trips by persons where a car is available in the household, and non-home based trips. These trips represent travel in the off-peak period.
- Offpeak External-Internal Trips (EITdist_op.mat) –Trip-table matrix, with all External-Internal trips for the off-peak period from the trip distribution gravity model.

Truck Distribution

- Peak Truck Trips (Truck_Trips_Pk.mat) – Trip-table matrix, with all truck trips for the peak period from the truck trip distribution gravity model.
- Offpeak Truck Trips (Truck_Trips_Op.mat) – Trip-table matrix, with all truck trips for the off-peak period from the truck trip distribution gravity model.

Transit Skims

- Peak Walk to Transit Matrix (WTRNPK.MC) – Transit skim matrix for peak period walk to transit.
- Peak Drive to Transit Matrix (DTRNPK.MC) – Transit skim matrix for peak period drive (park & ride) to transit.
- Peak Fringe to Transit Matrix (FringeSkimPK.MC) – Skim matrix for peak period fringe paths.
- Offpeak Walk to Transit Matrix (WTRNOP.MC) – Transit skim matrix for off-peak walk to bus.
- Offpeak Drive to Transit Matrix (DTRNOP.MC) – Transit skim matrix for off-peak drive to bus (park-and-ride).
- Transit skim files contain in-vehicle travel time(IVTT), out-of-vehicle travel time(OVTT), walk time (WALK), fare (in cents), time spent riding various types of vehicles (Bus, Trolley, Express Buses etc), total trip distance, and number of transfers.

Note: These output skims are modified for "HRT Version" to include LRT times.

Mode Choice

The output trip tables from the mode choice include internal-internal person trips by mode for three purposes (HBW, HBO and NHB) for two time periods (peak/off-peak). Each matrix has the following nine tables – Drive Alone (DA), Shared Ride 2 persons (SR2), Shared Ride 3+ persons (SR3), Walk to Transit (WKTRN), Drive to Transit (DRTRN), Fringe Walk (FPWLK), Fringe Transit (FPTRN), Fringe Shuttle (FPSHT) and Total trips (Total). Note that some tables will be empty in some matrices as not all purposes have the same mode choice nesting structure. For example, the three fringe tables have data only for HBW peak period. For all other purposes and time period those tables are empty.

- Peak HBW Trips by Mode (HBWOUT_Pk.dat) – Person trips by mode for peak period for home-based work person trips.
- Peak HBO Trips by Mode (HBOOUT_Pk.dat) – Person trips by mode for peak period for home-based other person trips.
- Peak NHB Trips by Mode (NHBOUT_Pk.dat) – Person trips by mode for peak period for non-home based person trips.
- Offpeak HBW Trips by Mode (HBWOUT_Op.dat) – Person trips by mode for off-peak period for home-based work person trips.
- Offpeak HBO Trips by Mode (HBOOUT_Pk.dat) – Person trips by mode for off-peak period for home-based other person trips.
- Offpeak NHB Trips by Mode (NHBOUT_Pk.dat) – Person trips by mode for off-peak period for non-home based person trips.

Highway Assignment

- AM Pk Final Trip Table (AM_pk_Final_TripTable_VOT_TMP.dat) – The vehicle trip table assigned to the highway network. This trip table includes all personal vehicle and truck trips, including adjustments for occupancy rates, and truck PCEs by five value of time buckets.
- Peak AM Loaded Network (AM_Pk_FDBKNET.net) – This network contains the model results from the AM highway assignment.
- MD Op Final Trip Table (MD_op_Final_TripTable_VOT_TMP.dat) – The vehicle trip table assigned to the highway network.
- Off Peak MD Loaded Network (MD_Op_FDBKNET.net) – This network contains the model results from the Midday highway assignment.
- PM Pk Final Trip Table (PM_pk_Final_TripTable_VOT_TMP.dat) – The vehicle trip table assigned to the highway network.
- Peak PM Loaded Network (PM_Pk_FDBKNET.net) – This network contains the model results from the PM highway assignment.
- NT Op Final Trip Table (NT_op_Final_TripTable_VOT_TMP.dat) – The vehicle trip table assigned to the highway network.
- Off Peak NT Loaded Network (NT_Op_FDBKNET.net) – This network contains the model results from the Overnight highway assignment.

Transit Assignment

- Peak Walk to Transit Line Volumes (LINKWPK.dbf) – Ridership volumes for each line for given period and access mode.
- Offpeak Walk to Transit Line Volumes (LINKWOP.dbf) – Ridership volumes for each line for given period and access mode.
- Peak Drive to Transit Line Volumes (LINKDPK.dbf) – Ridership volumes for each line for given period and access mode.
- Offpeak Drive to Transit Line Volumes (LINKDOP.dbf) – Ridership volumes for each line for given period and access mode.
- Peak Fringe Walk Line Volumes (LINKFWLKPK.dbf) – Ridership volumes for each line for given period and access mode.
- Peak Fringe Transit Line Volumes (LINKFTRNPK.dbf) – Ridership volumes for each line for given period and access mode.
- Peak Fringe Shuttle Line Volumes (LINKFSHTPK.dbf) – Ridership volumes for each line for given period and access mode.

Summaries

- Peak AM Screen Line Volume Summary (Am_Pk_Screenlines.prn) – Volume/Count ratio for each of the screenlines, for use in model validation.
- Peak PM Screen Line Volume Summary (Pm_Pk_Screenlines.prn) – Volume/Count ratio for each of the screen lines, for use in model validation.
- Peak MD Screen Line Volume Summary (Md_Op_Screenlines.prn) – Volume/Count ratio for each of the screen lines, for use in model validation.
- Peak AM Screen Line Volume Summary (Nt_Op_Screenlines.prn) – Volume/Count ratio for each of the screen lines, for use in model validation.

The above four files are in the REPORTS folder within the scenario output.

Air Quality Analysis

Visitor OD Trips (ODVisitorTrips.MAT) – This trip table contains additional vehicle trips occurring during the typical summer weekday travel period. Assigning these trips is required for air-quality conformity analysis, but they are typically not assigned for general traffic analysis.

Note: The visitor trip model is not updated during the Base 2009 validation process. The visitor trip matrices from the old (prior) model are kept in the model setup.

CALIBRATION CONSTANT FILES

The calibration constant files were developed during the calibration of the base year model. These files should not change between scenarios. Changing these files may violate the calibration of the model. The contents of this folder are shown in Table 3.2.

Table 3.2: Contents of the Calibration Constants Folder

Filename	Content
Base_visitor_trips.dat	Seed matrix for summer visitor trips
AT.dbf	Area Type - Density look up table
Tripattrrates.dbf	Trip Attraction Rates
Tripprodrates.dbf	Trip Production Rates
Hbwpk_attrsplt.dat	Peak HBW 0 Car Attraction Splits
Hbspk_attrsplt.dat	Peak HBS 0 Car Attraction Splits
Hbopk_attrsplt.dat	Peak HBO 0 Car Attraction Splits
Hbwop_attrsplt.dat	Offpeak HBW 0 Car Attraction Splits
Hbsop_attrsplt.dat	Offpeak HBS 0 Car Attraction Splits
Hboop_attrsplt.dat	Offpeak HBO 0 Car Attraction Splits
Termtime.dbf	Terminal Time Table
Improved_II_IE_FF_Pk.dbf	Peak Friction Factors
Improved_II_IE_FF_Op.dbf	Offpeak Friction Factors
Pk_Offpk_Fac.dbf	Peak and Offpeak splits from NHTS
PK_TOD_Fac.dbf	Peak Time-of-day factors from NHTS
OP_TOD_Fac.dbf	Offpeak Time-of-day factors from NHTS
Speedcap.dbf	Speed Capacity Table
ScreenlineCounts.dbf	Base Year counts for screen lines
MC_Params.dbf	Mode Choice parameters by purpose
MC_Params_LRT_soft.dbf	Mode Choice parameters by purpose. Note: for "HRT Version"
District.dbf	Various TAZ-District equivalencies
FactorDistricts.dbf	Flag to Factor HBW Trips. Note: for "HRT Version"

3.2.2 Accessing Output Files from the Application Flowchart

The files seen in the Application Flowchart, both input as well as output, can be opened by double-clicking the file box. This is the most common way of accessing files from the model catalog. The files will be opened in Cube, unless the format is not supported. Table 3.1 shows the execution order of the modules in the catalog and Section 3.2.1 (OUTPUT FILES) shows the file names.

Certain well-known file formats (DBF, text) can also be opened through Windows by right-clicking on the program input or output box and choosing "Open (Windows)" from the context menu. Opening the file in Windows will use the standard Windows viewer for the file type, typically the same viewer that opens if a file of that type is double-clicked in Windows Explorer.

Important: When opening files from the Application Flowchart or the Data Window, the user must make sure that the correct scenario is currently selected in the Scenario Window.

3.2.3 Accessing Output Files Directly from the Output Folder

Output files can also be accessed directly from the Output subfolder in the Catalog folder. *In general, it will be easier and less error-prone to open output files from the Application Flowchart or the Data Window.*

If the Output folder does not exist when the model is first installed, it is created automatically when the first scenario is run within Cube. The Output folder contains a sub-folder with the outputs of each scenario that has been run. For the Base_2009 scenario, an output folder called "Base_2009"

will be created inside the Output folder. If the Base_2009 has a child scenario called "Future_Scenario", an output directory called "Base_2009.Future_Scenario" will be created inside the Output folder. Each scenario sub-folder in the Output contains two additional sub-folders. The first is called "Logs", which contains log files for each program step. The log files can be useful when attempting to report or diagnose errors. The files in the Logs folder have the same base name as the corresponding program step (for example, the HNMAT00.PRN log file corresponds to the HNMAT00.S script file). The second sub-folder is called "Reports", which contains summaries of model performance and results in text format.

Helpful Tip: If the model does not run correctly (for example, a loaded network is not generated), the Logs folder can indicate where the failure occurred – each Log file is named after the corresponding program file and if these files are displayed in date order, the most recent Log file usually contains an error message. The user can then refer to the Application Flowchart to locate the program script (with the same name as the log file, but with a .S extension) and inspect its input files. Table 5.2 in the APPENDIX shows a list of common errors.

3.2.4 Standard Output Files

All output files produced by the model for each scenario are listed in Table 3.3, in the order in which they are produced by the application. Each table shows which application group produces the file (so it can be located in the Application Flowchart), and a brief description of what the file contains. Log files are not listed, since they correspond directly to program steps in the Application Flowchart, and are best understood when opened directly from the flowchart.

Table 3.3: Model Output Files and Report Files

File Name	File Content	Application Group	Execution Order in Catalog	Description
HR_ProcNet.net	Working Network	Highway Net	2	Network incorporating speeds, capacities and validation counts
FF_Skims.mat	Free Flow Skims	Highway Net	2	Free-flow highway skims
Truck_PA_All.dbf	Truck Trips	Trip Generation	3	Internal and External truck trips generated by purpose
Stratified_LandUse.DBF	HH Stratification as DBF	Trip Generation	3	Land Use stratified in cross-classification groups (DBF Format)
Stratified_LandUse.prn	HH Stratification as Text	Trip Generation	3	Land Use stratified (Text Format)
PK_E-E_Trips.mat	Peak E-E Trips	Trip Generation	3	Peak period External-External trip table
OP_E-E_Trips.mat	Offpeak E-E Trips	Trip Generation	3	Off-Peak period External-External trip table
PK_II.dbf	Peak I-I Trips	Trip Generation	3	Peak period internal trip ends
OP_II.dbf	Offpeak I-I Trips	Trip Generation	3	Off-Peak period internal trip ends
PkSkimSOV.mat	Peak Skims for Distribution	Highway Skims Peak	5	Highway Skims for peak trip distribution
PkHwySkims.mat	Peak Skims for Mode Choice	Highway Skims Peak	5	Highway Skims for peak mode choice
PkSkimHOV.mat	Peak Skims for HOV	Highway Skims Peak	5	Highway Skims for peak HOV
OPSkimSOV.mat	Offpeak Skims for Distribution	Highway Skims Off-Peak	16	Highway Skims for off-peak trip distribution
OpHwySkims.mat	Offpeak Skims for Mode Choice	Highway Skims Off-Peak	16	Highway Skims for off-peak mode choice
OpSkimHOV.mat	Offpeak Skims for HOV	Highway Skims Off-Peak	16	Highway Skims for off-peak HOV
EITdist_pk.mat	Peak I-E and E-I Trips	Trip Distribution	6	External-Internal Trip Table for peak period

File Name	File Content	Application Group	Execution Order in Catalog	Description
		Peak		
InitialTdist_pk.mat	Peak I-I Trips	Trip Distribution Peak	6	Internal-Internal raw gravity model output for peak period
Peak_Person_Triptable.mat	Peak I-I Trips by 0 and 1+ car/HH	Trip Distribution Peak	6	Internal-Internal person trip table by auto ownership for peak period (includes Home-Based Shopping)
EITdist_op.mat	Offpeak I-E and E-I Trips	Trip Distribution Off-Peak	17	External-Internal Trip Table for off-peak period
InitialTdist_op.mat	Offpeak I-I Trips	Trip Distribution Off-Peak	17	Internal-Internal raw gravity model output for off-peak period
Offpeak_Person_Triptable.mat	Offpeak I-I Trips by 0 and 1+ car/HH	Trip Distribution Off-Peak	17	Internal-Internal person trip table by auto ownership for off-peak period (includes Home-Based Shopping)
Truck_Trips_Pk.mat	Peak Truck Trips	Truck Distribution Peak	7	Truck trips for peak period
Truck_Trips_Op.mat	Offpeak Truck Trips	Truck Distribution Off-Peak	18	Truck trips for off-peak period
NewPkTransit.net	Peak Transit Network	Transit Skims Peak	8	Highway network with transit data for peak period
WTRNPK.MC	Peak Transit Skims Walk Access	Transit Skims Peak	8	Transit Skims for peak Walk to Transit
DTRNPK.MC	Peak Transit Skims Drive Access	Transit Skims Peak	8	Transit Skims for peak Drive to Transit
FringeSkimPK.MC	Peak Transit Skims Fringe	Transit Skims Peak	8	Skims for peak Fringe paths
WTRNPK.NET	Peak Transit PT Network, Walk Access	Transit Skims Peak	8	Walk to Transit peak Public Transport network
WTRNPK.RTE	Peak Transit PT Route File, Walk Access	Transit Skims Peak	8	Walk to Transit peak Public Transport route file
NTLEG_WKTRN.prn	Peak Non-Transit Links, Walk Access	Transit Skims Peak	8	Non-transit links in peak Walk to Transit network
DTRNPK.NET	Peak Transit PT Network, Drive Access	Transit Skims Peak	8	Drive to Transit peak Public Transport network
DTRNPK.RTE	Peak Transit PT Route File, Drive Access	Transit Skims Peak	8	Drive to Transit peak Public Transport route file
NTLEG_DRTRN.prn	Peak Non-Transit Links, Drive Access	Transit Skims Peak	8	Non-transit links in peak Drive to Transit network
FTRNPK.NET	Peak Transit PT Network, Fringe Transit	Transit Skims Peak	8	Fringe Transit peak Public Transport network
FTRNPK.RTE	Peak Transit PT Route File, Fringe Transit	Transit Skims Peak	8	Fringe Transit peak Public Transport route file
NTLEG_FRINGETRN.prn	Peak Non-Transit Links, Fringe Transit	Transit Skims Peak	8	Non-transit links in peak Fringe Transit network
FSHTPK.NET	Peak Transit PT Network, Fringe Shuttle	Transit Skims Peak	8	Fringe Shuttle peak Public Transport network
FSHTPK.RTE	Peak Transit PT Route File, Fringe Shuttle	Transit Skims Peak	8	Fringe Shuttle peak Public Transport route file
NTLEG_FRINGESHT.prn	Peak Non-Transit Links, Fringe Shuttle	Transit Skims Peak	8	Non-transit links in peak Fringe Shuttle network
FWLKPK.NET	Peak Transit PT Network, Fringe Walk	Transit Skims Peak	8	Fringe Walk peak Public Transport network
FWLKPK.RTE	Peak Transit PT Route File, Fringe Walk	Transit Skims Peak	8	Fringe Walk peak Public Transport route file
NTLEG_FRINGEWALK.prn	Peak Non-Transit Links, Fringe Walk	Transit Skims Peak	8	Non-transit links in peak Fringe Walk network

File Name	File Content	Application Group	Execution Order in Catalog	Description
NewOPTransit.net	Offpeak Transit Network	Transit Skims Off-Peak	19	Highway network with transit data for off-peak period
WTRNOP.MC	Offpeak Transit Skims Walk Access	Transit Skims Off-Peak	19	Transit Skims for off-peak Walk to Transit
DTRNOP.MC	Offpeak Transit Skims Drive Access	Transit Skims Off-Peak	19	Transit Skims for off-peak Drive to Transit
WTRNNETOP.NET	Offpeak Transit PT Network, Walk Access	Transit Skims Off-Peak	19	Walk to Transit off-peak Public Transport network
WTRNOP.RTE	Offpeak Transit PT Route File, Walk Access	Transit Skims Off-Peak	19	Walk to Transit off-peak Public Transport route file
NTLEG_WKTRNOP.prn	Offpeak Non-Transit Links, Walk Access	Transit Skims Off-Peak	19	Non-transit links in off-peak Walk to Transit network
DTRNNETOP.NET	Offpeak Transit PT Network, Drive Access	Transit Skims Off-Peak	19	Drive to Transit off-peak Public Transport network
DTRNOP.RTE	Offpeak Transit PT Route File, Drive Access	Transit Skims Off-Peak	19	Drive to Transit off-peak Public Transport route file
NTLEG_DTRNOP.prn	Offpeak Non-Transit Links, Drive Access	Transit Skims Off-Peak	19	Non-transit links in off-peak Drive to Transit network
HBWOUT_PK.DAT	Peak HBW Mode Choice Output	Mode Choice Peak	9	Home Based Work person trips by mode for peak period
UB_HBW_0_PK.DAT	Peak User Benefit File for 0 car/HH, HBW	Mode Choice Peak	9	FTA Summit User Benefit matrix for HBW 0 Car peak
UB_HBW_1_PK.DAT	Peak User Benefit File for 1+ car/HH, HBW	Mode Choice Peak	9	FTA Summit User Benefit matrix for HBW 1+ Car peak
HBOOUT_PK.DAT	Peak HBO Mode Choice Output	Mode Choice Peak	9	Home Based Other person trips by mode for peak period
UB_HBO_0_PK.DAT	Peak User Benefit File for 0 car/HH, HBO	Mode Choice Peak	9	FTA Summit User Benefit matrix for HBO 0 Car peak
UB_HBO_1_PK.DAT	Peak User Benefit File for 1+ car/HH, HBO	Mode Choice Peak	9	FTA Summit User Benefit matrix for HBO 1+ Car peak
NHBOUT_PK.DAT	Peak NHB Mode Choice Output	Mode Choice Peak	9	Non Home Based person trips by mode for peak period
UB_NHB_PK.DAT	Peak User Benefit File for NHB	Mode Choice Peak	9	FTA Summit User Benefit matrix for NHB peak
UB_HBW_0_PK.BEN	Peak User Benefit Binary File for 0 car/HH, HBW	Mode Choice Peak	9	FTA Summit User Benefit binary file for HBW 0 Car peak
UB_HBW_1_PK.BEN	Peak User Benefit Binary File for 1+ car/HH, HBW	Mode Choice Peak	9	FTA Summit User Benefit binary file for HBW 1+ Car peak
UB_HBO_0_PK.BEN	Peak User Benefit Binary File for 0 car/HH, HBO	Mode Choice Peak	9	FTA Summit User Benefit binary file for HBO 0 Car peak
UB_HBO_1_PK.BEN	Peak User Benefit Binary File for 1+ car/HH, HBO	Mode Choice Peak	9	FTA Summit User Benefit binary file for HBO 1+ Car peak
UB_NHB_All_PK.BEN	Peak User Benefit Binary File for NHB	Mode Choice Peak	9	FTA Summit User Benefit binary file for NHB peak
HBWOUT_OP.DAT	OffPeak HBW Mode Choice Output	Mode Choice Off-Peak	20	Home Based Work person trips by mode for off-peak period
UB_HBW_0_OP.DAT	OffPeak User Benefit File for 0 car/HH, HBW	Mode Choice Off-Peak	20	FTA Summit User Benefit matrix for HBW 0 Car off-peak
UB_HBW_1_OP.DAT	OffPeak User Benefit File for 1+ car/HH, HBW	Mode Choice Off-Peak	20	FTA Summit User Benefit matrix for HBW 1+ Car off-peak
HBOOUT_OP.DAT	OffPeak HBO Mode Choice Output	Mode Choice Off-Peak	20	Home Based Other person trips by mode for off-peak period

File Name	File Content	Application Group	Execution Order in Catalog	Description
UB_HBO_0_OP.DAT	OffPeak User Benefit File for 0 car/HH, HBO	Mode Choice Off-Peak	20	FTA Summit User Benefit matrix for HBO 0 Car off-peak
UB_HBO_1_OP.DAT	OffPeak User Benefit File for 1+ car/HH, HBO	Mode Choice Off-Peak	20	FTA Summit User Benefit matrix for HBO 1+ Car off-peak
NHBOUT_OP.DAT	OffPeak NHB Mode Choice Output	Mode Choice Off-Peak	20	Non Home Based person trips by mode for off-peak period
UB_NHB_OP.DAT	OffPeak User Benefit File for NHB	Mode Choice Off-Peak	20	FTA Summit User Benefit matrix for NHB off-peak
UB_HBW_0_OP.BEN	OffPeak User Benefit Binary File for 0 car/HH, HBW	Mode Choice Off-Peak	20	FTA Summit User Benefit binary file for HBW 0 Car off-peak
UB_HBW_1_OP.BEN	OffPeak User Benefit Binary File for 1+ car/HH, HBW	Mode Choice Off-Peak	20	FTA Summit User Benefit binary file for HBW 1+ Car off-peak
UB_HBO_0_OP.BEN	OffPeak User Benefit Binary File for 0 car/HH, HBO	Mode Choice Off-Peak	20	FTA Summit User Benefit binary file for HBO 0 Car off-peak
UB_HBO_1_OP.BEN	OffPeak User Benefit Binary File for 1+ car/HH, HBO	Mode Choice Off-Peak	20	FTA Summit User Benefit binary file for HBO 1+ Car off-peak
UB_NHB_All_OP.BEN	OffPeak User Benefit Binary File for NHB	Mode Choice Off-Peak	20	FTA Summit User Benefit binary file for NHB off-peak
VisitorTrips.MAT	Visitor Trips (from old model) in PA format	AQ Adjustments	10	Extra summer weekday trips(P/A)
ODVisitorTrips.MAT	Visitor Trips (from old model) in OD format	AQ Adjustments	10	Extra summer weekday trips (O/D)
HBW_AM_PK.mat	AM HBW Trips	Time of Day Peak	11	HBW trips for AM peak period
HBW_PM_PK.mat	PM HBW Trips	Time of Day Peak	11	HBW trips for PM peak period
HBO_AM_PK.mat	AM HBO Trips	Time of Day Peak	11	HBO trips for AM peak period
HBO_PM_PK.mat	PM HBO Trips	Time of Day Peak	11	HBO trips for PM peak period
NHB_AM_PK.mat	AM NHB Trips	Time of Day Peak	11	NHB trips for AM peak period
NHB_PM_PK.mat	PM NHB Trips	Time of Day Peak	11	NHB trips for PM peak period
AM_PK_E-E_TRIPS.mat	AM E-E Trips	Time of Day Peak	11	E-E trips for AM peak period
AM_PK_ODVisitorTrips.mat	AM Visitor OD Trips	Time of Day Peak	11	Visitor trips for AM peak period
EITdist_pk_AM.mat	AM E-I Trips	Time of Day Peak	11	E-I trips for AM peak period
Truck_Trips_AM_pk.mat	AM Truck Trips	Time of Day Peak	11	Truck trips for AM peak period
PM_PK_E-E_TRIPS.mat	PM E-E Trips	Time of Day Peak	11	E-E trips for PM peak period
PM_PK_ODVisitorTrips.mat	PM Visitor OD Trips	Time of Day Peak	11	Visitor trips for PM peak period
EITdist_pk_PM.mat	PM E-I Trips	Time of Day Peak	11	E-I trips for PM peak period
Truck_Trips_PM_pk.mat	PM Truck Trips	Time of Day Peak	11	Truck trips for PM peak period
HBW_MD_OP.mat	Midday HBW Trips	Time of Day Off-Peak	21	HBW trips for MD off-peak period
HBW_NT_OP.mat	Night HBW Trips	Time of Day Off-Peak	21	HBW trips for NT off-peak period
HBO_MD_OP.mat	Midday HBO Trips	Time of Day Off-Peak	21	HBO trips for MD off-peak period
HBO_NT_OP.mat	Night HBO Trips	Time of Day Off-Peak	21	HBO trips for NT off-peak period

File Name	File Content	Application Group	Execution Order in Catalog	Description
NHB_MD_OP.mat	Midday NHB Trips	Time of Day Off-Peak	21	NHB trips for MD off-peak period
NHB_NT_OP.mat	Night NHB Trips	Time of Day Off-Peak	21	NHB trips for NT off-peak period
MD_OP_E-E_TRIPS.mat	Midday E-E Trips	Time of Day Off-Peak	21	E-E trips for MD off-peak period
MD_OP_ODVisitorTrips.mat	Midday Visitor OD Trips	Time of Day Off-Peak	21	Visitor trips for MD off-peak period
EITdist_op_MD.mat	Midday E-I Trips	Time of Day Off-Peak	21	E-I trips for MD off-peak period
Truck_Trips_MD_op.mat	Midday Truck Trips	Time of Day Off-Peak	21	Truck trips for MD off-peak period
NT_OP_E-E_TRIPS.mat	Night E-E Trips	Time of Day Off-Peak	21	E-E trips for NT off-peak period
NT_OP_ODVisitorTrips.mat	Night Visitor OD Trips	Time of Day Off-Peak	21	Visitor trips for NT off-peak period
EITdist_op_NT.mat	Night E-I Trips	Time of Day Off-Peak	21	E-I trips for NT off-peak period
Truck_Trips_NT_op.mat	Night Truck Trips	Time of Day Off-Peak	21	Truck trips for NT off-peak period
AM_PK_Final_TripTable.dat	AM Highway Trip Table	AM Peak Highway Assignment	12	Total AM peak vehicle trips in the model region (O/D Format)
AM_PK_Final_TripTable_VOT_TMP.dat	AM Highway Trip Table by VOT	AM Peak Highway Assignment	12	Vehicle trips by value of time buckets assigned to the highway network (O/D Format)
AM_PK_FDBKNET.net	AM Loaded Network	AM Peak Highway Assignment	12	Loaded network for {Alternative}
AM_PK_Feedback.net	AM Feedback Network	AM Peak Highway Assignment	12	Feedback highway network to be used in the next feedback iteration
AM_PK_SCREENLINES.dbf	AM Screenline Vol/Count as DBF	AM Peak Highway Assignment	12	Volumes for all Screenline links for AM peak period
AM_PK_SCREENLINES.prn	AM Screenline Vol/Count as Text	AM Peak Highway Assignment	12	Summary of counts and assigned volumes for AM peak period
PM_PK_Final_TripTable.dat	PM Highway Trip Table	PM Peak Highway Assignment	13	Total PM peak vehicle trips in the model region (O/D Format)
PM_PK_Final_TripTable_VOT_TMP.dat	PM Highway Trip Table by VOT	PM Peak Highway Assignment	13	Vehicle trips by value of time buckets assigned to the highway network (O/D Format)
PM_PK_FDBKNET.net	PM Loaded Network	PM Peak Highway Assignment	13	Loaded network for {Alternative}
PM_PK_Feedback.net	PM Feedback Network	PM Peak Highway Assignment	13	Feedback highway network to be used in the next feedback iteration
PM_PK_SCREENLINES.dbf	PM Screenline Vol/Count as DBF	PM Peak Highway Assignment	13	Volumes for all Screenline links for PM peak period
PM_PK_SCREENLINES.prn	PM Screenline Vol/Count as Text	PM Peak Highway Assignment	13	Summary of counts and assigned volumes for PM peak period
MD_OP_Final_TripTable.dat	Midday Highway Trip Table	MD Off-Peak Highway Assignment	22	Total MD off-peak vehicle trips in the model region (O/D Format)
MD_OP_Final_TripTable_VOT_TMP.dat	Midday M Highway Trip Table by VOT	MD Off-Peak Highway Assignment	22	Vehicle trips by value of time buckets assigned to the highway network (O/D Format)
MD_OP_FDBKNET.net	Midday Loaded Network	MD Off-Peak Highway Assignment	22	Loaded network for {Alternative}
MD_OP_Feedback.net	Midday Feedback	MD Off-Peak	22	Feedback highway network to be used in the

File Name	File Content	Application Group	Execution Order in Catalog	Description
	Network	Highway Assignment		next feedback iteration
MD_OP_SCREENLINES.dbf	Midday Screenline Vol/Count as DBF	MD Off-Peak Highway Assignment	22	Volumes for all Screenline links for MD off-peak period
MD_OP_SCREENLINES.prn	Midday Screenline Vol/Count as Text	MD Off-Peak Highway Assignment	22	Summary of counts and assigned volumes for MD off-peak period
NT_OP_Final_TripTable.dat	Night Highway Trip Table	NT Off-Peak Highway Assignment	23	Total NT off-peak vehicle trips in the model region (O/D Format)
NT_OP_Final_TripTable_VOT_TMP.dat	Night M Highway Trip Table by VOT	NT Off-Peak Highway Assignment	23	Vehicle trips by value of time buckets assigned to the highway network (O/D Format)
NT_OP_FDBKNET.net	Night Loaded Network	NT Off-Peak Highway Assignment	23	Loaded network for {Alternative}
NT_OP_Feedback.net	Night Feedback Network	NT Off-Peak Highway Assignment	23	Feedback highway network to be used in the next feedback iteration
NT_OP_SCREENLINES.dbf	Night Screenline Vol/Count as DBF	NT Off-Peak Highway Assignment	23	Volumes for all Screenline links for NT off-peak period
NT_OP_SCREENLINES.prn	Night Screenline Vol/Count as Text	NT Off-Peak Highway Assignment	23	Summary of counts and assigned volumes for NT off-peak period
BusTrips.dat	Peak Transit Trip Matrix	Transit Assignment Peak	25	Total peak period transit person trips (P/A format)
LINKWPK.dbf	Peak Transit Assignment, Walk Access	Transit Assignment Peak	25	Loaded transit links for Walk to Transit Peak
LINKDPK.dbf	Peak Transit Assignment, Drive Access	Transit Assignment Peak	25	Loaded transit links for Drive to Transit Peak
LINKFTRNPK.dbf	Peak Transit Assignment, Fringe Transit	Transit Assignment Peak	25	Loaded transit links for Fringe Transit Peak
LINKFSHTPK.dbf	Peak Transit Assignment, Fringe Shuttle	Transit Assignment Peak	25	Loaded transit links for Fringe Shuttle Peak
LINKFWLKPK.dbf	Peak Transit Assignment, Fringe Walk	Transit Assignment Peak	25	Loaded transit links for Fringe Walk Peak
OP_BusTrips.dat	Offpeak Transit Trip Matrix	Transit Assignment Off-Peak	26	Total off-peak period transit person trips (P/A format)
LINKWOP.dbf	Offpeak Transit Assignment, Walk Access	Transit Assignment Off-Peak	26	Loaded transit links for Walk to Transit Off-Peak
LINKDOP.dbf	Offpeak Transit Assignment, Drive Access	Transit Assignment Off-Peak	26	Loaded transit links for Drive to Transit Off-Peak
AllDay_LoadedNet.net	Loaded Highway Network, All Day	All Day Highway Summary	26	Highway network with summary of all four period highway assignment results
HANET00C.prn	Highway Summary, RMSE, Vol/Count	All Day Highway Summary	27	Various Crosstabs of daily highway assignment volumes including RMSE, Volume/Count etc.
HANET00D.prn	Highway Summary, R-Square	All Day Highway Summary	27	R-Square for daily assignment results compared to validation year counts
HANET00I.prn	Truck Summary, RMSE, Vol/Count	All Day Highway Summary	27	R-Square for daily assignment of trucks
HANET00G.prn	Truck Summary, R-Square	All Day Highway Summary	27	Various Crosstabs of daily truck assignment including RMSE, Volume/Count etc.

3.3 Interpreting the Loaded Networks and Other Model Results

The Loaded Networks by AM, PM, Midday and Night periods are the most frequently used output network files. The fields in these networks are detailed in Table 3.4 (Refer the APPENDIX for rules on coding the network attributes). Following the table, suggestions for interpreting the model results are presented.

The "Source" column in the table has the following possible entries:

- Scenario – indicates that the attribute is supplied with the Master Network.
- Output – indicates that the attribute is generated by the model.

Table 3.4: Attributes in the Loaded Network

Field	Source	Description
A	Scenario	Node from which flow on this link departs
B	Scenario	Node to which flow on this link travels
ZN	Output	TAZ associated with the link
LENGTH	Scenario	Straight line distance between A and B nodes
JURIS_NO	Scenario	City/County Jurisdiction Number
POST_SPD	Scenario	Posted Speed limit on the link if available
MPO_ID	Scenario	"HR" for all links in the Hampton Roads highway network
FACTYPE	Scenario	Facility Type of the link. This attribute is scenario specific
TRK_PHB	Scenario	0 = Trucks allowed on the link 1 = Trucks are prohibited on the link
AREATYPE	Output	Area Type calculated using land use. This attribute is scenario specific
TOLL_GRP	Scenario	1 = George P. Coleman Bridge (Northbound) 2 = Chesapeake Expressway X = index for other scenario specific toll facilities coded in the network. Note that Toll.txt input file needs to be in sync with this field coding. This is scenario specific
AWDT	Scenario	Average Weekday Daily Traffic for validation year (2009)
RTE_NO	Scenario	Official State highway route # (Federal Aid number)
FEDFUNC	Scenario	Federal Functional Class
FEDAT	Scenario	Federal Area Type
LINK_CAP	Scenario	Link Capacity in vehicles/lane/hour if known
SPDCLASS	Output	Combination of Facility Type and Area Type computed in Highway Net Step
CAPCLASS	Output	Combination of Facility Type and Area Type computed in Highway Net Step
TMS_ID	Scenario	TMS Count Station ID if available
DISTANCE	Scenario	True Shape highway link distance
TWLTL	Scenario	Two Way Left Turn Lane indicator
RTE_NAME	Scenario	Local Street Name (911)
PROJ_ID	Scenario	Project ID used by VDOT and/or MPO
YR_OPEN	Scenario	Estimated year highway project open for traffic
YR_CLOSE	Scenario	Estimated year highway project closed to traffic
SCRLN_ID	Scenario	Screenline Identifier

Field	Source	Description
CORD_ID	Scenario	Cordon Line Identifier
CUTLN_ID	Scenario	Cutline Identifier
RTE_ID	Scenario	HTRIS Route ID
BEGIN_MP	Scenario	Beginning Milepoint of a link
END_MP	Scenario	Ending Milepoint of a link
TOLLGATE	Scenario	Toll gate Group representing delay at toll barrier. This is scenario specific
LANES	Scenario	Number of directional through lanes. This is scenario specific
HOVTYPE	Scenario	HOV Type Identifier. This is scenario specific
ONEWAY	Scenario	Directionality Indicator
COUNTY	Output	County the link exists in
R_AREATYPE	Scenario	Area Type that can be manually coded by the user
R_FFLOWSPEED	Scenario	Free flow speed that can be manually coded by the user
R_LINK_CAP	Scenario	Link capacity that can be manually coded by the user
COUNTAM	Output	Year 2009 AWDT for AM Peak Period
COUNTMD	Output	Year 2009 AWDT for Midday Period
COUNTPM	Output	Year 2009 AWDT for PM Peak Period
COUNTNT	Output	Year 2009 AWDT for Overnight Period
FFLOWSPEED	Output	Freeflow Speed on the link
FFTIME	Output	Freeflow time calculated using freeflow speed and distance
FDBKTIME	Output	Congested time from the highway assignment
FDBKVOL	Output	Volume from the highway assignment
VMTAM	Output	VMT calculated for AM Peak Period
VMTMD	Output	VMT calculated for Midday Period
VMTPM	Output	VMT calculated for PM Peak Period
VMTNT	Output	VMT calculated for Overnight Period
VOLDIFF	Output	Difference in link volumes between two successive feedback iterations
V_1	Output	Total one-way vehicle volume (Note that this volume has PCEs for trucks)
TIME_1	Output	Congested travel time
VC_1	Output	V_1/C for the link.
CSPD_1	Output	Congested speed in MPH, computed from DISTANCE and TIME_1
VDT_1	Output	Vehicle miles traveled, computed from DISTANCE and V_1
VHT_1	Output	Vehicle hours traveled, computed from DISTANCE and TIME_1, in **hours**
V1_1	Output	Average Weekday SOV Vehicle Trips
V2_1	Output	Average Weekday HOV2 Vehicle Trips
V3_1	Output	Average Weekday HOV3+ Vehicle Trips
V4_1	Output	Average Weekday Truck Vehicle Trips
VT_1	Output	Total bi-directional vehicle trips
V1T_1	Output	Bi-directional - Average Weekday SOV Vehicle Trips
V2T_1	Output	Bi-directional - Average Weekday HOV2 Vehicle Trips
V3T_1	Output	Bi-directional - Average Weekday HOV3+ Vehicle Trips
V4T_1	Output	Bi-directional - Average Weekday Truck Vehicle Trips (VOT bucket 1)

3.4 All Day Loaded Network

The loaded networks from AM, PM, Midday and Night highway assignment are combined to generate All Day Loaded network which is used to compute daily statistics and generate summary reports. The attributes of this network are summarized in the following table

3.5 Interpreting Model Results

A reporting application automatically produces reports and maps for Hampton Roads model. Before running the model, users have an option to either create the automatic reports and maps or not by populating a catalog key. The key accepts two numbers either 1 or 0 where:

- Key value =1: Users **wants** to produce the reports and maps
- Key value =0: User **does not want** to produce the reports and maps.

Another key – *Base Year Run* is used to determine whether to produce the validation statistic block of the application or not. Like before this key accepts two values 1 and 0 where:

- Key value =1: Users **wants** produce validation statistics
- Key value =0: User **does not want** produce validation statistics.

Please note that users cannot run the validation reports for future years so the key value for future scenario should always be equal to zero, else the application will fail.

Application Inputs

Major inputs to the reporting application are either referenced to the files produced earlier in the model run or provided by the users. Each input file is explained in Table 3.5 below.

Table 3.5: Summary and Reporting Application Inputs

File Name	Description	Source Application
Referenced from Model Outputs (User input not required)		
AUTO_PA_inc_IE.DBF	Productions and Attractions for all zones	Trip Generation
AllDay_LoadedNetwork.NET	Loaded Highway Network	All Day Highway Assignment
HBWOUT_PK.DAT	Peak HBW trips Matrix	Time of Day PK
HBOOUT_PK.DAT	Peak HBO trips Matrix	Time of Day PK
NHBOUT_PK.DAT	Peak NHB trips Matrix	Time of Day PK
HBWOUT_OP.DAT	Off Peak HBW trips Matrix	Time of Day OP
HBOOUT_OP.DAT	Off Peak HBO trips Matrix	Time of Day OP
NHBOUT_OP.DAT	Off Peak NHB trips Matrix	Time of Day OP
AM_Pk_Final_TripTable.DAT	AM peak final trip table	AM PK Highway Assignment
PM_Pk_Final_TripTable.DAT	PM peak final trip table	PM PK Highway Assignment
Md_OP_Final_TripTable.DAT	MB off peak final trip table	Mid-Day OP Highway Assignment
Nt_OP_Final_TripTable.DAT	NT off peak final trip table	Night OP Highway

		Assignment
DistMatrix_PK.MAT	Summary of trips by district	Trip Distribution PK
DistMatrix_OP.MAT	Summary of trips by district	Trip Distribution OP
LINKWPK.DBF	Peak Walk to Transit Trips	Transit Assignment PK
LINKDPK.DBF	Peak Drive to Transit Trips	Transit Assignment PK
LINKWOP.DBF	Off Peak Walk to Transit Trips	Transit Assignment OP
LINKDOP.DBF	Off Peak Drive to Transit Trips	Transit Assignment OP
LINKFTRNPK.DBF	Peak Fringe walk trips	Transit Assignment PK
LINKFSHTPK.DBF	Peak Fringe shuttle trips	Transit Assignment PK
PkHwySkims.MAT	Peak Highway Skims	Highway Skims PK
OPHwySkims.MAT	Off Peak Highway Skims	Highway Skims OP
Dist_Number.dbf	List of districts and corresponding numbers	Reports
CONGESTION_PARAMETERS.dbf	Parameters to define congestion parameters	Reports

Dist_Number.dbf: stores the district numbers and corresponding district names. Users should modify this file if the district numbering for the model area changes.

CONGESTION_PARAMETERS.dbf: stores the congestion parameters used to determine the congested links in the model. The volume to count ratio value is stored separately for freeway and other roads. Users can modify the value if needed.

Application Outputs

The application generates multiple output files, which are then referenced to create cube reports and ArcGIS maps. Users can access these scenario specific reports and maps via the data section in Cube catalog. Reports are stored under the "Reports" folder. ArcGIS maps are stored under the "Output→ Maps" folder. To open the files, first highlight the scenario and then double-click on the report or map to open it. The outputs generated a summarized below:

1. Maps
    - Volume.mxd – Traffic Volume bandwidth map
    - AM Volume.mxd – AM traffic volume bandwidth map
    - PM Volume.mxd – PM traffic volume bandwidth map
    - MD Volume.mxd – MD traffic volume bandwidth map
    - NT Volume.mxd – NT traffic volume bandwidth map
    - AM Screenline VC.mxd – map showing the AM screenline volume to count
    - PM Screenline VC.mxd – map showing the PM screenline volume to count
    - MD Screenline VC.mxd – map showing the MD screenline volume to count
    - NT Screenline VC.mxd – **m**ap showing the NT screenline volume to count
    - Congestion.mxd – map showing the congestion level on each road
    - HBW Trip Productions.mxd –Home Based Work trip productions for each TAZ
    - HBO Trip Productions.mxd –Home Based Other trip productions for each TAZ
    - NHB Trip Productions.mxd –Non Home Based trip productions for each TAZ

- HBS Trip Productions.mxd – Home Based Shop trip productions for each TAZ
- Transit OP.mxd – OP transit volume bandwidth
- Transit PK.mxd – PK transit volume bandwidth

2. Reports
    - Landuse.rep
        - Table - Land Use summary
        - Table - Trip Production by Jurisdiction
        - Table - Trip Attraction by Jurisdiction
    - Trip P and A.rep
        - Pie Chart - Trip Production by purpose
        - Table – Trip Production by purpose and jurisdiction
        - Pie Chart - Trip Attraction by purpose
        - Table – Trip Attraction by purpose and jurisdiction
    - Daily Trip Generation Summary.rep – All pie charts
        - Daily Trip Production by Purpose – Model Area, all jurisdictions and external stn
        - Daily Trip Attraction by Purpose – Model Area, all jurisdictions and external stn
    - Trip Length Frequency.rep
        - Bar Graph - Trip Length Frequency for Home Based Work (peak and off peak)
        - Bar Graph - Trip Length Frequency for Home Based Other (peak and off peak)
        - Bar Graph - Trip Length Frequency for Non Home Based (peak and off peak)
        - Table- Trip Length Frequency by purpose (peak and off peak)
    - Trip Summary.rep
        - Table – Trip summary (Travel Time and Trip Distance) for Model Region
    - VMT.rep
        - Cross classification Table – free VMT by Jurisdiction, Facility Type and Area Type
    - VMT Congested.rep
        - Cross classification Table – Congested VMT by Jurisdiction, Facility Type and Congestion level
    - VHT.rep
        - Cross classification Table – free VHT by Jurisdiction, Facility Type and Area Type
    - VHT Congested.rep
        - Cross classification Table – Congested VHT by Jurisdiction, Facility Type and Congestion level
    - Speed.rep
        - Cross classification Table – Average free flow speed by Jurisdiction, Facility Type and Area Type

- Congested Speed.rep
  - Cross classification Table – Congested Speed by Jurisdiction, Facility Type and Area Type
- Trips.rep
  - Table – Person and Vehicle Trips per capita
- RMSE.rep
  - Table – RMSE
  - Table – Volume to Count Ratio by Facility Type
  - Table – Volume to Count Ratio by Area Type
- AQ.rep
  - Pie Chat – VMT distribution by jurisdiction
  - Table – VMT distribution by jurisdiction
  - Bar chart – average congested speed by jurisdiction
  - Table – average congested speed by jurisdiction
  - Bar chart – change in average free flow speed by jurisdiction
  - Table – change in average free flow speed by jurisdiction
- Corridor.rep
  - Table – total volume for all corridors by TOD
  - Table - average contested speed for all corridors by TOD
- District to District trips.rep
  - Cross classification table – HBW district to district trips (peak and off peak)
  - Cross classification table – HBO district to district trips (peak and off peak)
  - Cross classification table – NHB district to district trips (peak and off peak)
  - Cross classification table – HBS district to district trips (peak and off peak)
  - Cross classification table – All purposes district to district trips (peak and off peak)
- District to District Truck Trips.rep
  - Cross classification table – district to district truck trips (peak and off peak)
- HOV.rep
  - Table – total volume for all HOV facilities by TOD
  - Table - average contested speed for all HOV facilities by TOD
  - Table – volume to capacity ratio for all HOV facilities by TOD
- Mode Choice.rep
  - Table – Peak Mode distribution and statistics by purpose
  - Table – Off Peak Mode distribution and statistics by purpose
  - Pie chart - HBW mode split (peak and off peak)
  - Pie chart - HBO mode split (peak and off peak)
  - Pie chart - NHB mode split (peak and off peak)
- Transit.rep
  - Table- Peak period transit route summary
  - Table- Off Peak period transit route summary
- Trips by Jurisdiction.rep

- Pie chart – HBW trip productions by jurisdiction
- Pie chart – HBW trip attractions by jurisdiction
- Pie chart – HBO trip productions by jurisdiction
- Pie chart – HBO trip attractions by jurisdiction
- Pie chart – NHB trip productions by jurisdiction
- Pie chart – NHB trip attractions by jurisdiction
- Pie chart – HBS trip productions by jurisdiction
- Pie chart – HBS trip attractions by jurisdiction

4 Constructing New Scenarios

Preparing a new scenario is a straightforward procedure in Cube. To specify a new scenario, the user must supply suitable land use files, a master highway network, suitable transit files, and other relevant input files. The input files distributed with the model will typically support some portion of the future network. As of this writing, this model has not yet been applied to air quality analysis.

4.1 Creating a Cube Scenario

To create a new scenario, select an existing scenario in the Scenario Window, right click, and choose "Create Child". Note that 'Base_2009' is the only scenario available in the current model distribution, and initial scenarios will be children of the Base scenario. A child scenario also initially shares all its parameters with its parent. When the new scenario is created, Cube will make a new sub-folder below the parent folder under the "Base" hierarchy – this folder will contain the input files for the scenario, and all changes to the input files that are required for the scenario will be stored in these folders. In addition to making an input folder, Cube will copy key files from the parent scenario into the new child scenario input folder. Due to this behavior, each new scenario will start out with the same files and setup as its parent. By changing file names and file contents in the child's input folder, the scenario can be fully specified. The Base_2009 scenario has input files that are saved in "Base_2009" and in "Calibration Constants" directories. The child scenario will have all these input files from the Base_2009 scenario. The input files in Calibration Constants are the validation files and it is recommended that they be kept the same for the future year scenarios. However, the input files from Base_2009 directory may be changed for the future year scenarios (example: transit schedules, turning penalties etc).

The remainder of this section describes how to set up input files for a new scenario using the Scenario Edit/Run dialog in Cube, and how to inspect those files.

4.2 Description of Input Files

The input files in the model are already described in Section 3.2.1. The input files included in the base scenario folder ("Base_2009") and necessary to define a new scenario are listed in Table 4.1.

Table 4.1: Contents of the Base Scenario Folder to be Updated for New Scenarios

Filename	Description
HR_Highway_Master	Master Network used in the model
LandUse_2009.dbf	Land Use: Landuse Data
MC_ZoneData.dbf	Land Use: Zonal Data for Mode Choice Program
Transit.lin	Transit: Base Year Transit Lines
Fare.lin	Transit: Base Year Transit Fare File
PNR.lin	Transit: Base Year Park and Ride Locations
TurnPenalties.dat	Other Files: Turn Penalty File
FringeLot.lin	Fringe Parking Locations
WalkTrn.fac	Walk to Transit PT Factor File
DriveTrn.fac	Drive to Transit PT Factor File
FringeTrn.fac	Fringe-Transit PT Factor File
FringeShut.fac	Fringe-Shuttle PT Factor File
FringeWalk.fac	Fringe-Walk PT Factor File
Extsta.dbf	External Station Counts
TruckZones.dbf	Truck Zones
Following 4 files are base year congested skims used for the 1st iteration in base year run. If the user has congested skims for the future year, then they can use them with these file names. If not, continue using these base year skims files.	
FBCongTimeSOV_Pk_Iter0.mat	Peak Congested Time for Iter 1 Feedback Loop.
FBCongTimeSOV_OP_Iter0.mat	OP Congested Time for Iter 1 Feedback Loop
FBCongTimeSOVMC_Pk_Iter0.mat	Peak Congested Time for Iter 1 Feedback Loop for Mode Choice
FBCongTimeSOVMC_OP_Iter0.mat	OP Congested Time for Iter 1 Feedback Loop for Mode Choice

4.2.1 Land Use File and Zone Data File for Mode Choice

Land Use File

2009 Land use file for this model has been developed by the Hampton Roads Transportation Planning Organization (HRTPO). Typically, land use forecasts are prepared for a horizon year with attributes for each zone in the model (for a description of the zone structure, see the Hampton Roads Methodology Report). Intermediate year values are computed by linear interpolation of each zone between base year and horizon year. The land use file is in dBase IV format with the fields shown in Table 4.2. All fields are numeric and of a width sufficient to accommodate the actual data.

Table 4.2: Primary Land Use File Attributes

Name	Description
ZONE	Zone Number
POP	Total Population
AUTOS	Automobiles registered in this zone
HH	Households
TOTEMP	Total employment in this zone
RETEMP	Retail employment in this zone
NRETEMP	Non-Retail employment in this zone
AVGAUTO	Average Autos per Household
AREA	Zone area in acres
COUNTY	County of each zone
NAICS_XX	NAICS Employment Group with NAICS code 'XX' described in Table 4.3 for Truck model.

Table 4.3: NAICS Employment Group Classifications

NAICS Employment Group	NAICS Code	Retail	Office	Industrial	Other
Agriculture, Forestry, Fisheries	11	0%	0%	100%	0%
Mining	21	0%	0%	100%	0%
Communications, Utilities	22	10%	10%	70%	10%
Construction	23	0%	10%	90%	0%
Manufacturing	31,32,33	0%	10%	80%	10%
Wholesale Trade	42	40%	10%	20%	30%
Retail Trade	44,45	90%	10%	0%	0%
Transportation	48,49	5%	15%	50%	30%
Information	51	0%	60%	10%	30%
Finance, Insurance, Real Estate	52	0%	100%	0%	0%
Finance, Insurance, Real Estate	53	0%	100%	0%	0%
Other Professional & Related Services	54	0%	90%	0%	10%
Finance, Insurance, Real Estate	55	0%	100%	0%	0%
Administration & Support	56	30%	30%	10%	30%
Educational Services	61	0%	20%	0%	80%
Health Services	62	30%	30%	10%	30%
Entertainment, Recreation	71	30%	10%	0%	60%
Personal Services	72	40%	30%	10%	20%
Personal Services	81	40%	30%	10%	20%
Public Administration	92	10%	40%	20%	30%
Unknown	99	0%	0%	0%	100%

The field TOTEMP (total employment) is redundant, and should always be the sum of RETEMP (Retail Employment) and NRETEMP (Non-Retail Employment). The redundancy is maintained to facilitate zonal data reports. For the purposes of the truck model, non-retail employment is further split into three categories: Industrial, Office and Other employment using North American Industrial Classification System (NAICS) data provided by VDOT and the percentage splits shown in Table 4.3.

Zone Data File for Mode Choice

In addition to the land use file in dBase IV format, a secondary DBF file with the zonal data is maintained for use in the mode choice program. The secondary file contains the fields shown in Table 4.4. All fields are numeric and of a width sufficient to accommodate the actual data. This file was created to keep the input additional information required by the mode choice program separate from all other land use data. The terminal time values are updated with information from the calibration file "TerminalTimes.dbf" after area type procedure calculates zonal area type using land use data. The terminal time attributes for each zone (TTO and TTD) reflect modal access times for trips originating in and destined to the zone, respectively.

Table 4.4: Attributes in Mode Choice Input File

Name	Description
ZONE	Zone Number
TTO	Terminal Time for trips originating in the zone
TTD	Terminal Time for trips destined to the zone
PCOST	Destination Parking Cost

4.2.2 Master Highway Network

The Master network is a highway network for the base year as well as future planned projects. The base year network was developed by VDOT and planned projects for future years were added by HRTPO and VDOT. The model extracts the alternative specific base highway network and user specified changes required for a scenario from the Master network during the model run. The Master network is available in the input folder (e.g. "Base_2009") of any scenario and is the same for all scenarios.

The HRTPO, in conjunction with VDOT coded planned projects from the 2034 LRTP for incorporation into the master network. As per VDOT Policy and Procedure Manual, standard attributes (listed in Methodology Report) are maintained in the Master network. In addition to the standard attributes, HRTPO has also defined alternative or project specific attributes (eg: standard attribute LANES and scenario specific LANES34). These additional attributes are useful for running specific alternatives defined through the Master network. The scenario specific highway network is extracted using the "Alternative" and "Project" names defined in the catalog keys. A flag variable (NETxx) is included in the Master network to identify the Alternative. For example, Base_2009 scenario is defined by attribute NET09=1. The user should note that the scripts developed for running the model are compatible with the standard attribute names. Hence, the attributes extracted for a specific alternative base network will have standard names for the link attributes during model process. Table 5.1in Appendix provides detailed listing and coding rules for attributes in master network.

The user has an option to manually enter the values for area type, free flow speed and link capacity on the links through R_AREATYPExx, R_FFLOWSPEEDxx and R_LINK_CAPxx attributes in the master network.

Important: Note that the user is responsible for manually coding the area type = 1 for CBD in the master network through "R_AREATYPE" attribute.

The Master network also includes the transit only links and nodes to facilitate the transit line coding and incorporate fixed guideway transit system (e.g. LRT) as explained in the following section. As explained in Table 5.1, the properties for these links are defined using the attributes LINKFLAG and R_FFLOWSPEED and the highway movements are restricted using the attribute HOVTYPE.

4.2.3 Transit Files

Transit routes and other transit information as operated and/or provided by Hampton Roads Transit (HRT), Williamsburg Area Transit Authority (WATA) and HRTPO are encoded in a single transit line file, and in supplemental files describing transit fare policy, walk links from centroids to bus stops, and park-and-ride links from centroids to park-and-ride facilities.

The transit routes operated by HRT and WATA are coded in the Cube network. HRT transit includes the local buses and the MAX (express) buses in Hampton, Chesapeake, Newport News, Norfolk, Portsmouth, Suffolk, and Virginia Beach. The transit network also includes ferry, Virginia Beach Wave, and the NET. Transit networks are coded with headways for peak period and off-peak period. The networks are compatible with the Public Transport (PT) program in Cube Voyager. Access, egress and transfer links are built using PT procedures. Park-N-Ride information is also defined on the highway nodes to model drive to transit trips. The base year transit files are shown in Table 4.5. Default versions of these files coded for the base year scenario are located in the Base scenario input folder.

If the highway network is updated for a new scenario with addition or removal of nodes and/or links, the user should remember to make necessary changes in the transit line coding file. If the series of nodes and links in the transit coding is not consistent with the highway network, the model run will give an error during the transit skimming process. The log file will show where the error occurred. If the transit lines demand the use of transit-only links which may not be the part of the highway network, for example fixed-guideway transit stations on LRT, the user can define the nodes and links for such links in Master network. As explained in Table 5.1, the attributes LINKFLAG and HOVTYPE are used to define the properties and restrict any highway movements on these links. The travel time on the transit-only links is computed through manual override speed R_FFLOWSPEED coded in the master network.

Important: If the transit-only links are coded for future year (xx) alternative, the alternative specific attributes NETxx, R_FFLOWSPEEDxx, LANESxx noted in the previous section have to be coded for the model to extract these links from Master network and define them for specific alternative.

Each transit line in the Transit line file is coded with a unique identifying name, one-way flag, color, mode, peak headway, and off-peak headway. Since the Hampton Roads highway network is micro-coded for most arterials and freeways, the bus lines are coded separately for the individual

directions. PT does not allow the bus line to be coded as a two-way (oneway=F) on a one-way link. The user can refer to Cube's PT documentation for more details on transit line coding.

The Factor file and the System file, both created during the base year calibration/validation process, provide information about in-vehicle time, out-of-vehicle time weights, wait time functions, modes available etc in the transit skimming process. The user can refer to the Factor files and the System file used in the Base year scenarios to define new scenarios. Transit fares are coded as mode specific. A fare system number is defined for each mode. The boarding fares and transfer fares are coded in a separate transit fare file for each fare system. The information about coding these files is available in Cube's PT documentation.

Table 4.5: Base Year Transit Input Files

File Name	Description
Transit.lin	Local, Express and Premium Bus Routes
Fringelot.lin	Fringe Park and Ride Locations
PNR.lin	Park and Ride Locations
Fare.lin	Transit Fare File
Walktrn.fac	Walk to Transit path parameters
Drivetrn.fac	Drive to Transit path parameters
Fringe.fac	Fringe Transit and Shuttle path parameters
Fringewalk.fac	Fringe walk path parameters
Tsysd.pts	System wide walk and drive to transit parameters

4.2.4 Other Input Files and Parameters

The Turn Penalty File has a format documented with the Cube Voyager HIGHWAY program. This file was updated for the base year scenario and may need to be updated for new scenarios. The turn penalties were derived by VDOT and HRTPO for the base year scenario. The turn penalties can be applied by time of day. Table 4.6 shows the turn penalty flags and their application in the base year scenario.

Table 4.6: Turn Penalty Flags

Turn Penalty Flag	Description
1	Turn prohibitions applied as part of base year validation
2	Turn prohibition all day
3	Turn prohibition in AM (6:00 am to 9:00 am)
4	Turn prohibition in Midday (9:00 am to 3:00 pm)
5	Turn prohibition in PM (3:00 pm – 6:00 pm)
6	Turn prohibition in Night (6:00 pm to 6:00 am)

The Visitor Model is not updated as part of the base year validation effort and placeholder matrices for the module are used from the old (prior) Hampton Roads model. The checkbox labeled "Run Air Quality Conformity Analysis with Visitor Model", adds a correction factor to the trip assignment that converts the model output to Average Summer Weekday Traffic. The setup and the correction

factors are the same as they were in the old (prior) Hampton Roads model. This checkbox is left unchecked for project and scenario analysis as well as for the base year scenario.

4.3 Scenario Example

This section presents a step-by-step overview of the process of running a scenario, and of creating a new model scenario.

Certain users will not need to construct a new scenario, and may find that their needs are met by running and inspecting the results of scenarios distributed with the model.
To run a scenario that already exists:

1. Open the model catalog.
2. Open the scenario in the catalog's Scenario Window (Figure 2.4) by double-clicking the scenario, or by right-clicking and choosing "Edit/Run Scenario" from the context menu. Press the "Run" button in the Edit/Run Scenario Dialog (Figure 2.4).
3. Inspect model output through the Data Window or Application Flowchart (see Figure 2.3).

To create a new scenario:

1. Within the Scenario Window pane, right click the Base_2009 scenario (Figure 2.3). This scenario will be referred to as the "Parent Scenario", and the folder that contains its input files is the "Parent Folder".
2. Select the "Add Child" option. You may add a name for the scenario. Once the name has been entered, a box will appear allowing you to type in a description of the scenario.
3. The Edit/Run Scenario dialog (Figure 2.4) will appear, with the file keys already filled in. The file names will refer to copies of the parent input files that have been placed in the new child scenario input folder, a sub-folder of the parent folder. See the Cube Catalog documentation for more information.
4. You may provide alternate file names for certain inputs to the child scenario or leave them unchanged.
5. Once you have set up the input files appropriately, you may "Save" the scenario, or you may "Run" it. Saving the scenario records your changes into the catalog, and running the scenario will record the changes, and will also start a model run.
6. If the model run does not complete successfully, see the discussion of the Logs folder ("Section 3.2.3 Accessing Output Files Directly from the Output Folder") for guidance.
7. Inspect model output through the Application Flowchart window or the Data Window (Figure 2.3).

5 Appendix

Table 5.1: Master Highway Network Coding Rules

No.	Link Variable	Description	Data Type	Coding Rule
1	ANODE	Beginning node of model network link	Numeric	Node number
2	BNODE	Ending node of model network link	Numeric	Node number
3	DISTANCE	Highway Link distance in miles	Numeric	Distance in miles
4	LANES	Number of DIRECTIONAL through lanes in Base Year 2009	Numeric	Number of lanes
5	FACTYPE	Facility Type used for Modeling Only in Base Year 2009	Character	1 if Interstate/Principal Freeway
				2 if Minor Freeway
				3 if Principal Arterial/Highway
				4 if Major Arterial/Highway
				5 if Minor Arterial/Highway
				6 if Major Collector
				7 if Minor Collector
				8 if Local
				9 if High Speed Ramp
				10 if Low Speed Ramp
				11 if Centroid Connector
				12 if External Station Connector
6	TWLTL	Two Way Left Turn Lane	Character	1 if Two Way Left Turn Lane
				Leave Blank if Not Applicable
7	ONEWAY	Directionality Indicator	Numeric	1 if Oneway
				2 if Twoway
8	TRK_PHB	Truck Prohibition Identifier	Character	A if Truck Prohibition in AM peak
				M if Truck Prohibition in Midday
				P if Truck Prohibition in PM peak
				T if Truck Prohibition in Night
				Y if Truck Prohibition All Day
				N if No Truck Restriction

No.	Link Variable	Description	Data Type	Coding Rule
9	POST_SPD	Posted Speed Limit in miles per hour (mph)	Character	Speed in miles/hour
				Leave Blank if no data available
10	SPDCLASS	Speed class code from speed lookup table for the region	Character	2-character Facility Type followed by 2-character Area Type. Example: Facility Type 7 and Area Type 2 will have SPDCLASS as 0702. The model calculates this on the fly. User may or may not code this value.
11	LINK_CAP	Link Capacity in vehicles/lane/hour if known for Base Year 2009	Numeric	Model calculates this as a numeric value on the fly using Speed Capacity Table.
12	CAPCLASS	Capacity class code from capacity lookup table for the region	Character	2-character Facility Type followed by 2-character Area Type. Example: Facility Type 7 and Area Type 2 will have SPDCLASS as 0702. The model calculates this on the fly. User may or may not code this value.
13	AWDT	Observed 24 hour average weekday count for Base Year	Numeric	Observed Avg Weekday Counts
14	RTE_NAME	Local street name (911)	Character	Name of the route. Leave Blank if data not available.
15	RTE_NO	Official State highway route # (Federal Aid Number)	Character	Route number. Leave Blank if data not available.
16	PROJ_ID	Project ID used by VDOT and/or MPO	Character	Leave Blank if Not Applicable.
17	YR_OPEN	Estimated year highway project open for traffic	Character	Leave Blank if Not Applicable.
18	YR_CLOSE	Estimated year highway project closed to traffic	Character	Leave Blank if Not Applicable.
19	JURIS_NO	VDOT's city/county jurisdiction code	Numeric	Jurisdiction Number
20	FEDFUNC	Federal functional class	Character	1 if Interstate
				2 if Other Principal Arterial
				6 if Minor Arterial
				7 if Major Collector
				8 if Minor Collector
				9 if Rural Local
				11 if Urban Interstate
				12 if Urban Freeways/Expressways

No.	Link Variable	Description	Data Type	Coding Rule
				14 if Urban Other Principal Arterials
				16 if Urban Minor Arterial
				17 if Urban Collector
				19 if Urban Local
21	AREATYPE	Land use ID: Five types	Character	1 if CBD. User should define this through R_AREATYPE
				2 if Urban
				3 if Dense Suburban
				4 if Suburban
				5 if Rural
22	FEDAT	Federal Area Type: Urban or Rural	Numeric	1 if Urban
				2 if Rural
23	MPO_ID	Identifier for which MPO region link belongs to.	Character	2-character code for MPO ID
24	SCRLN_ID	Screenline Identifier	Character	3-character Screenline ID. Leave Blank if Not Applicable
25	CORD_ID	Cordon Line Identifier	Character	3-character Cordonline ID. Leave Blank if Not Applicable
26	CUTLN_ID	Cutline Identifier	Character	3-character Cutline ID. Leave Blank if Not Applicable
27	TMS_ID	TMS Count Station ID	Character	6-character TMS Count Station ID. Leave Blank if Not Applicable
28	RTE_ID	HTRIS Route ID	Character	State Database Connection
29	BEGIN_MP	Beginning Milepoint of a link	Numeric	State Database Connection
30	END_MP	Ending Milepoint of a link	Numeric	State Database Connection
31	HOVTYPE	HOV Type Identifier	Character	4-character where each character represents the period. First character represents AM, Second represents MD, Third represents PM and Fourth represents Nt.
				1 if All Vehicles Allowed
				2 if HOV2+
				3 if HOV3+
				9 if Closed to All
				Example: 9121 represents a lane closed to traffic in AM, open to all vehicles in Midday, HOV2 in PM and open to all vehicles at Night

No.	Link Variable	Description	Data Type	Coding Rule
				Coded as '9999' for transit-only links to prevent highway movements.
32	TOLL_GRP	Toll Group	Numeric	1, 2, 3, etc depending on the toll value and type.
				In Base Year, 1 is used for Coleman Bridge, 2 is used for Chesapeake Expressway. If there are more tolls to be coded, the user can code unique toll group values and define the tolls in the Toll.txt input file. Also, toll values can be changed in the Toll.txt file for the existing toll facilities.
33	TOLLGATE	Toll Gate Group representing delay at toll barrier	Numeric	Value will be updated in toll.txt file
34	R_AREATYPE	Land use ID: Five types, as defined by the user for Base_2009 (override of the value computed during model run)	Character	CBD AreaType=1 must be defined by the user through this attribute. The areatype of Freeways (FACTYPE 1 and 2) should also be defined by the user. If R_AREATYPE is left blank or un-coded, the model calculates the areatype on the fly. Note that CBD areatype is not calculated on the fly and must be defined by the user using R_AREATYPE.
35	R_FFLOWSPEED	Free Flow Speed as coded by user for Base_2009	Numeric	Free Flow Speed in miles/hr. If left Blank, the model calculates free flow speed on the fly using Speed Capacity Table. Note: For transit only links R_FFLOWSPEED is used to compute transit travel time
36	R_LINK_CAP	Link Capacity in vehicles/lane/hour as coded by user for Base_2009	Numeric	Link Capacity in vehicle/hour/lane. If left Blank, the model calculates link capacity on the fly using Speed Capacity Table.

No.	Link Variable	Description	Data Type	Coding Rule
37	LINKFLAG	Flag to define transit-only links	Numeric	0 if highway link
				1 if Transit Access links (for e.g. walk access links to LRT)
				2-3 not used currently
				4 if Transit only links for transit lines
				5 if Ferry
				6 if LRT transit links
Alternative/Future Scenario /Project Specific Attributes:				
	NETxx	Boolean flag to represent the alternative/future scenario 'xx'	Numeric	0 if link is not included for alternative 'xx'
				1 if link is included for alternative 'xx'
				For all Base Year linksNET09=1, NET18=1, NET28=1 etc. For a new link added for 2018, NET09=0, NET18=1, NET28=1 etc.
	LANESxx	Number of directional through lanes for (future) alternative 'xx'	Numeric	Number of Lanes
	LANESPRJ	Number of directional through lanes for specific project PROJ_ID	Numeric	Number of Lanes
	FACTYPExx	Facility Type used for modeling for (future) alternative 'xx'	Character	See FACTYPE above
	FACTYPEPRJ	Facility Type used for modeling for (future/test) specific project PROJ_ID	Character	See FACTYPE above
	HOVTYPExx	HOV Type Identifier for (future) alternative 'xx'	Character	See HOVTYPE above
	HOVTYPEPRJ	HOV Type Identifier for (future/test) specific project PROJ_ID	Character	See HOVTYPE above
	TOLL_GRPxx, TOLLGATExx	Toll Group and Toll Gate group for (future) alternative 'xx'	Numeric	See TOLL_GRP, TOLLGATE above
	TOLL_GRPPRJ, TOLLGATEPRJ	Toll Group and Toll Gate group for (future/test) specific project PROJ_ID	Numeric	See TOLL_GRP, TOLLGATE above
	R_AREATYPExx	Land use ID, as defined by user for (future) alternative 'xx'	Character	See R_AREATYPE above

No.	Link Variable	Description	Data Type	Coding Rule
	R_AREATYPEPRJ	Land use ID, as defined by user for (future/test) specific project PROJ_ID	Character	See R_AREATYPE above
	R_FFLOWSPEEDxx	Free Flow Speed as coded by user for (future) alternative 'xx'	Numeric	See R_FFLOWSPEED above
	R_FFLOWSPEEDPRJ	Free Flow Speed as coded by user for (future/test) specific project PROJ_ID	Numeric	See R_FFLOWSPEED above
	R_LINK_CAPxx	Link Capacity as coded by user for (future) alternative 'xx'	Numeric	See R_LINK_CAP above
	R_LINK_CAPPRJ	Link Capacity as coded by user for (future/test) specific project PROJ_ID	Numeric	See R_LINK_CAP above

Table 5.2: List of Common Errors during Model Run

Common Errors	Possible Cause/Resolution
Application Manager Message: Errors Encountered checking execution order and file existence. Create a Batch Job anyway?	This may happen if one or more input files are missing or have been renamed without being updated in the Scenario Keys. To resolve this, click "No" on the Message Window and check the files listed. Make sure the files listed are present in the relevant directories.
Error Message: Required files for this program are not specified. Press OK to see report of errors	Missing links in the catalog or required data in the input file is missing. Check the file linkages from the previous modules to the current module. Fix the linkage if it is broken. Make sure that there is required data in the input files defined.
Cluster Related Error: Model stops running or pauses	This may happen due to closing cluster windows or not enough disk space or the hard disk goes into hibernation. The user should not close the popping cluster windows during the model run. If the model pauses at a particular module for an unknown reason, then stop running the model, try running that particular module individually and then check for fatal errors to trace back the cause.
Fatal Errors during running scripts	Several reasons for this error including insufficient data, syntax errors, division by zero error. To identify the exact reason, the user should look at the listing file of that module and trace back the error..
Cube Task Monitor has encountered a problem and needs to close	This could happen if one or more files generated during the model run have got corrupted. If this error occurs during a full model run, then try deleting the output files and run the model again. If that doesn't work, copy the model setup to a different folder and re-run.
Error for incorrect values in catalog keys	If the "Base Year Run" catalog key flag is left blank, the model will not run. The flag should be defined as 1 for base year scenario and 0 for future year scenarios.
Note: The above lists some common types of errors. There are several other reasons due to which errors can occur. The best solution is to find out when the error occurs, identify that module, look at the listing file and try to trace it back.	