# Focus

## DRCOG Regional Activity-Based Travel Model

# User Guide

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*Version 2.3*

*Denver Regional Council of Governments*

DENVER REGIONAL COUNCIL OF GOVERNMENTS

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# Chapter 1: Introduction

The ***Focus*** travel model is an activity-based model (**ABM**) for the Denver region developed by DRCOG in conjunction with Cambridge Systematics. Based roughly on Sacramento's activity-based model, the model forecasts individual regional households and persons travel activities throughout a typical weekday based on personal and travel-related characteristics.

***Focus*** uses mathematical models to forecast what decisions people will make in the future. The model's forecasts are based on a wide variety of data about the region's people, transportation systems and development pattern, including:

- Where jobs and households will be located
- Where roads will be located and how much traffic they can accommodate
- The location of transit lines
- Data counting the number of cars on certain roads and number of people on transit facilities
- How the changing nature of our population may affect travel behavior, such as an increase in the number of retirees

Based on this data, the model answers a series of question for each person in the region, then combines the answers to these questions for all the region's people to determine how much total travel will occur.

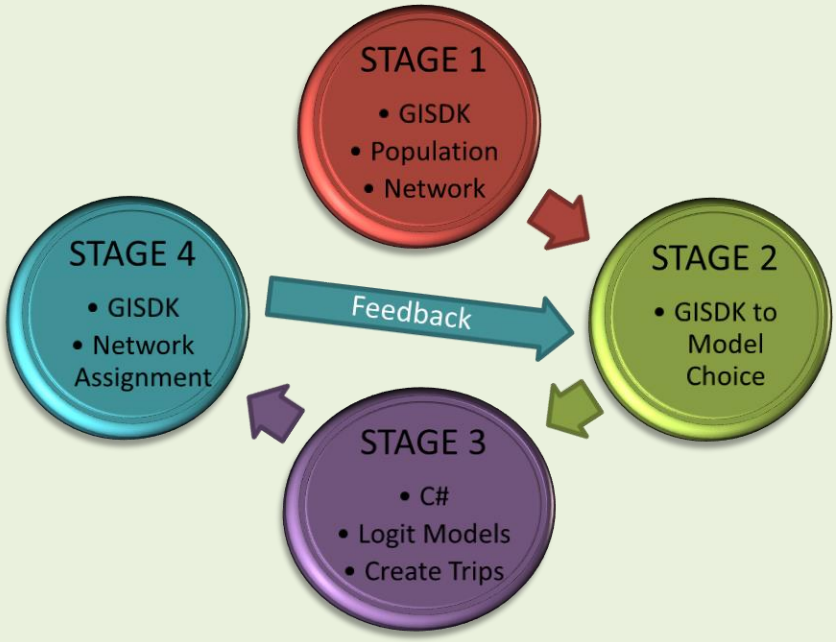
# Chapter 2: Process Overview

## 2.1 Introduction

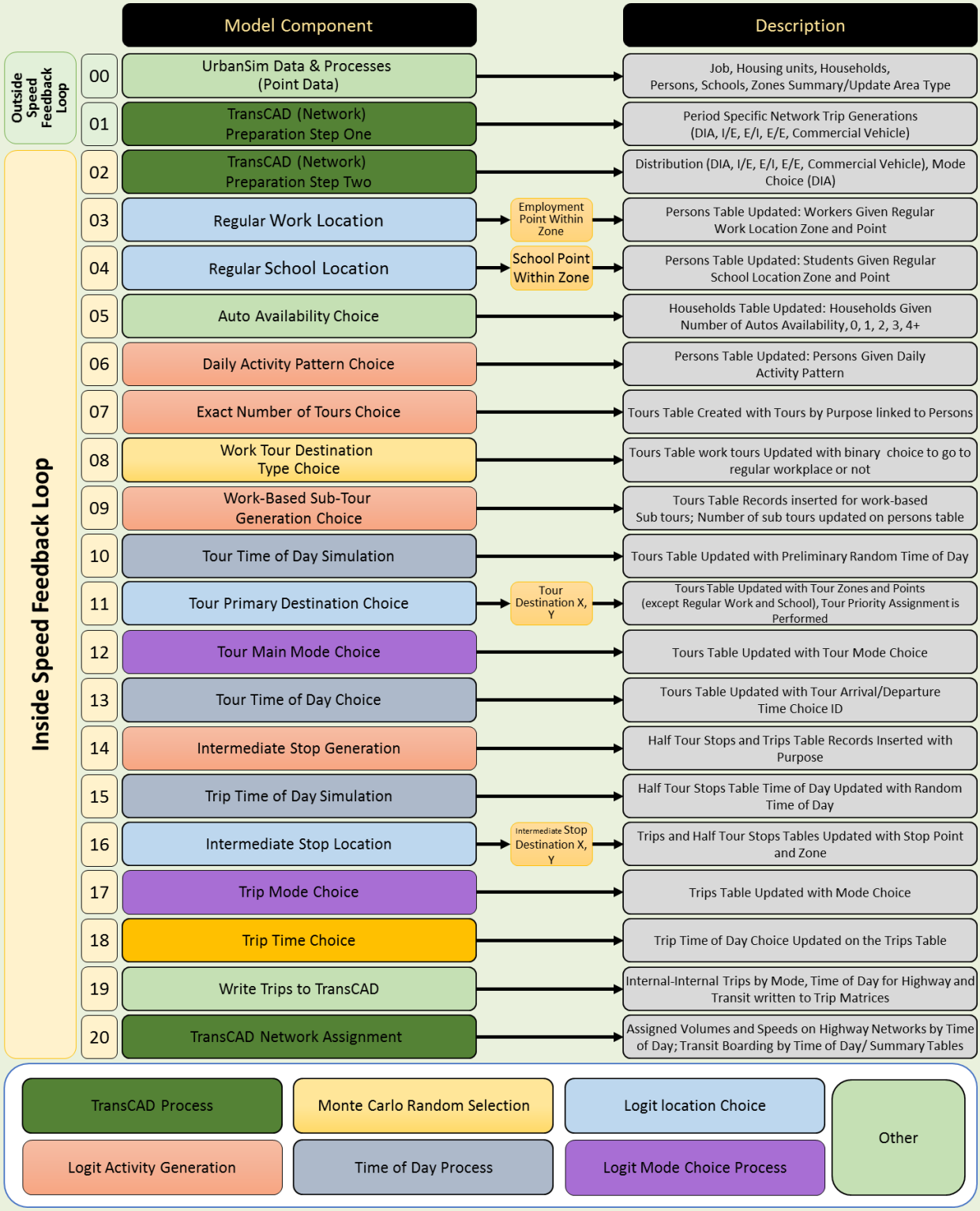
***Focus*** Travel Model is used to help local officials decide which proposed transportation infrastructure and service improvements will best address congestion in the region as well as where to direct future growth and development. ***Focus*** Travel Model forecasts allow examination of spatial variability and environmental justice issues in the modeled region. For example, the model outputs give travel patterns that vary by county and municipality.

The ***Focus*** Travel Model uses forecasts of future population, households and jobs developed by both DRCOG and others. ***Focus*** travel models forecast who wants to travel where at what time, by what mode (drive alone, carpool, bus, train, bike or walk), and by what route.

## 2.2 Process Work-Flow



## 2.3 FOCUS Model Flow Diagram



## 2.4 Pre-process Components Outside the Feedback Loop

### 2.4.1 UrbanSim Data and Preprocesses (Point Data)

UrbanSim simulates the location choices of households and businesses - including the profit maximization activities of land developers - from 2010 (the current base year) to 2040. Locations are represented by buildings and individual parcels. As the region grows, new households and businesses move and make location choices according to their own characteristics and the amenities of each parcel.

From UrbanSim results, six point data files are generated as inputs for ***Focus***: (1) a zonal table describing the economic and demographic characteristics of each TAZ; (2 and 3) two tables recording household and person characteristics and location; (4) a housing units table with the coordinates of each residential building; (5) an establishments table with the location of each business and their number of employees; and (6) a centroid table with the location of the closest transit stop in each TAZ.

A separate process is used to generate school points with enrollment by grade level.

### 2.4.2 TransCAD Network Preparation Step One

This component [not shown on the ***Focus*** UI] consists of four steps: (1) General Preprocess, (2) Transit Access/Egress, (3) Calculate Households, and (4) Calculate Productions and Attractions. The TransCAD General Preprocess step splits combined daily networks into separate peak, off-peak and period-specific ones. It also calculates additional fields in the zonal data file. The Transit Access/Egress step determines the fraction of each TAZ within 1.5 miles of transit (where walk access might be feasible) and fills those values in the zonal file.

- The Calculate Households step of the Trip Generation stage produces a 15-cell count of households based on income (three levels) and household size (five levels) in each zone, based on the income group totals and average household size supplied in the zonal data file. The Calculate Productions and Attractions step applies trip generation and attraction rates for the ancillary purposes (airport, commercial vehicle, IE/EI, and EE).

- Highway and Transit Preprocess: Updates the highway and transit network files by creating additional fields in the geographic files and compiles them into TransCAD, ".NET", and ".TNW" files respectively.

## 2.5 Process Components Inside the Feedback Loop

### 2.5.1 TransCAD Network Preparation Step Two

- Skimming: Outputs a set of highway and transit matrices that provide the impedance values such as travel time and cost associated with each pair of origin and destination zones.
- Trip Distribution: Uses gravity models by home-based work, home-based non-work, non-home-based, internal-external, and commercial vehicle purposes to create origin-destination trip pairs. The external-external pattern matrix is adjusted to match EE marginals using TransCAD's Growth Factor process.
- Mode Choice: Multinomial logit models are applied to determine how many home-based work, home-based-non-work, and non-home-based airport trips use auto modes (by three occupancy levels) and transit modes (walk and drive access). Commercial vehicle trips, IE/EI, and EE trips are assumed to be made by auto. (This assumption predates FLEX and Bustang.)

### 2.5.2 Person: Regular Work Location Choice

Using the skim matrices, the Regular work location choice model assigns each worker (full- and part-time) a regular work location zone and point.

### 2.5.3 Person: Regular School Location Choice

Using the skim matrices, the Regular school location choice model assigns each student a regular school location zone and point at the appropriate grade level.

### 2.5.4 Person: Auto Availability

The auto availability choice model is a multinomial logit model that selects number of automobiles available for each household.

### 2.5.5 Person: Daily Activity Pattern

This component determines which set of purposes for activities outside the home are made during each person's day.

### 2.5.6 Person: Exact Number of Tours

Uses the daily activity pattern predicted in the previous component to determine exactly how many (home-based) tours of each purpose will be made by each person during his or her day.

### 2.5.7 Tour: Work Tours Destination Type

The work tour destination type model is a binary logit model of whether each (home-based) work tour travels to the regular workplace or another location. (Work tours made by people who work at home are defined as being to "another location" since home is the regular workplace for these people.)

### 2.5.8 Tour: Work-based Subtour Generation

Work-based subtour generation is another component that determines the amount of travel activity in a person's day. Work based subtours are tours that begin and end at a person's regular workplace.

### 2.5.9 Tour: Time of Day Simulation

The ***Focus*** model does Monte Carlo simulations for arrival and departure time for all tours destinations. A simulation is made so that a time of day is available for the following destination and mode choice components. Later, the actual multinomial logit models for time of day are run. These choices typically either confirm the simulated time or move the tour to an adjacent hour.

### 2.5.10 Tour: Primary Destinations

The tour primary destination choice model uses tour, person, zonal, and skim information to select for each tour, the primary destination zone and point of the tour. The tour priority assignment is performed as part of this component. Tour Priority Assignment gives a primary order to model tours mode choice and time of day.

### 2.5.11 Tour: Main Mode Choice

After the tour destination is known, the tour main mode choice model predicts the main mode used on the tour based on (1) the impedances associated with each mode from the tour origin to the tour destination, (2) zonal characteristics, and (3) demographic person characteristics.

### 2.5.12 Tour: Time of Day

Given the known tour origin, destination and mode from previous models, the tour arrival and departure time model predicts the time arriving at the primary destination of the tour and the time leaving the primary destination, both to within one hour periods.

### 2.5.13 Trip: Intermediate Stop Generation

This component generates intermediate stops along. It uses a multinomial logit model applied to each half tour in an individual's daily activity pattern that includes at least one stop. The model choices may be to add a stop of a purpose indicated by the daily activity pattern, or to quit adding intermediate stops and to consider the next half tour.

### 2.5.14 Trip: Time of Day Simulation

This component selects the arrival time for stops made on the half tour from tour origin to the primary activity (outbound) and the departure time for stops made on the half tour from the primary activity to tour origin (inbound). The time is drawn from an observed distribution to provide the following location and mode components with information about which travel times to use for each mode. A Time of Day Choice component later confirms or revises the simulated times.

### 2.5.15 Trip: Intermediate Stop Location

The intermediate stop location choice model is a multinomial logit model that select the zones and points for each intermediate stop. The choice of stop location is influenced by both the attractiveness of the stop destination as well as the additional time and cost to detour from the half tour to the stop.

### 2.5.16 Trip: Mode Choice

The trip mode choice model determines the trip mode on all trips, including half-tours with no stops. The modes available for trips are determined by the tour main mode. Trips may use a lower priority mode than the tour main mode. For example, on a shared-ride two escort tour, a person may drive alone on one half-tour or trip, representing the travel after dropping off or before picking up the family member or friend they may be escorting.

### 2.5.17 Trip: Time of Day

The trip time of day choice model predicts the arrival time for stops made on the half tour from home to the primary activity (outbound) and the departure time for stops made on the half-tour from the primary activity to home (inbound).

### 2.5.18 Write Trips to TransCAD

Takes the trips and puts them into matrix cores for ten highway time periods and four transit time periods.

### 2.5.19 TransCAD Network Assignment

This model component consists of two main steps:

- Network Assignment: The internal-internal trip matrices, created by previous component, are combined with those created from the TransCAD processes for airport, internal-external, external-external and commercial trips. These matrices are then assigned to the highway and transit networks by time-of-day. Walk, bike and school bus trips are not assigned to a network.
- Convergence Test and Speed Balancing: Upon completing highway assignment, the resulting speeds may be inconsistent with the speeds initially used to develop skims and feed trip distribution and mode choice. To check for this situation, the speed balancing routine compares the speeds input to skimming and the speeds output from assignment for each individual link. If the two speeds differ by more than 10 percent, the link is flagged. If less than 2.5 percent of links are flagged, then the speeds are considered converged and the model run stops. Otherwise, the speeds are averaged for the next speed feedback loop (starting with TransCAD Network Preparation Part Two).

## 2.6 FOCUS Model Main Components

**TransCAD GISDK**

- Network Preparation
- Network Assignment

**Person**

- Regular Work Location
- Regular School Location
- Auto Availability
- Daily Activity Pattern
- Exact Number of Tours

**Tours**

- Work Tours Destination Type
- Work-based Subtour Generation
- Tour Time of Day Simulation
- Tour Primary Destinations
- Tour Mode Choice
- Tour Time of Day

**Stops**

- Intermediate Stops Generation
- Intermediate Stops Locations
- Trip Mode Choice
- Trip Time of Day

# Chapter 3: Installing FOCUS

## 3.1 Hardware Requirements

- Windows 64-bit Operating System
- Minimum 4 logical cores, recommended 16 cores or above
- Minimum 1.8 GHz Core speed, recommended 2.8 GHz or above
- Minimum 24 GB RAM, recommended 64 GB or above
- Minimum 60 GB, recommended 100 GB HD and above for a single model run (Enough for 4 to 5 multiple feedback iteration runs)

The model can be conceivably run on a smaller system but will require a much longer run time. The software can take advantage of an unlimited number of processors and memory. Extra memory and processors will make the model run faster.

DRCOG machine's specifications:

- Dell Precision 7920 Rack
- 2 20-core processors for a total of 40 physical cores (80 Logical Cores).
- 128 GB RAM
- 3 TB Solid-State Drive Space
- Microsoft Windows 10 Pro for Workstations
- Windows 64-Bit Operating System
- Hyper-threaded

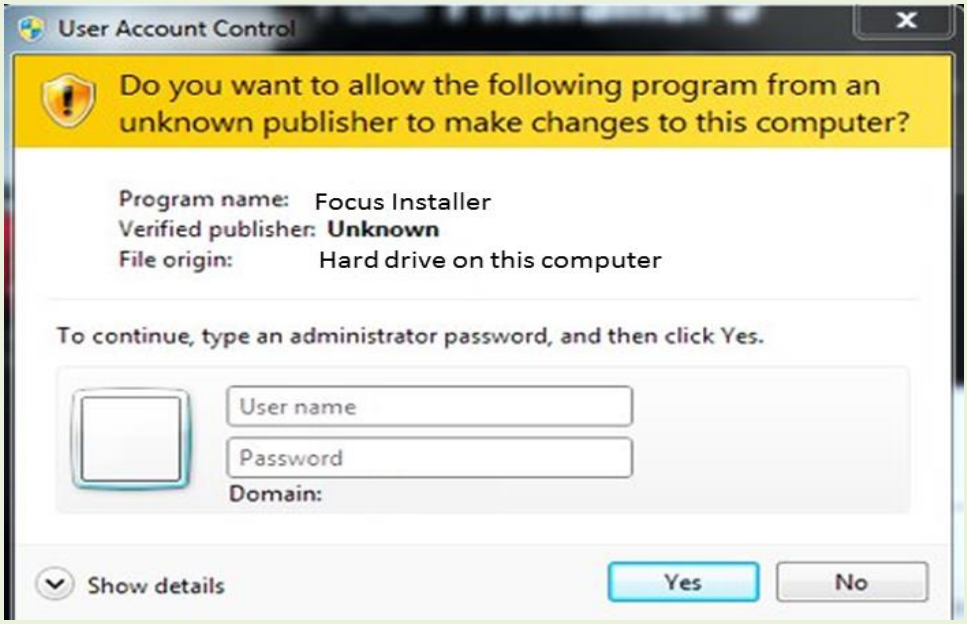
## 3.2 Software Requirements

- [Required]
  - TransCAD 7.0 build 12400 or later build of TransCAD 7.0
- [Optional]
  - Microsoft SQL Server 2008 and above
  - Microsoft Office 2013 and above

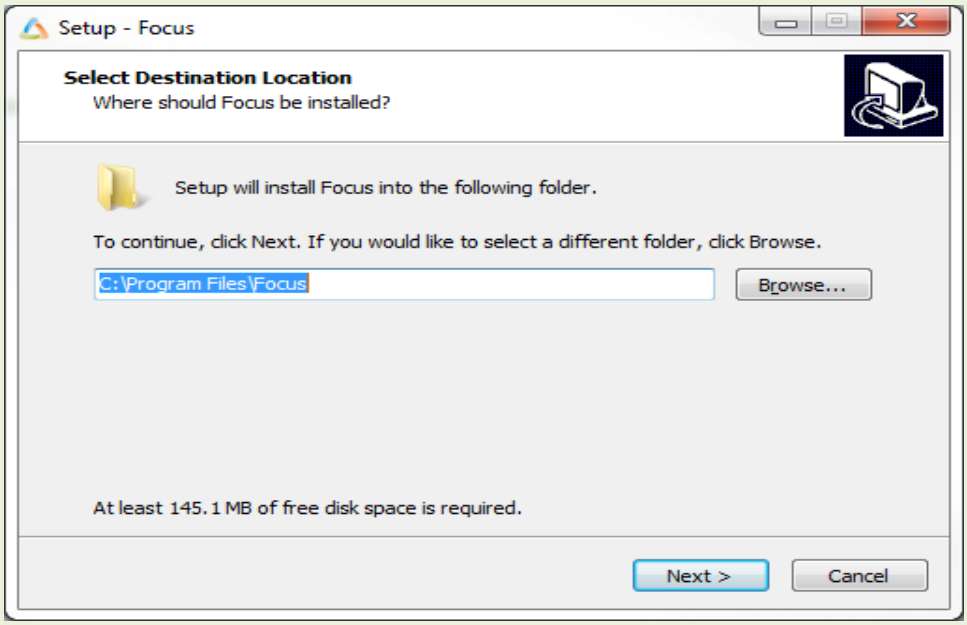
## 3.3 Installation Instructions

The installation process is simple. Double click the “Focus Installer.exe” file included in the package.

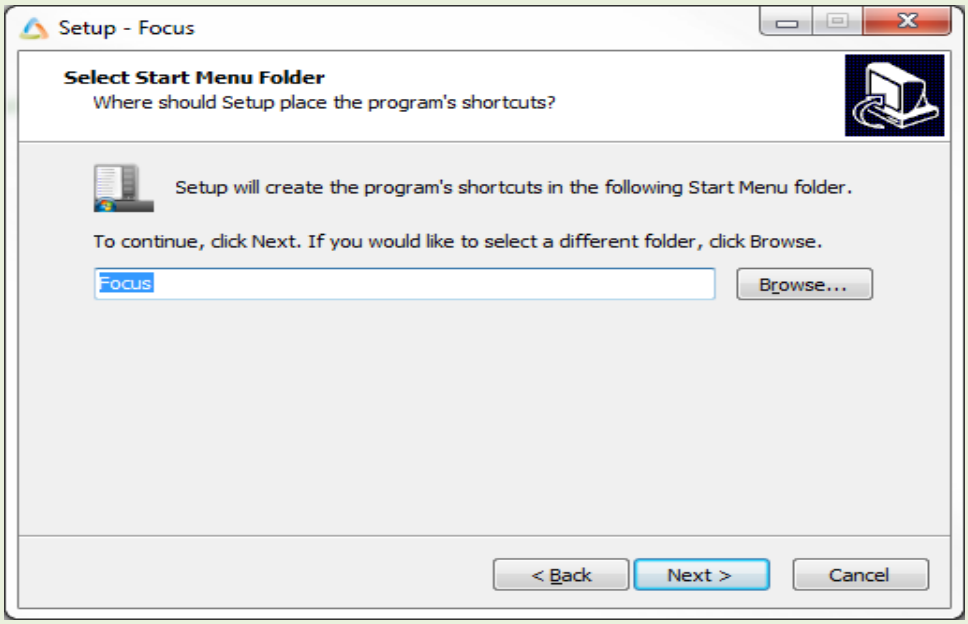
1) In some windows versions, a “**User Account Control**" screen may pop up to ask for administrator account credentials.



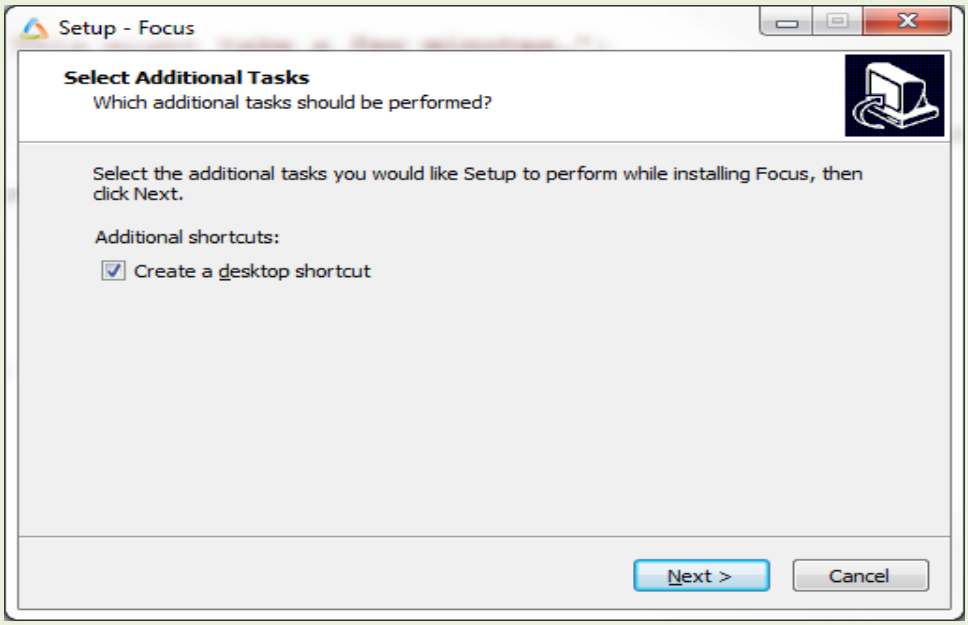

2) The installer screen asks where the user wants to install ***Focus***.



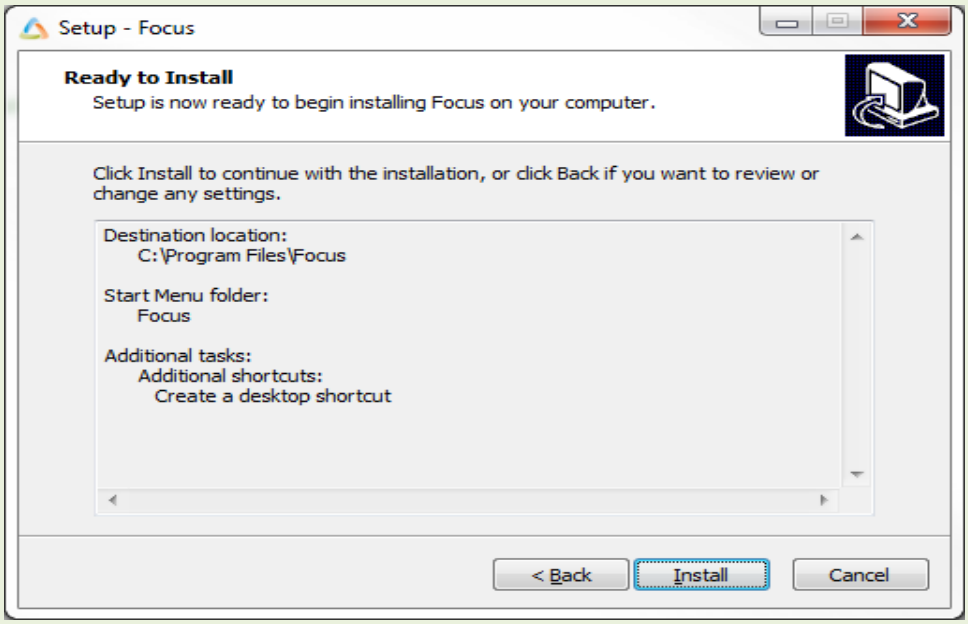
3) The installer screen asks if the user want to change the ***Focus*** shortcuts folder name in the start menu.



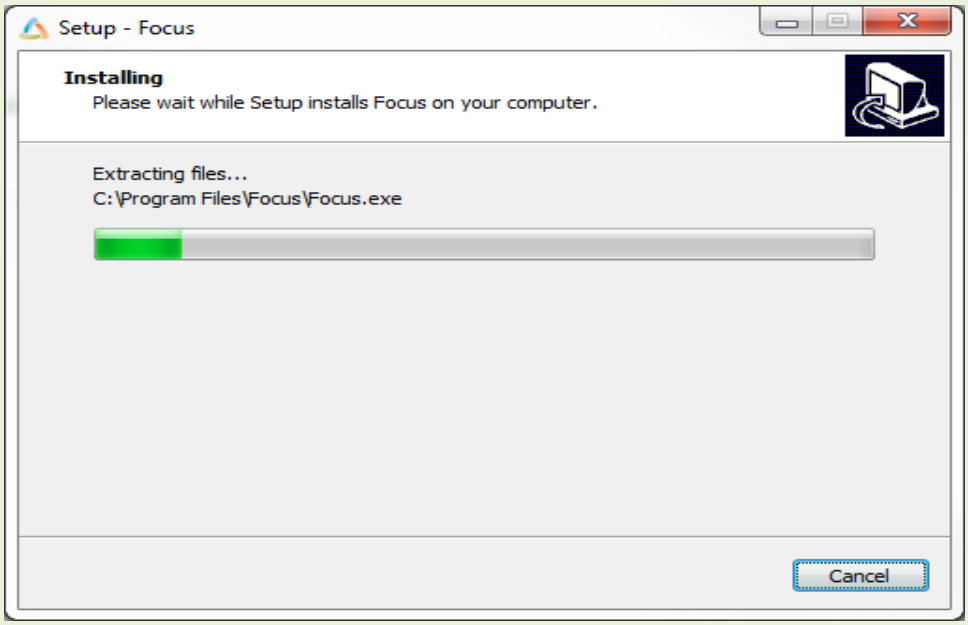

4) The installer screen asks if the user want to add a shortcut to ***Focus*** in Desktop.



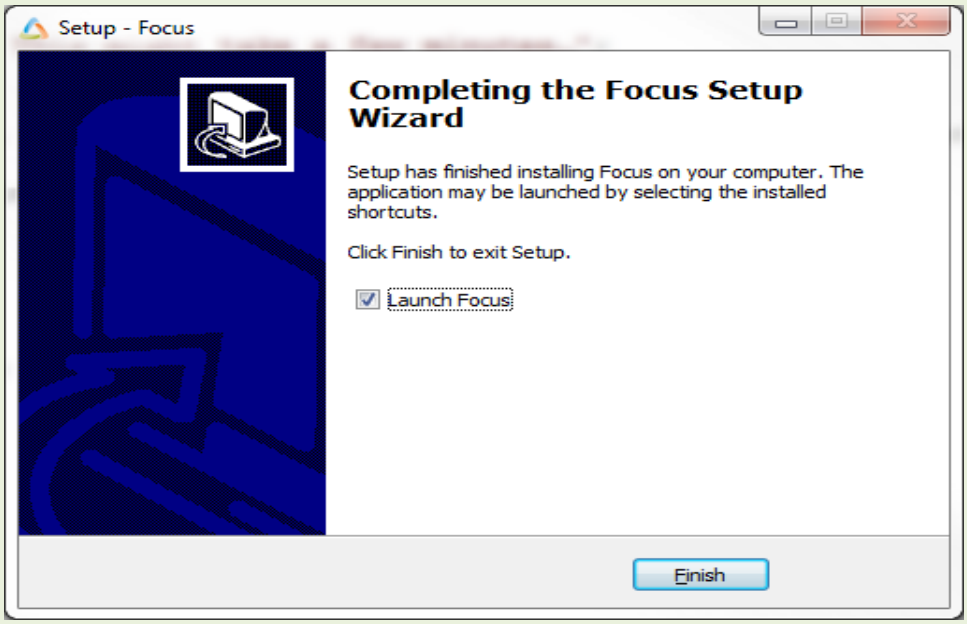
5) The installer screen provides the user with a summary of the installation setting he/she selected.




6) The installer screen will show the installation progress.




7) In the last screen, the installer will ask if the user wants to launch ***Focus*** before exiting the installer.




**Congratulations!**

You have successfully installed ***Focus*** software.

# Chapter 4: Installing Tripod Toolbox in TransCAD

## 4.1 Introduction

At this point, you've completed installing the ***Focus 2.3*** executable. There are still three steps you'll need to complete to make ***Focus 2.3***work with your TransCAD installation. These five steps are:

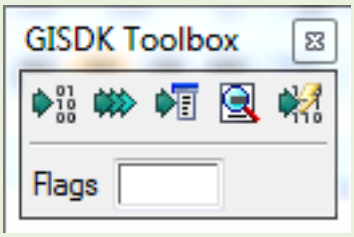
1. Compiling the **Tripod Toolbox** GISDK resource files to user interface (UI)
2. Setting up the **Tripod Toolbox** as an Add-In within TransCAD
3. Copying various supporting files used by Tripod

As you've noticed, these steps require TransCAD, so you should install it now if you haven't already done so. Please refer to Caliper's documentation for TransCAD installation instructions.

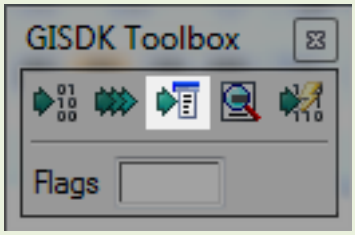
***Focus 2.3*** works with TransCAD versions **7.0**. You may wish to make a note of where you've installed TransCAD on your hard drive, so you can install the Tripod files in the same location (if you have appropriate privileges). This was also the practice for the earlier Compass model software.

## 4.2 Compiling the Tripod Toolbox GISDK

Launch TransCAD.

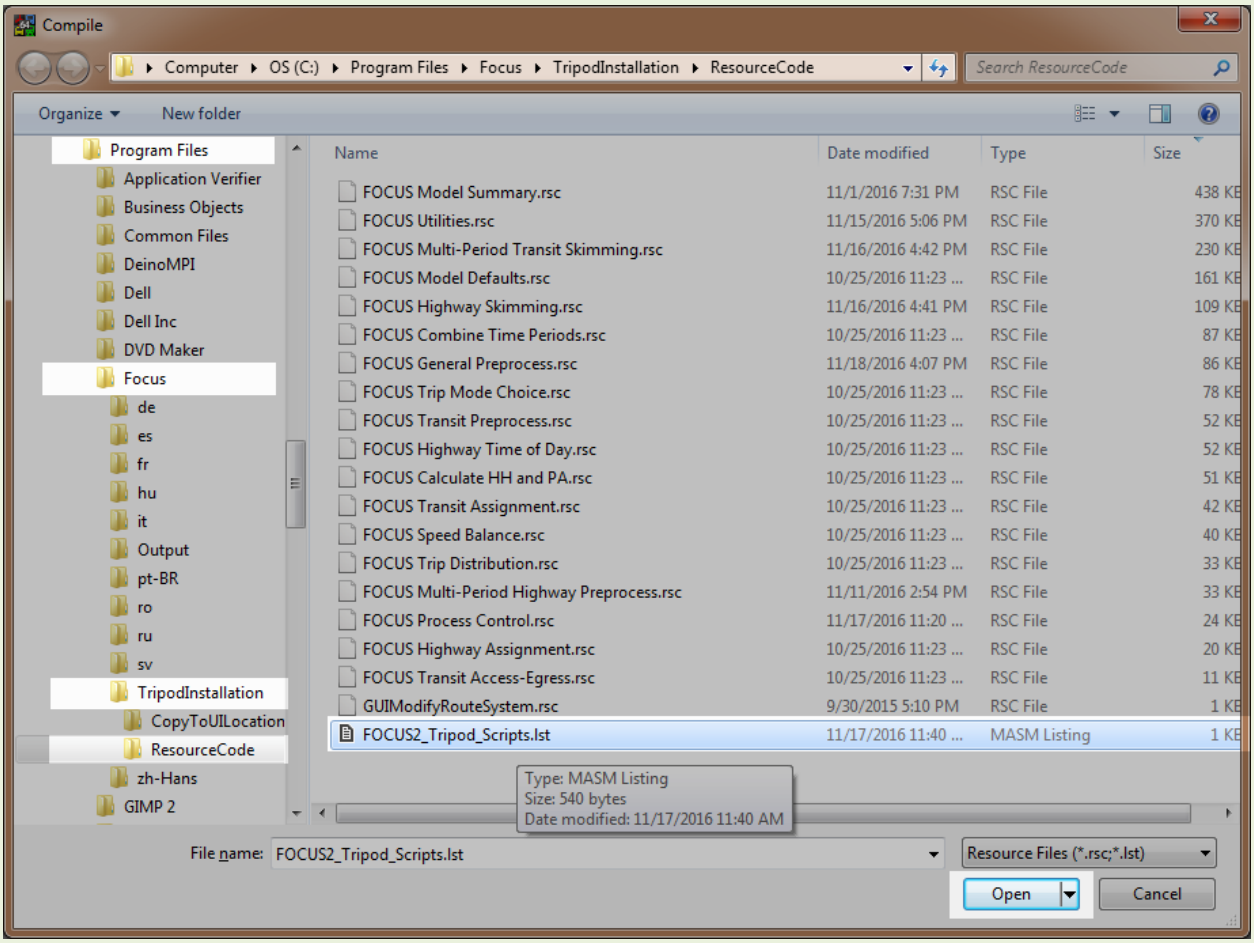



From the TransCAD menu, select "**Tools --> GIS Developer's Kit**" to activate the **GISDK Toolbox** (if it is not already active). The **GISDK Toolbox** is pictured at left.




On the **GISDK Toolbox**, press the Compile to UI icon, which is the middle icon of the top row.

A Windows file selection box will now ask for the file to compile. The Tripod scripts are located where you installed Focus. This is usually "**c:\Program Files\Focus**", but you may have chosen to change it during installation. From the Focus folder, choose the "**TripodInstallation**" folder within Focus, and then choose the ResourceCode folder within "**TripodInstallation**". Here, you should choose the only "***.lst**" file in the "**TripodInstallation**" folder.




Now a second Windows file selection box is asking where to store the compiled UI database. You have some flexibility here regarding what location and name you use, but you'll need to remember this information for the remaining steps. A box is provided below to record the information about your Tripod installation.

First choose a folder location. As with the Compass model, we suggest the TransCAD installation directory, usually **"c:\Program Files\TransCAD\\"**. Sometimes the TransCAD version number may be included in the directory name.

Some organizations restrict users from adding or changing files in the "**c:\Program Files**" directory hierarchy. If this is the case, some other options are available.

If you will be the only Focus user on the workstation, you can save the UI database in your application data folder. TransCAD uses this folder as the default location for your log and report files (although Tripod and Compass change this when you run a scenario). Your application data folder some typically named something like "**C:\Users\%UserName%\AppData\Roaming\Caliper\TransCAD**" where **%UserName%** is the name you use to log into Windows. The "**\TransCAD**" part may or may not include the version number.

If you're using a workstation where two or more users will use **Tripod**, we suggest creating a new directory off your hard drive, such as "**C:\Focus2Config**".

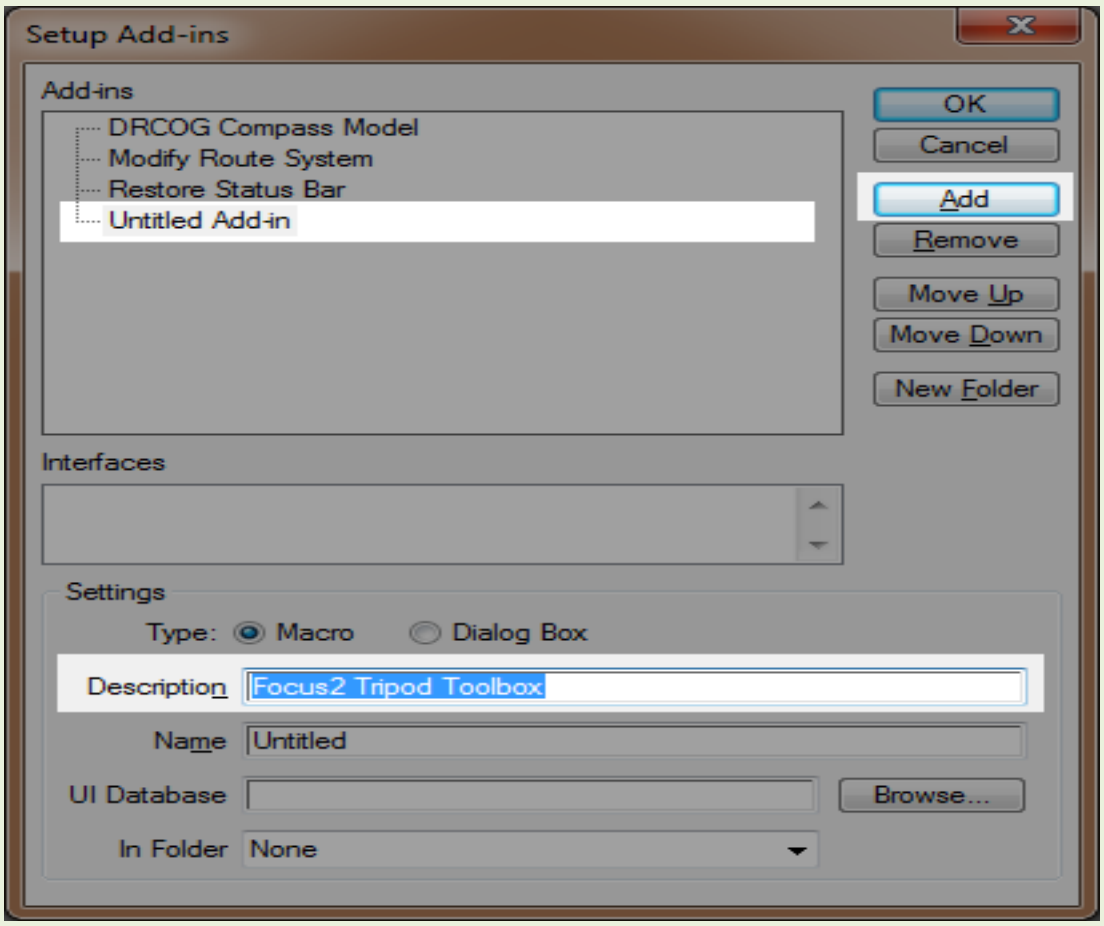
You also have a bit of flexibility with the UI database file name. TransCAD requires it to have the "***.dbd**" extension. This happens to be the same extension that TransCAD uses for standard (editable) geographic layers, so we suggest appending "**_ui**" to the base name, so you don't confuse the compiled UI database for a spatial layer. Some suggestions are "**focus2_ui.dbd**" or "**tripod_ui.dbd**".

| Record Information About Your Installation Here | |
|---|---|
| Computer Description | |
| Installation Date | |
| UI Database Directory | |
| UI Database File Name | **.dbd** |

After entering the file name, click "**OK**" or "**Save**". The "**Focus2x2_Tripod_Scripts_SelectLink.lst**" file contains a list of "**FOCUS*.rsc**" files that are included in the compilation. You should get confirmation that the compilation succeeded.

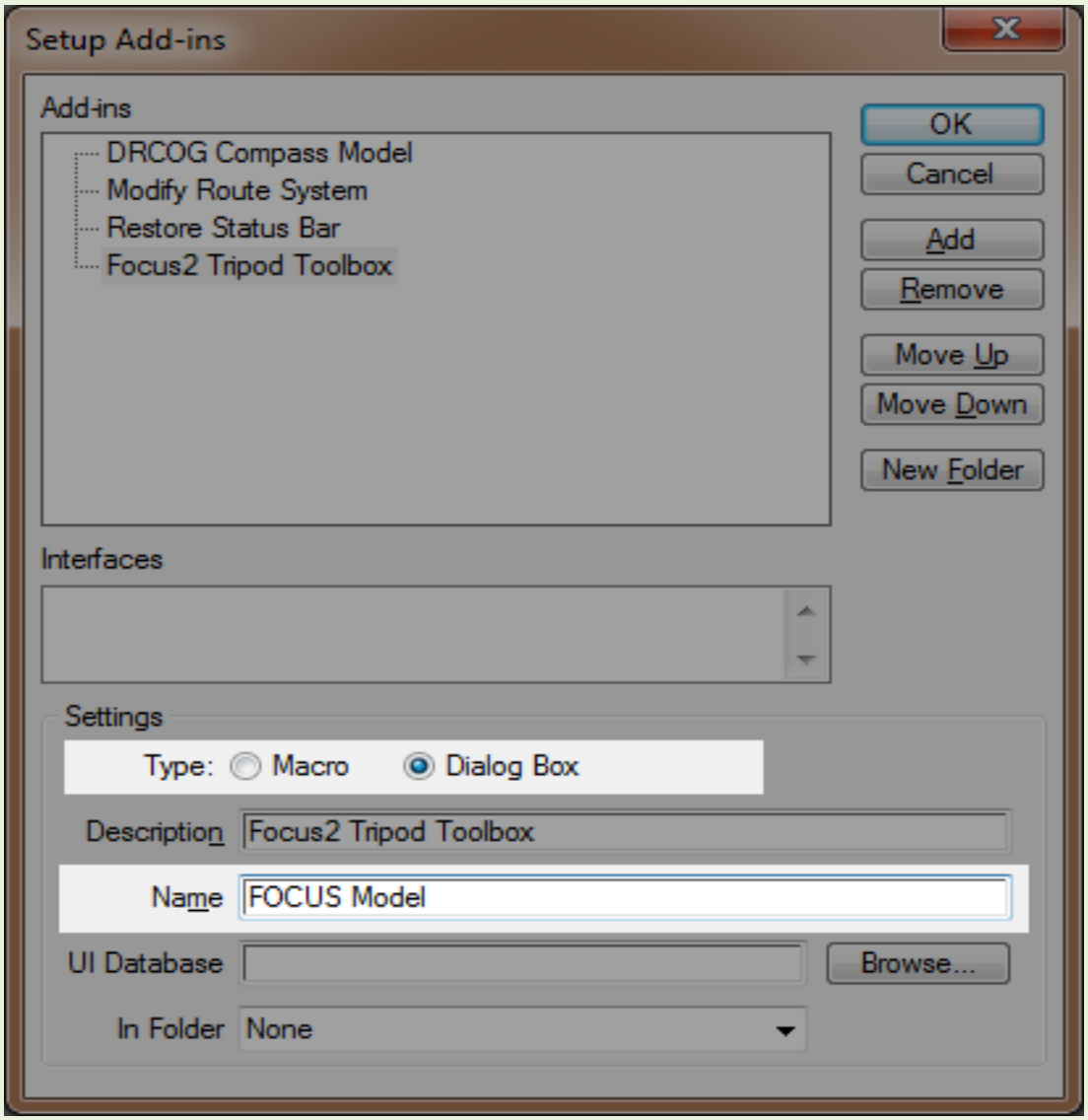
## 4.3 Setting up the Tripod Toolbox Add-In

From the TransCAD menu, select "**Tools --> Setup Add-Ins**". In the dialog box that appears, click on the Add button. Your dialog box should now look something like the following (depending on what other add-ins you might already have installed):

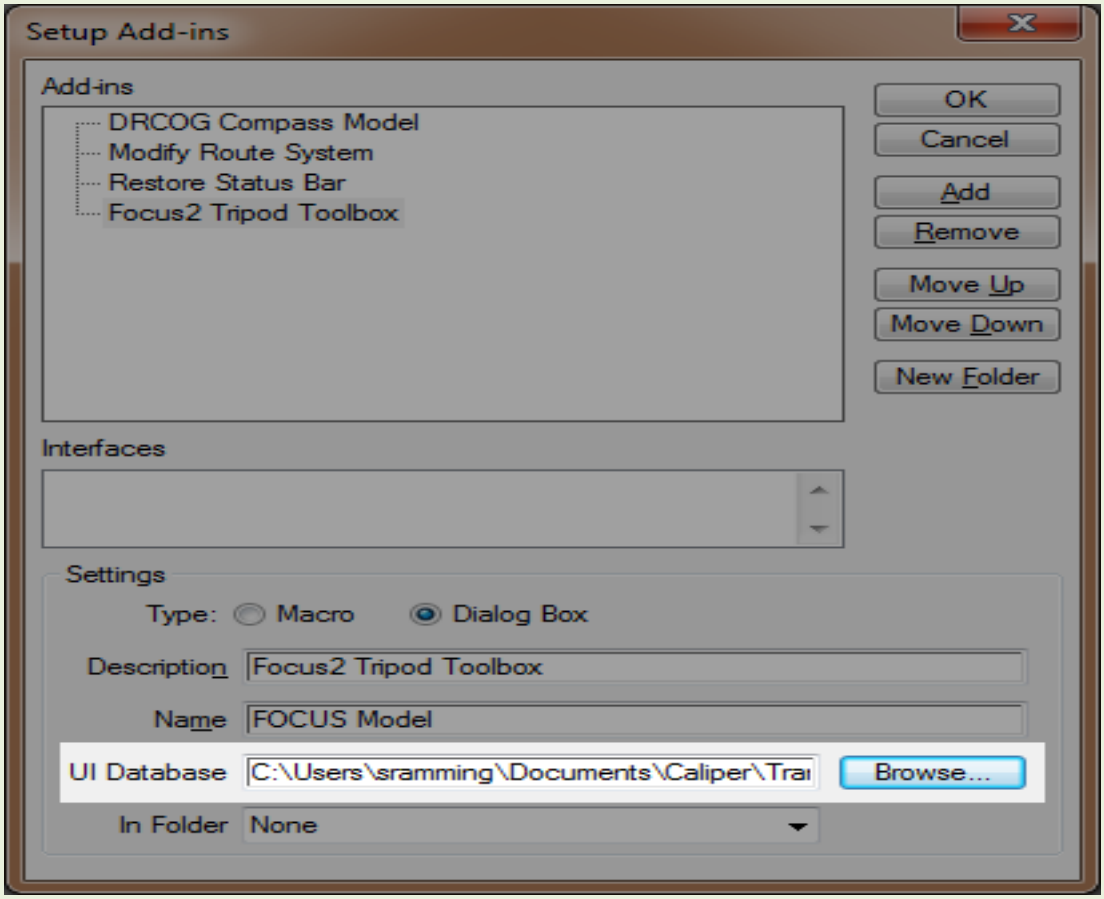



In the description box, enter a name that you'll recognize on the TransCAD Tools menu. This can be anything you want, but we recommend something familiar such as "**Focus Tripod Toolbox**" or some variation. Note that after you tab away from the description box, the name will change in the Add-ins box.

Next, in the Type row, click the "**Dialog Box**" radio button. In the name field, enter "**FOCUS Model**" without the quotes, and with **FOCUS** in all caps. These settings must match exactly so TransCAD will know which resources from the **UI** database file you just compiled it should execute.




Now click the **Browse** button and locate the UI database file you just compiled with the Windows File Selection dialog box that appears. Press the Open button to select it.




Usually you do not need to change the "**In Folder**" drop-down from its default of "**None**". If you do encounter issues when trying to launch this add-in, you may need to consult your IT staff or DRCOG to determine a different setting for the "**In Folder**" drop-down that works with your site's computing security policies.

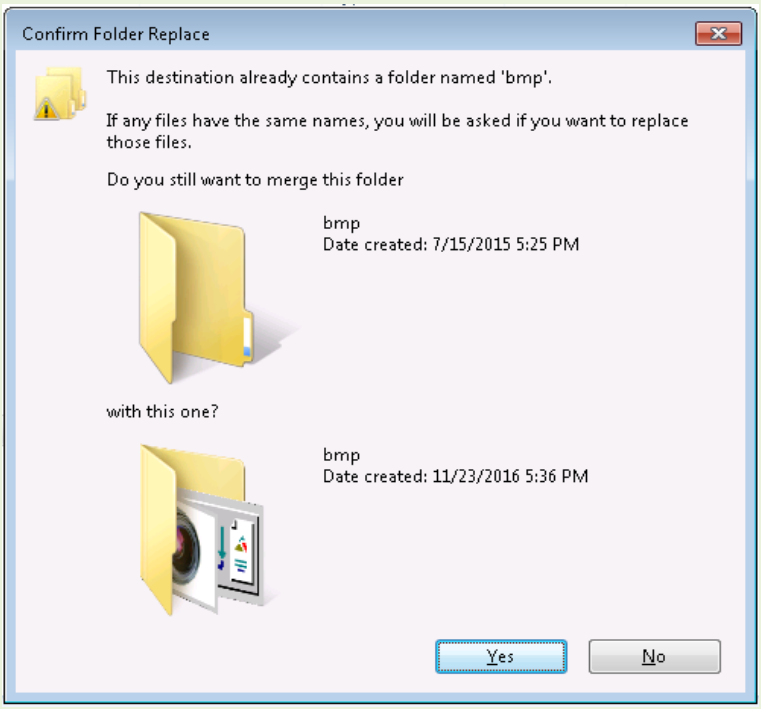
Click on the OK button of the Setup Add-ins dialog box. You should now be able to launch the **Tripod Toolbox** from **TransCAD's** "**Tools --> Add-Ins**" menu. Some of the buttons may appear empty until you complete the next step though.

Note that if you recompile the Tripod GISDK, and you replace the earlier version of your UI database file, you won't need to modify the Add-In settings to use the new GISDK. If you create a new UI database file, you only need to change the UI Database location with the Browse button.

## 4.4 Copying the Supporting Files

Launch a Windows File Explorer window. (You can do this by right-clicking on the Start button and selecting Open Windows Explorer.)
Navigate to the directory where you installed Focus, typically "**C:\Program Files\Focus 2.3**". Open the **TripodInstallation** folder within Focus. Then open the folder named **CopyToUILocation** within **TripodInstallation**. You will see a folder named **bmp**. Select both (for example, by pressing **Ctrl-A**). Copy them to the clipboard by pressing **Ctrl-C**.

Now navigate to the folder where you installed the Tripod UI database in the first step. Refer to the box above if necessary. Paste the files from the clipboard by pressing **Ctrl-V**. (You may also use Windows File Explorer's drag and drop functions if your more comfortable.) You will likely see a dialog box alerting you that the destination folder already contains a folder named "**bmp**" and asking if you want to merge the two folders. Press Yes.



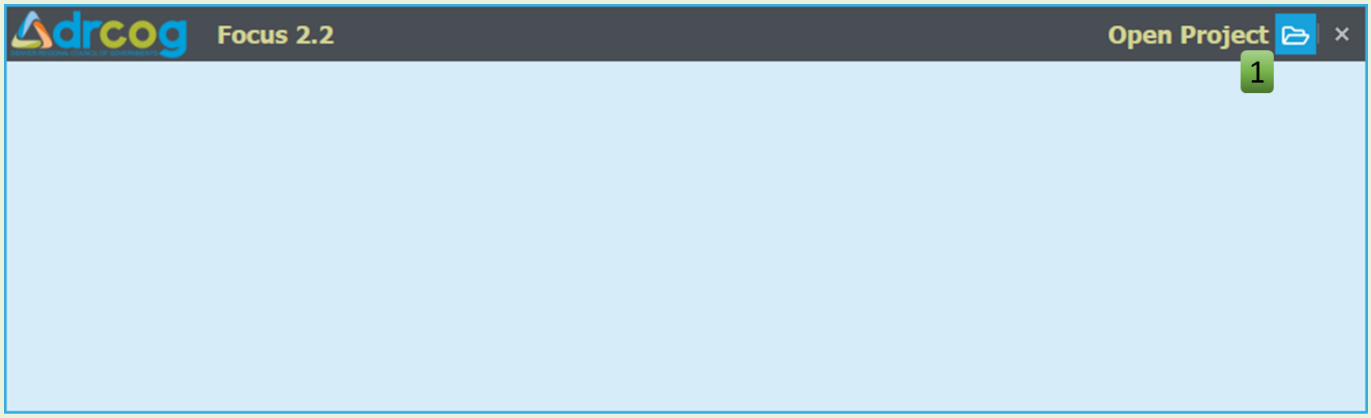

Choose to **Copy and Replace** individual files as necessary.

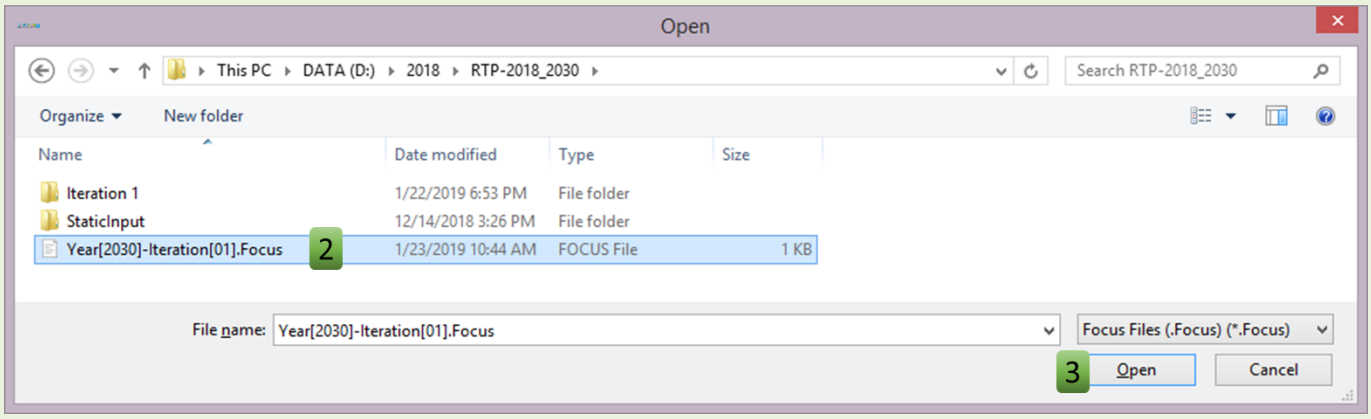
# Chapter 5: *FOCUS* Graphical User Interface

## 5.1 Focus Starting Interface

### 5.1.1 Focus Starting Interface before opening a project

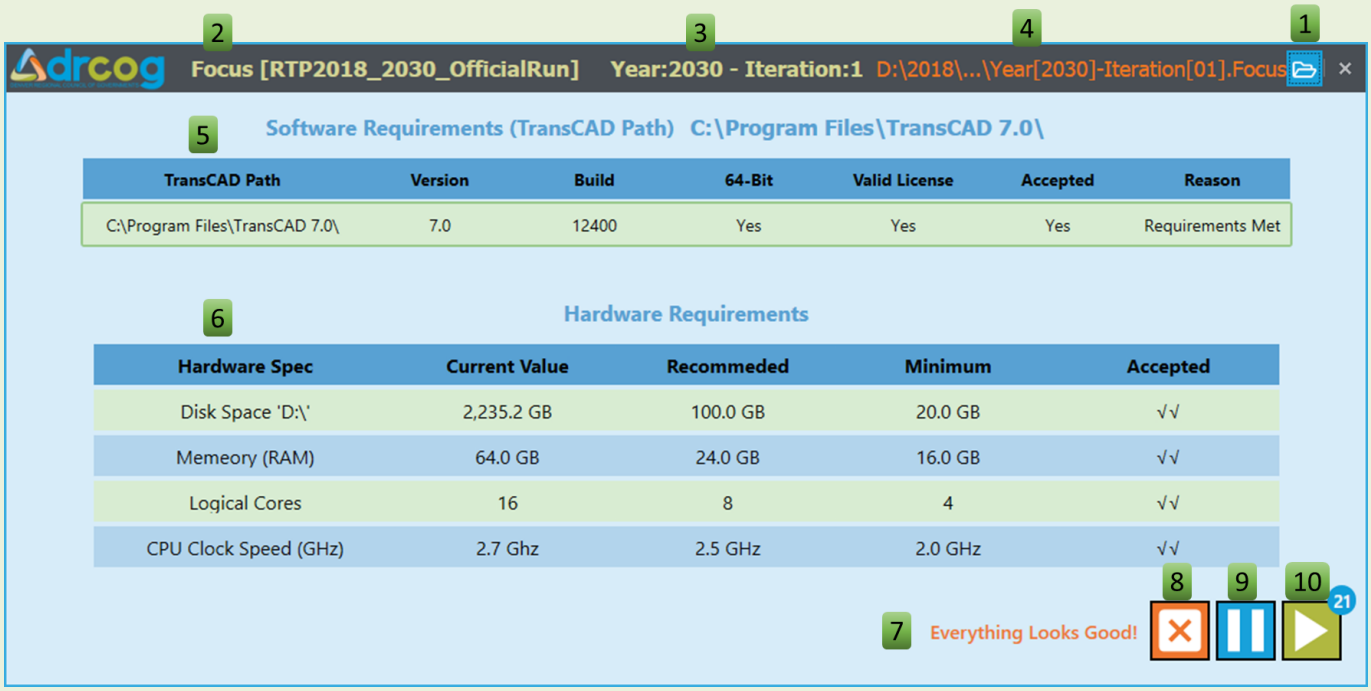
When you open ***Focus*** software, you will see the following screen:




1. To open a ***Focus*** project (.Focus), click on the open icon  located at title bar to the left of the close icon  .
2. This will open a window open dialog to navigate through the computer file system to locate the desired project
3. Click open button to go to the next screen.

### 5.1.2 Focus Starting Interface after opening a project

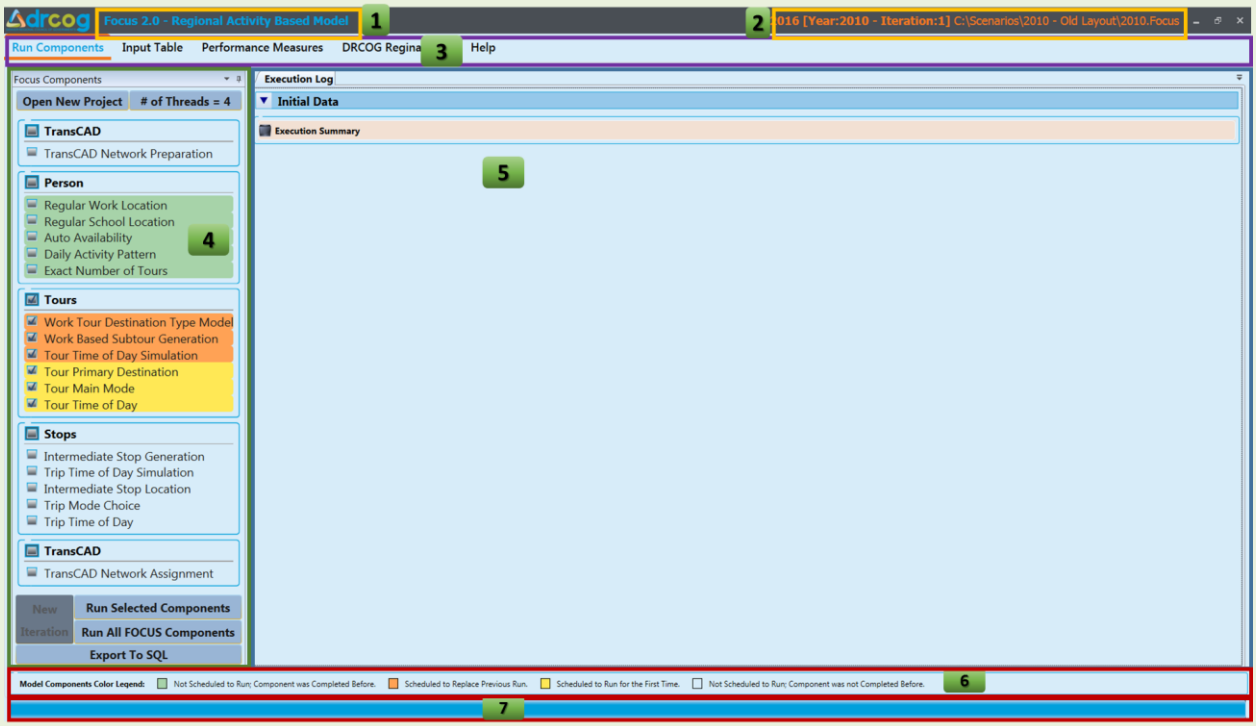



1. The Open Icon  remains at the same location in case the user wants to open another ***Focus*** project file.
2. The left side of the title bar shows the project name **see @ Focus 2.3 Metadata[CSharp].docx**.
3. The middle portion of the title bar displays the staging year and the iteration number.
4. The right side of the title bar displays the location of the opened ***Focus*** project file. The screen is divided into two section:
5. This section displays any installed path of TransCAD software and allows the user to select the desired path to run with; this feature is only available when 2 or more TransCAD installations were found.
6. This section shows some requirements that must be met for ***Focus*** to run smoothly, for every requirement it lists user's computer score, recommended, minimum, and Focus decision to accept the computers score or not:

   a. Disk space (GB) for the drive where the staging network data folder is located
   b. Available RAM (GB)
   c. Number of logical cores
   d. Core speed (Ghz)
7. The middle bottom of the screen displays a summary message about Focus decision mention above
8. The user can click on  icon to close ***Focus*** interface
9. The user can click on  icon to prevents ***Focus*** from automatically switching to the main interface see the next bullet
10. The user can click on  icon to continue to the main window, see @ 5.2
   a. If all requirements were met, ***Focus*** will continue to the main interface after 25 seconds from the time the project was opened
   b. The icon displays the number of remaining seconds before switching to the main interface
   c. The count-down will stop and disappear if the user clicked on  icon. Focus will not change the visible window in this case.

## 5.2 Main Interface

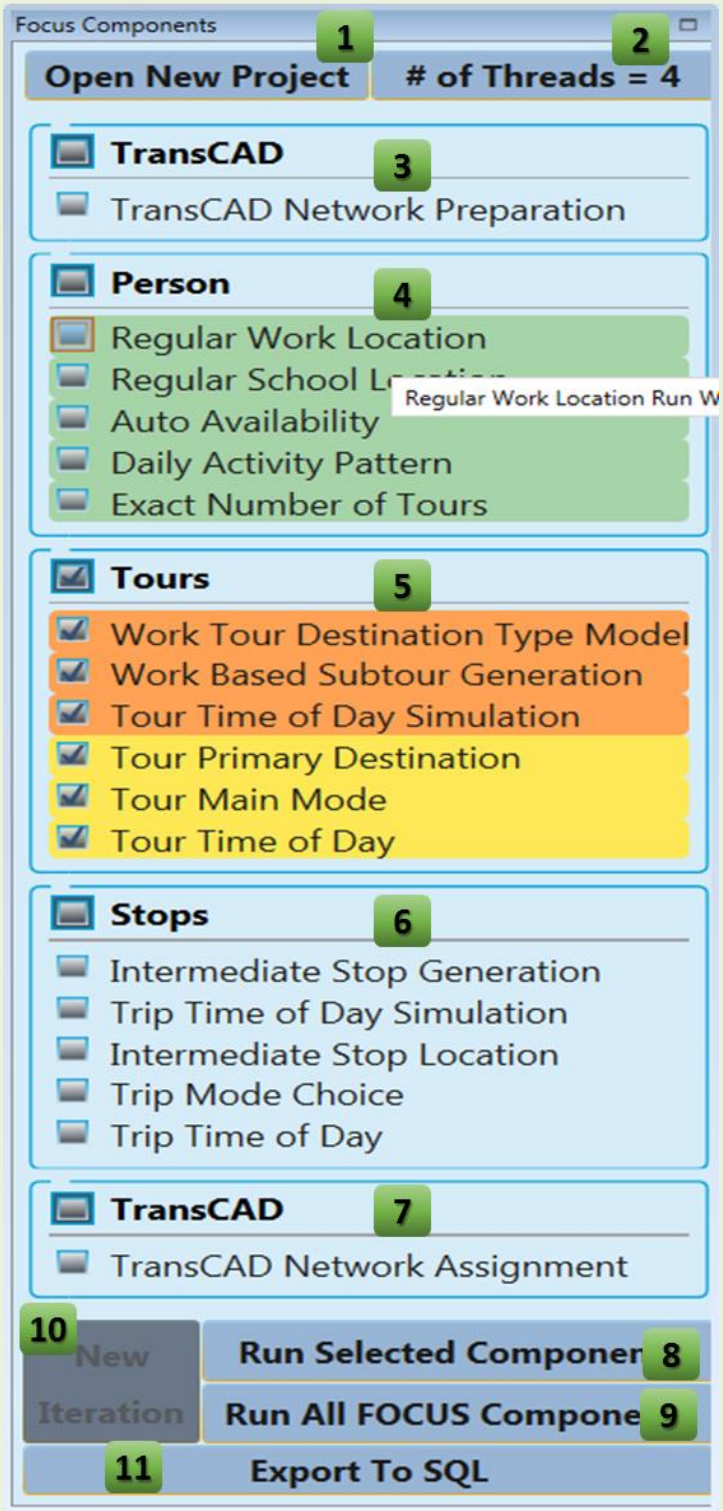
When you open ***Focus*** software, you will see the following screen:




1. Application name and version.
2. Project name with its full path.
3. Each "**Tab page**" hosts a main functionality in the ***Focus*** software.
4. This section of the screen hosts the Various Components of the ***Focus*** model.
5. This section hosts "**Execution Log**". When starting new task, the start date and time will be the title of the corresponding "**Execution Log**" page.
6. This section shows the completion status of the ***Focus*** model components.
   - Component run was completed.
   - Component run was completed, and is selected to be rerun.
   - Component run was not completed, and is selected for execution.
   - Component was not completed and is not selected.
7. This area displays the progress status bar for the task(s) in execution.

# 5.3 Run Components TAB

## 5.3.1 Component Selector Panel




1. Opens a dialog box that asks to locate the desired project file to be loaded. (for more information, see page **31**).
2. Allows the user to modify the number of logical cores reserved for ***Focus*** to use while executing. (for more information, see page **33**).
3. Opens TransCAD to perform network preparation and initialization. (for more information, see pages **6,** and **10**).
4. Person Components: Generates **Person Table Data**. (for more information, see page **7**).
5. Tours Components: generates Tours for the **Tours Table Data**. (for more information, see pages **8** and **9**).
6. Stops Components: Generates **Stop Data Table**, and **Trips OD Matrices** by occupancy for different time periods. (for more information, see pages **9** and **10**).
7. Opens TransCAD to perform network Assignment. (for more information, see page **10**).
8. Allows the user to execute subset of the components. (for more information, see page **42**).
9. Selects Person, Tours, and Stops components and Executes them. (for more information, see page **42**).

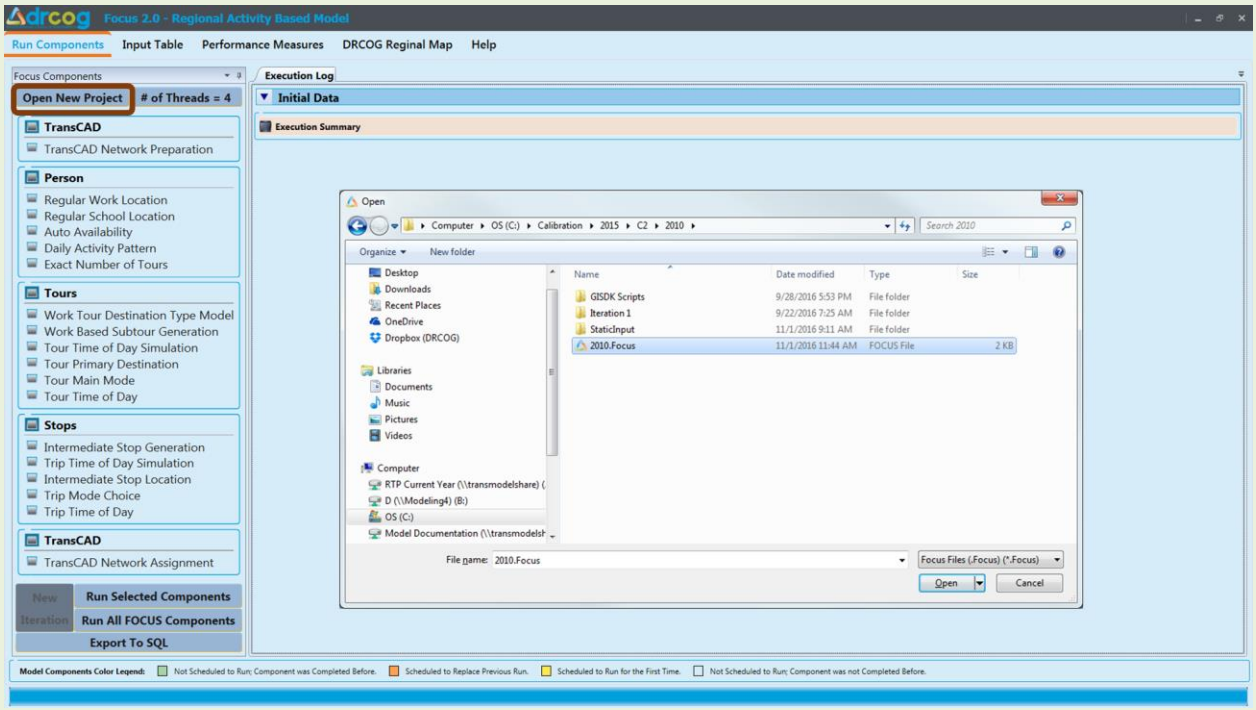
10. **New Iteration** button will be enabled only after all ***Focus*** components in 4,5, and 6 are completed. Once clicked, it will back-up the project configuration file, modify it by incrementing the iteration by one and clear the execution history section, create a new iteration folder, update the component selection panel to reflect the status of the new iteration, and finally disable itself.
11. If **Person**, **Tours**, and **Stops** Data Tables exist, the user can use this option to transfer the results a desired Microsoft SQL server. (for more information, see page **37**).

## Notes: Selection Rules for Focus Model Components

- The user can select any component in the left side panel with few rules:
  - Exact Number of Tours will always force selecting Daily Activity Pattern.
  - If the User selects two components, all intermediate components will be selected as well.
  - The user is not allowed to deselect any of the intermediate components.
- Each component requires the completion of the previous component (i.e., the previous component was completed before, or selected with the current component for the scheduled run).

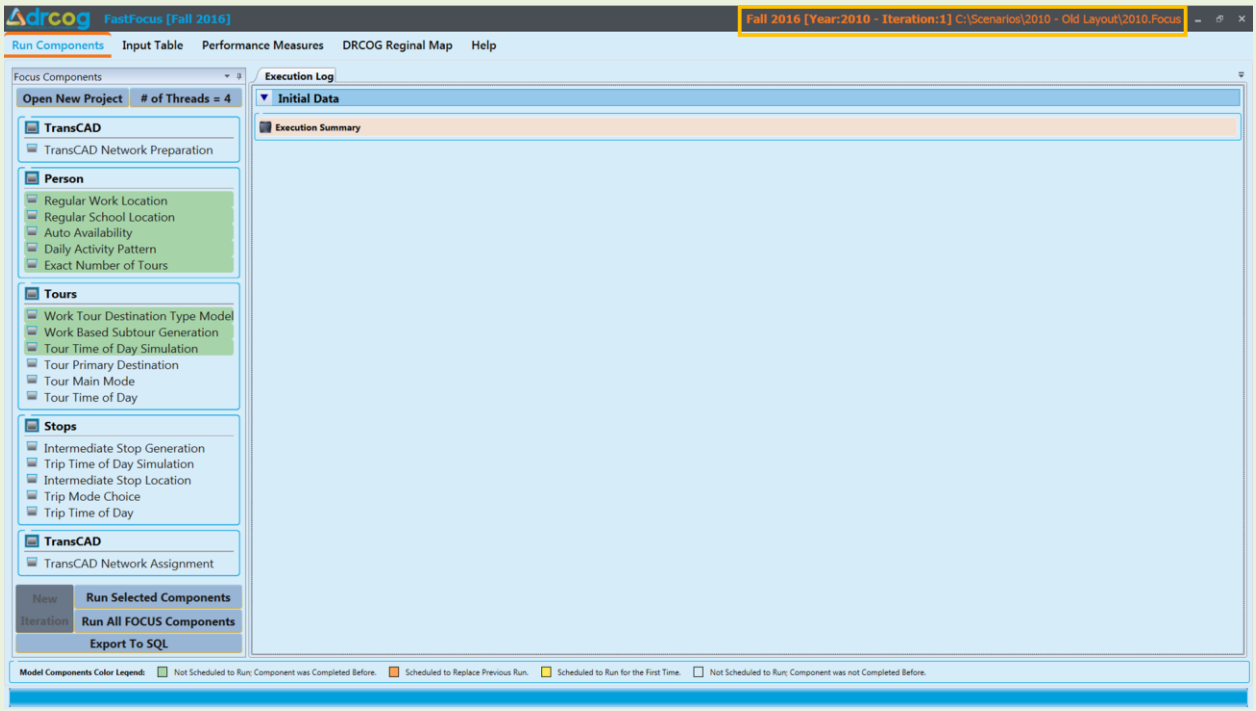
### 5.3.1.A Open a New Project

- The user can open a project by clicking on the "Open New Project" button or by simply start executing any component; if started executing without having a project opened it will automatically open a dialog box and force the user to select a project file.

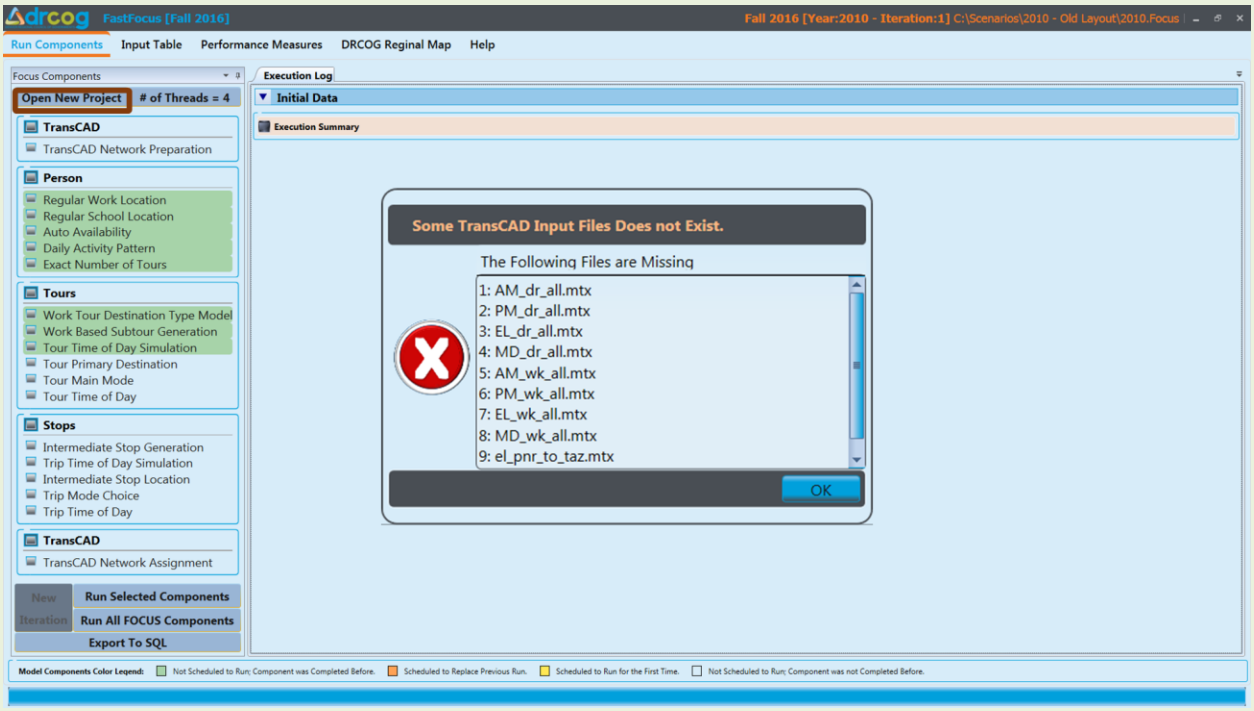



- ***Focus*** application will always remember the last project.
- When executing ***Focus*** software, it will automatically select the previously opened project.

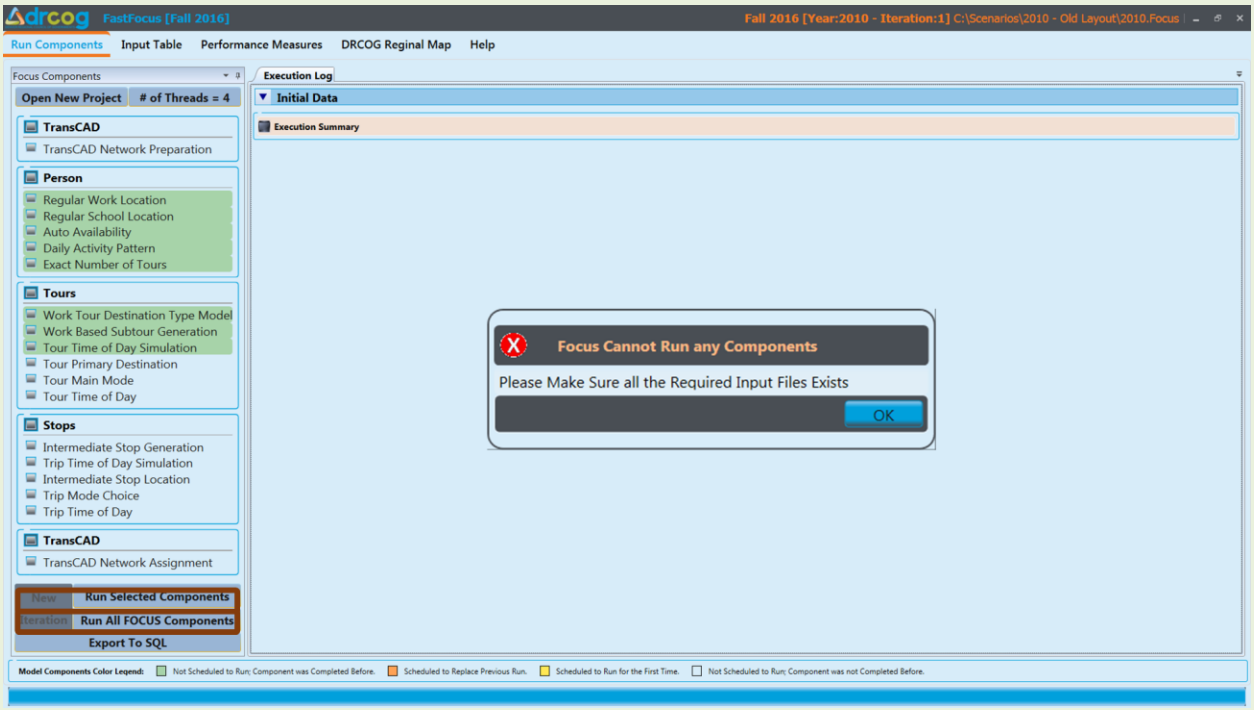
- The user can tell if a project was opened or not by looking at the right side of the title bar. The user should see the project name, Model Year, Iteration Number, and the project's full path if a project was opened successfully. Also, if some component runs were completed, they will appear with a green background color.



- ***Focus*** Software will check for missing files. If any file is missing it will generate a message showing a list of the missing files.

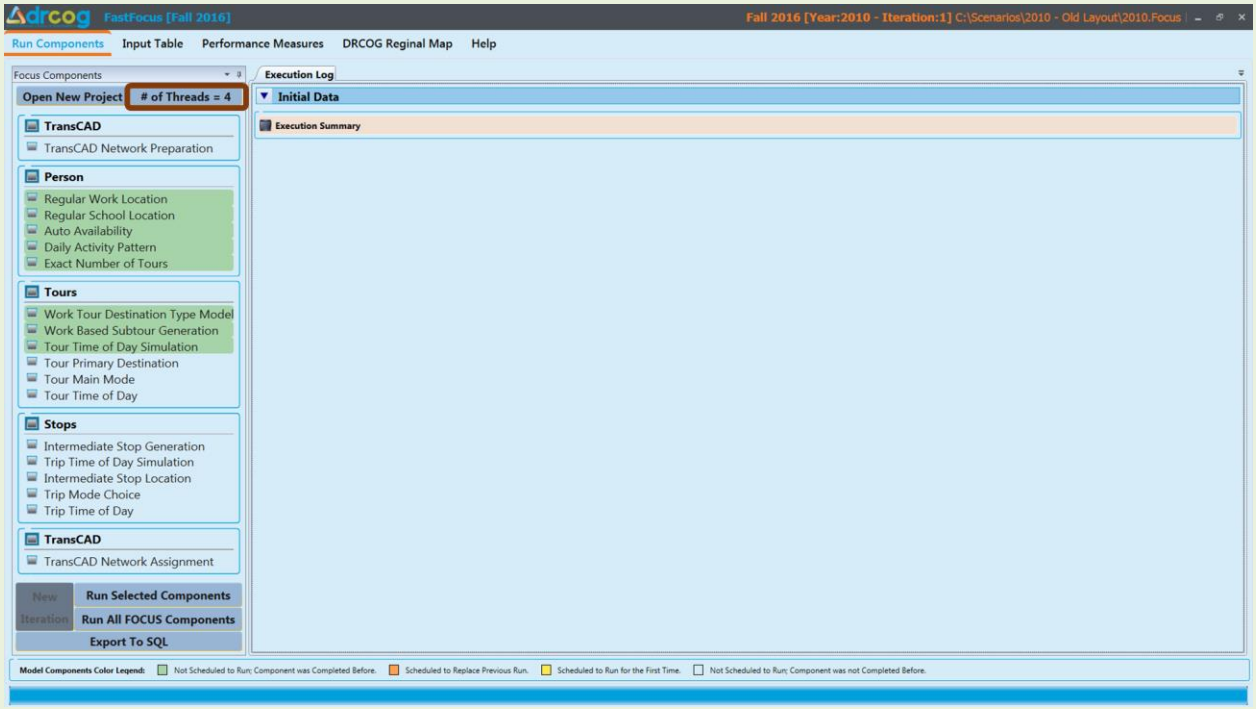


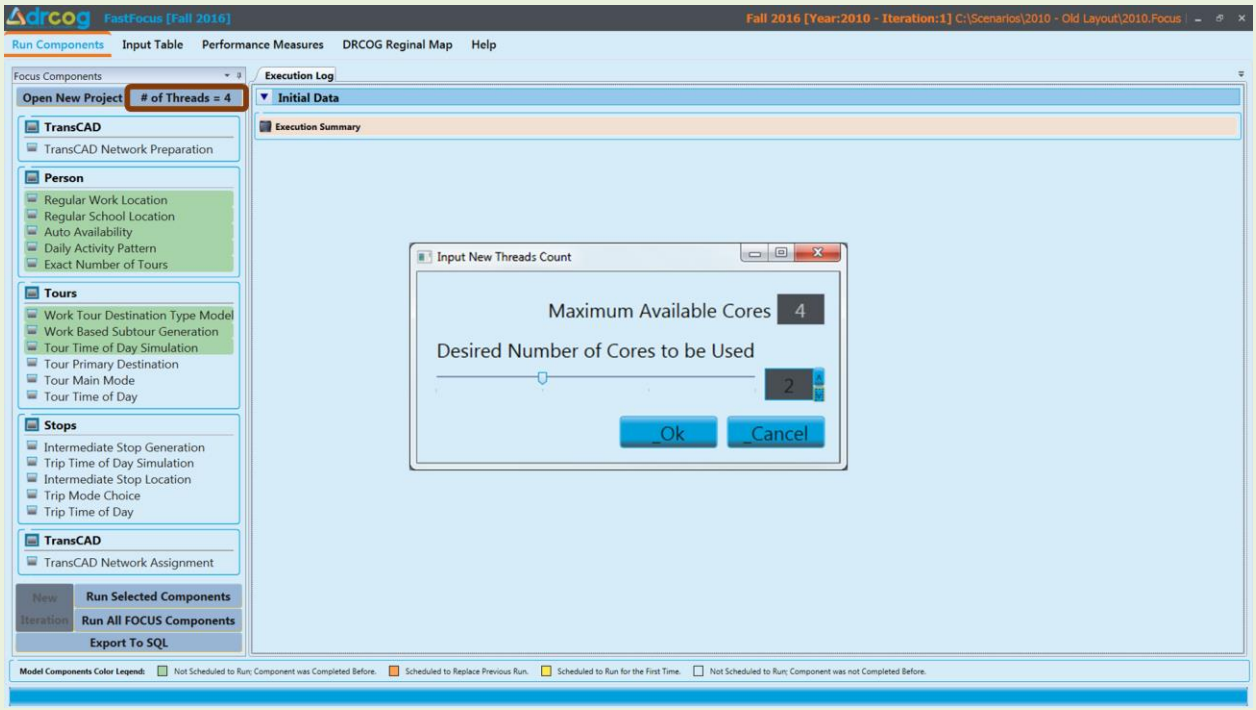

- ***Focus*** software will not allow the user to perform any component in the case of missing files.



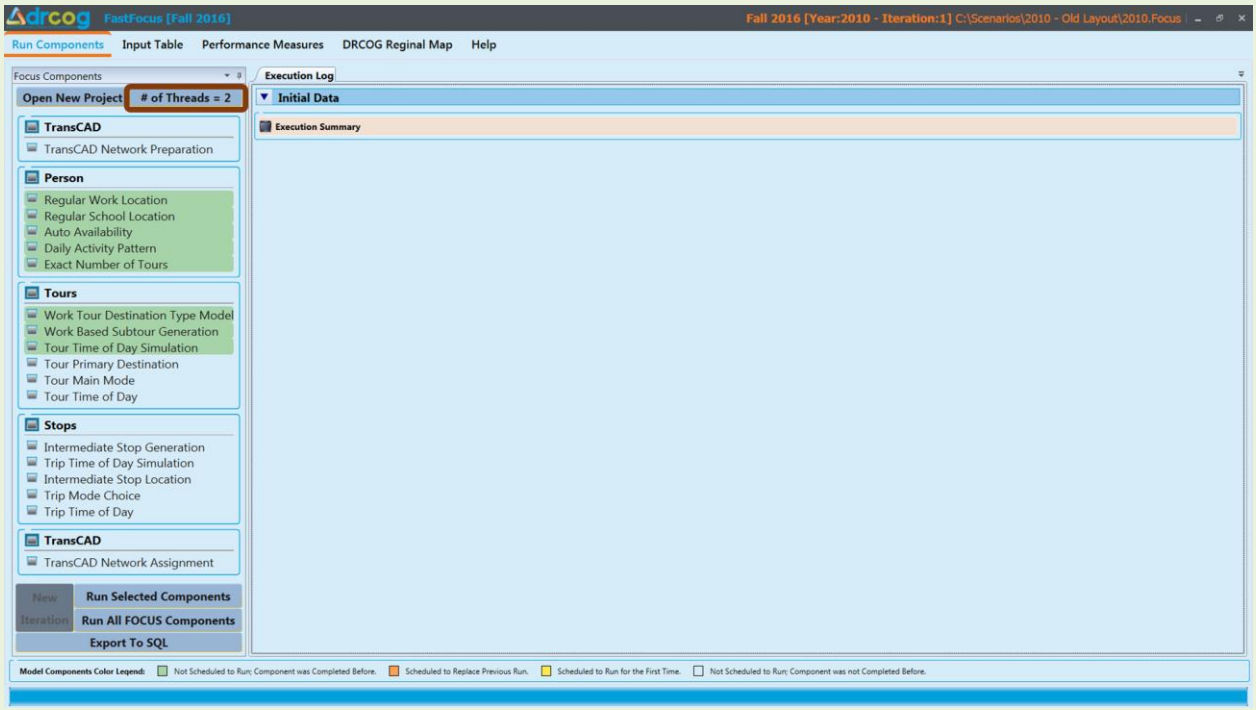
### 5.3.1.B Number of Threads

- ***Focus*** automatically calculate the maximum number of logical cores (Threads) available in the user's computer.
- Upon startup, ***Focus*** automatically sets the "**Desired Number of Cores**" to the maximum available.
- ***Focus*** interface allows the user to modify the "**Desired Number of Cores**".
- When the user clicks on **"# of Threads = n"** button, a pop up screen shows that shows what is the maximum available in the computer, and allocated value for the desired number of cores. The user can modify this value.






- The user is not allowed to exceed the maximum available number of existing logical cores.
- The "**Desired Number of Cores**" cannot go below 1.
- Number of Threads can be changed using:
  - Dragging the **Slide bar** left or right.
  - Clicking on the **Up/Down** buttons.
  - Manually write the number of desired threads in the designated area.
- Once the user selects the desired number of cores and clicks on the **"OK"** button:
  - The thread modification screen disappears.
  - "**n**" in the text displayed on the "**# of Threads = n**" button will be replaced by the new value of "**Desired Number of Cores**".

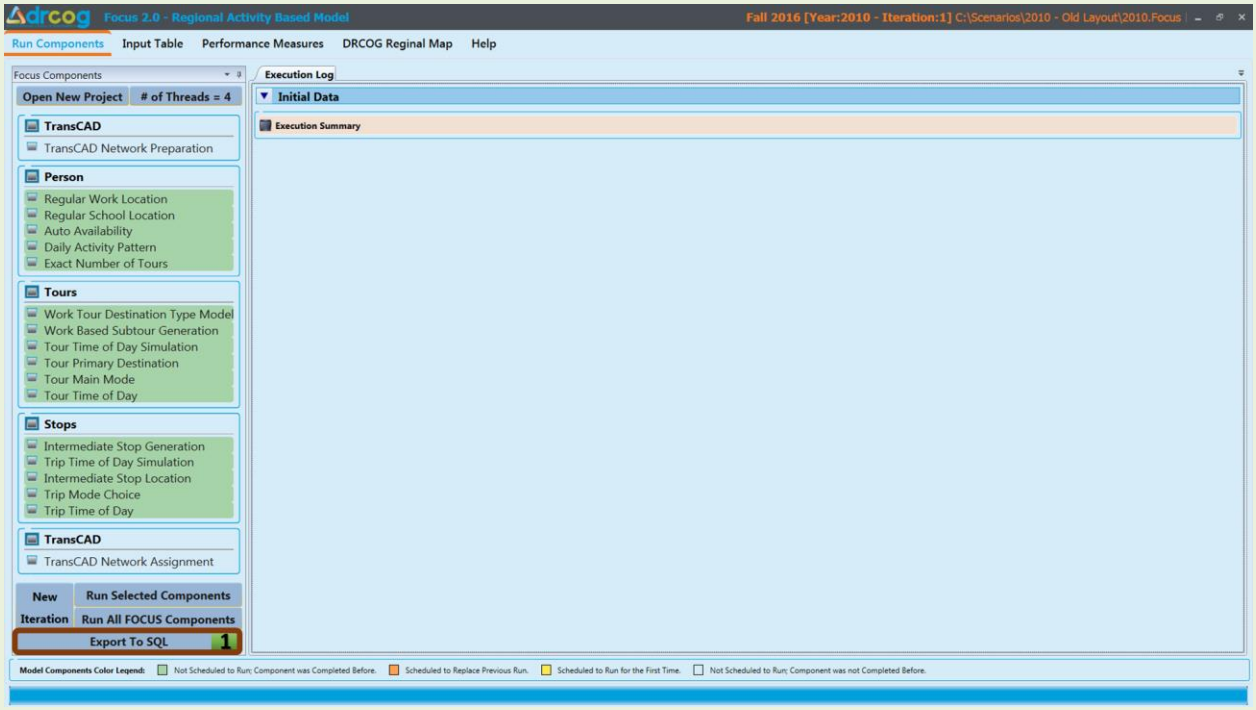



- In the example shown in the figures:
  - ***Focus*** software calculated the "**Maximum Available Cores**", and "**Desired Number of Cores**" and sets their values to 4.
  - The user picked the value 2 for "**Desired Number of Cores**".
  - The new text displayed on "**# of Threads = n**" is now changed to "**# of Threads = 2**"

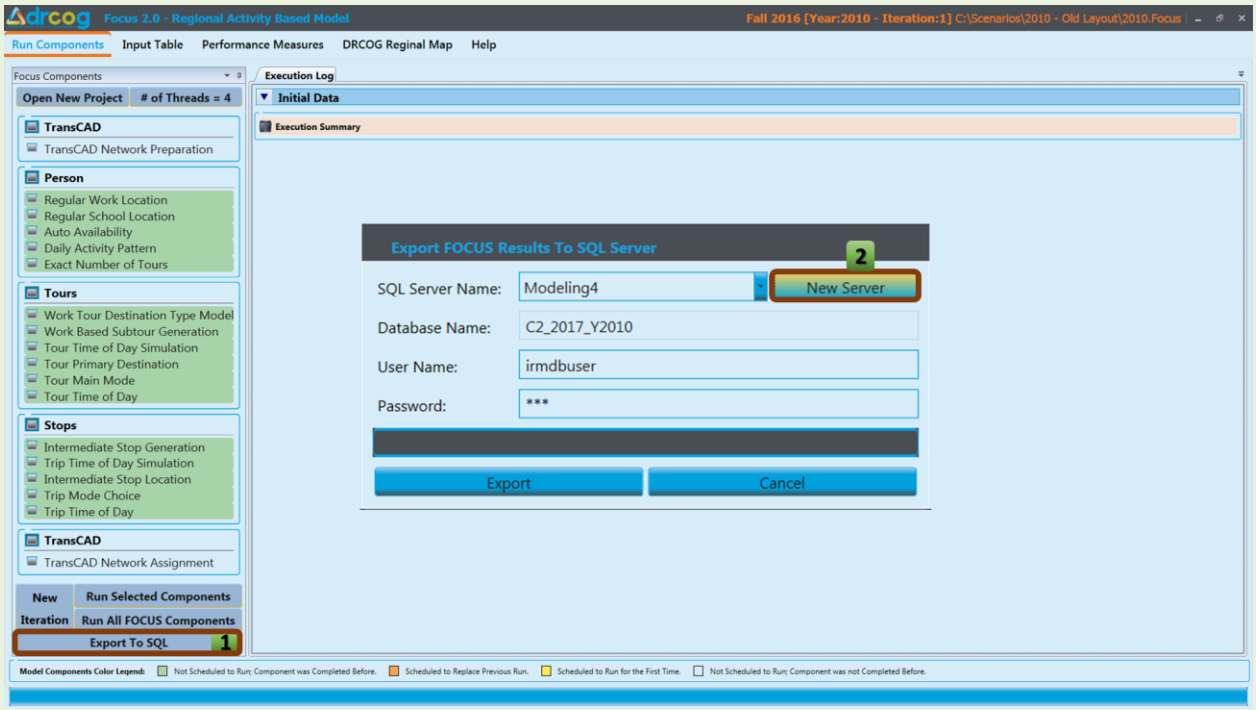
### 5.3.1.C Export Results to Microsoft SQL Server

***Focus*** interface is capable of exporting the model run results (**Persons**, **Tours**, **Stops** data tables) to Microsoft SQL Server. To perform the export to SQL process successfully, please follow the steps below:

1. To start the process, the user needs to click **"Export To SQL"** button

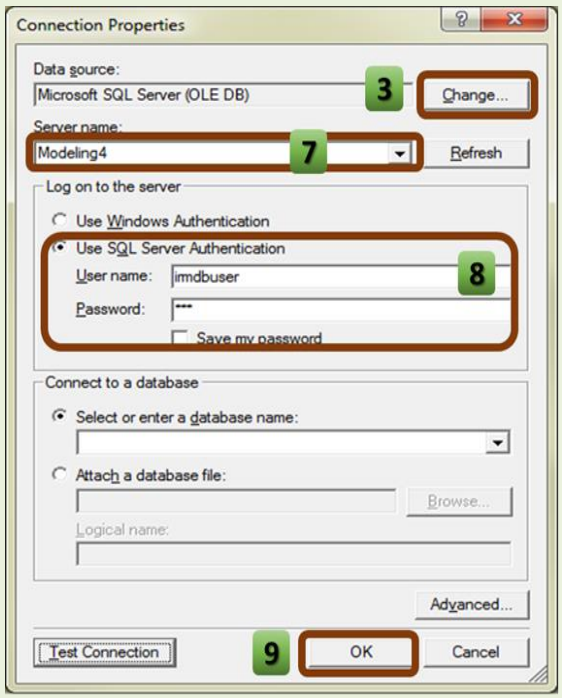


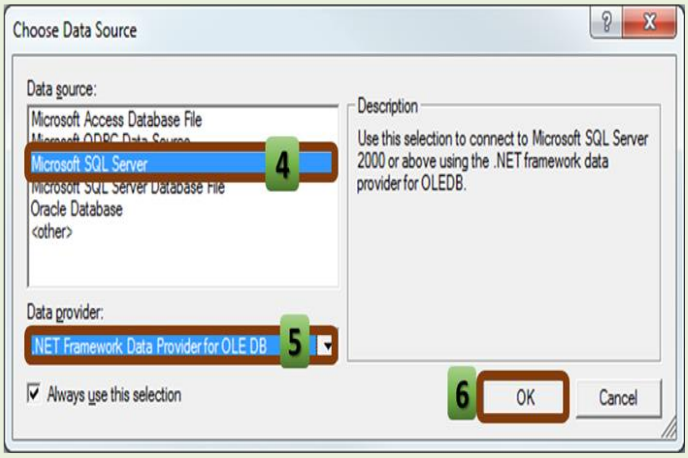
2. The user now has the option of:
    a. Filling the fields to match the targeted MSSQL database server (server name, user name, and password)
    b. If a.) is not working, the user can click **"New Server"** button which will open a Microsoft tool to automatically fill the fields and some other internal settings



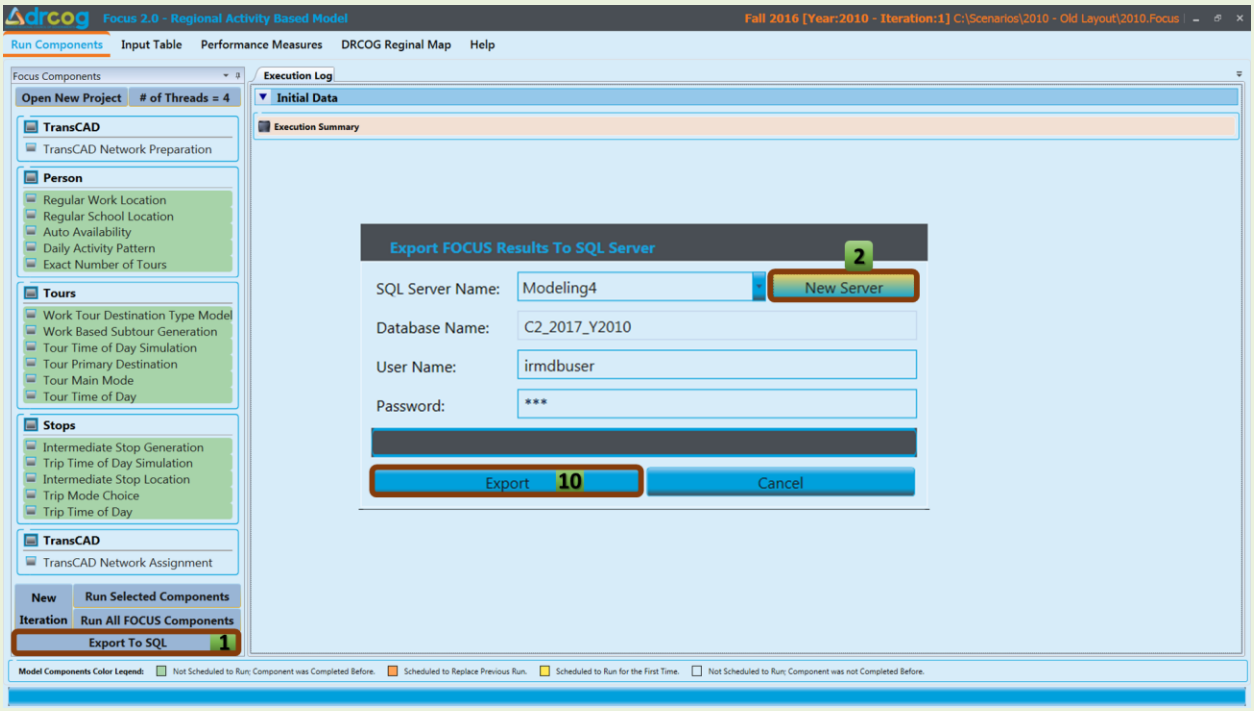
3. The user now should click on **"Change"** button
4. Select **"Microsoft SQL Server"** as a data source
5. Select **".NET Framework Data Provider for OLE DB"** as a data provider.
6. Click the **"OK"** button
7. Write the server name or click on the ▼ to open a list of available servers and select the desired one
8. Fill the credentials needed to access the SQL server.
9. Click the **"OK"** button

**Note: In theory, Steps 4. and 5. can be changed to fits the configuration of targeted server. However, we only tested them using the Data source, and Data provider settings mentioned above.**

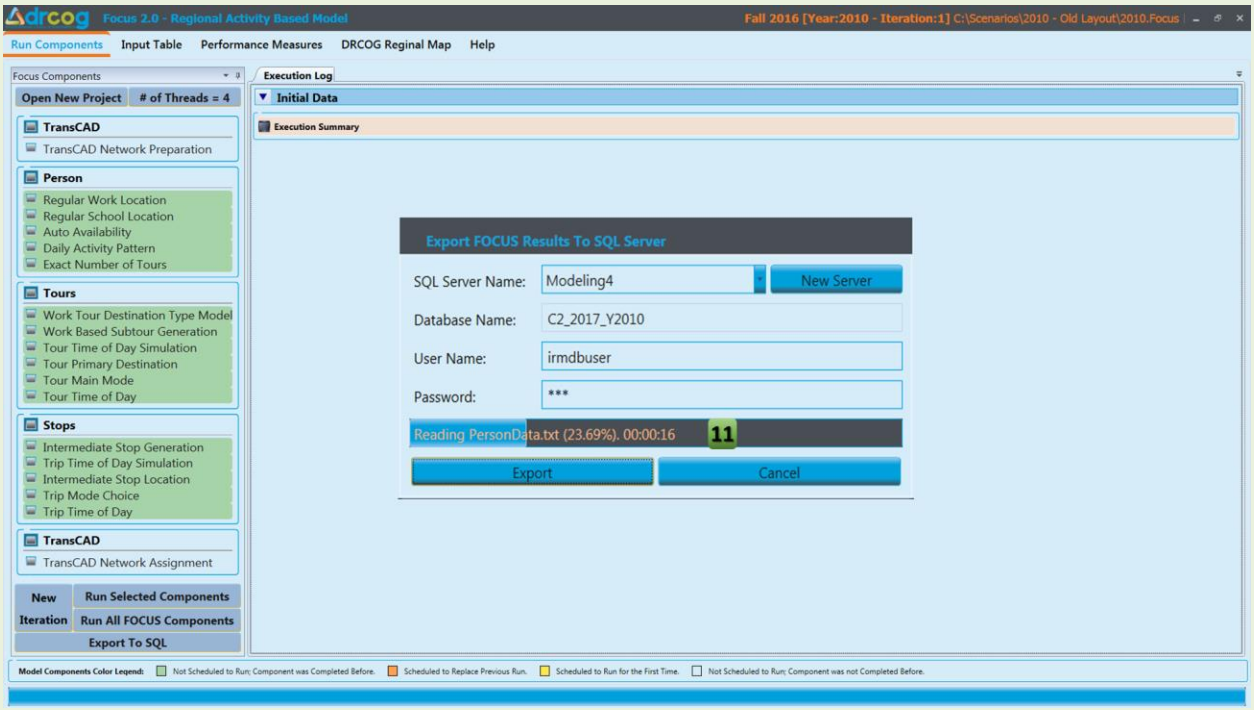


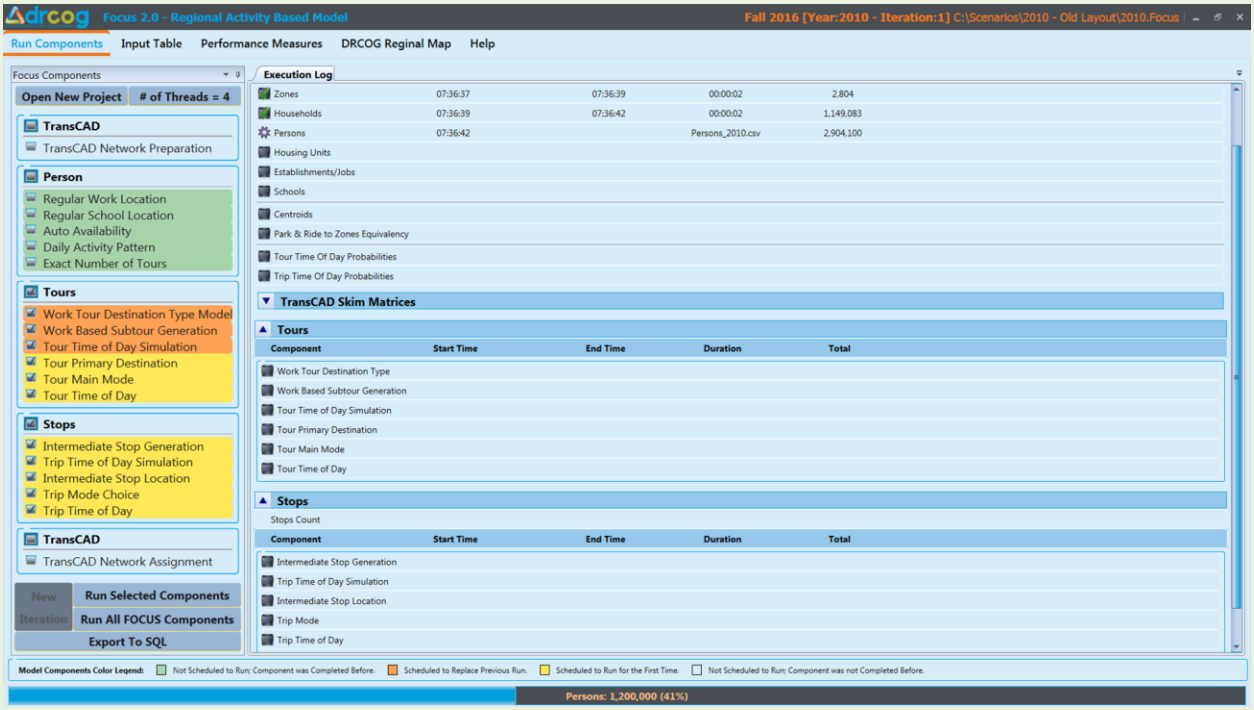
10. Click the **"Export"** button.




11. ***Focus*** will automatically generate a new database in the SQL server, **Persons**, **Tours**, and **Stops** Tables. Once the export process finished, the Export screen will disappear after displaying a message indicating the success of the process with the time it took to export the data tables to the destination MSSQL server.




## 5.3.2 Execution Log Page



1. Once a run is started, the right side of "**Run Components**" Tab page will show the current progress of:
   - Reading of the input files
   - Components execution
   - Writing of the output files
   - Calculation status of the performance measures
   - Writing Trips OD Matrices
2. The **"Initial Data"** is composed of a) Land Use / Demographic / Initial Settings, b) TransCAD SKIM Matrices, and c) Tours/Trips time of day initialization files.
   - The start time, end time, duration of reading the "Initial Data" files are shown once the reading process started.
   - A simple statistic ("**Total**", or "**Establishment /Jobs**") are shown under the "**Total**" column.
3. The execution status of the selected components is displayed in the same way as in the left-side panel (**Focus Components**).
   a. The start time, end time, and duration are shown once the component run is started to run.
   b. A simple statistic ("**Total**") is also shown under the "**Total**" column for some of the components.
4. The overall progress is shown in the form of a progress bar at the bottom of the screen with some simple messages to show the actual progress value.

### 5.3.3 Focus Project Configuration File

```
{
  1
    "ProjectName": "FFCalib2016-2010",
    "ModelYear": 2010,
    "Cycle": "none",
    "Iteration": 1,
  2
    "GISDKScripts": "GISDKScripts",
    "StaticInputFolder": "StaticInput",
    "InputFolder": "Input",
    "OutputFolder": "Output",
    "FocusFolder": "Focus",
    "TransCADFolder": "TransCAD",
  3
    "ParametersFile": "Parameters.txt",
  4
    "PersonsFile": "Persons.csv",
    "ZonesFile": "Zones.csv",
    "HouseholdsFile": "Households.csv",
    "HousingUnitsFile": "Housing_Units.csv",
    "SchoolsFile": "Schools.txt",
    "CentroidsFile": "Centroid.csv",
    "EstablishmentsFile": "Establishments.csv",
  5
    "Tour_TimeOfDay_AlternativesFile": "TourTimeOfDayProbs_FRTC.csv",
    "Trip_TimeOfDay_AlternativesFile": "TripTimeOfDayProbs_FRTC.txt",
  6
    "ExecutionHistory":
    {
        "Regular Work Location": "2016-10-31T06:53:48.6195564-06:00",
        "Regular School Location": "2016-10-31T06:53:48.6305575-06:00",
        "Auto Availability": "2016-10-31T06:53:48.6305575-06:00",
    }
}
```

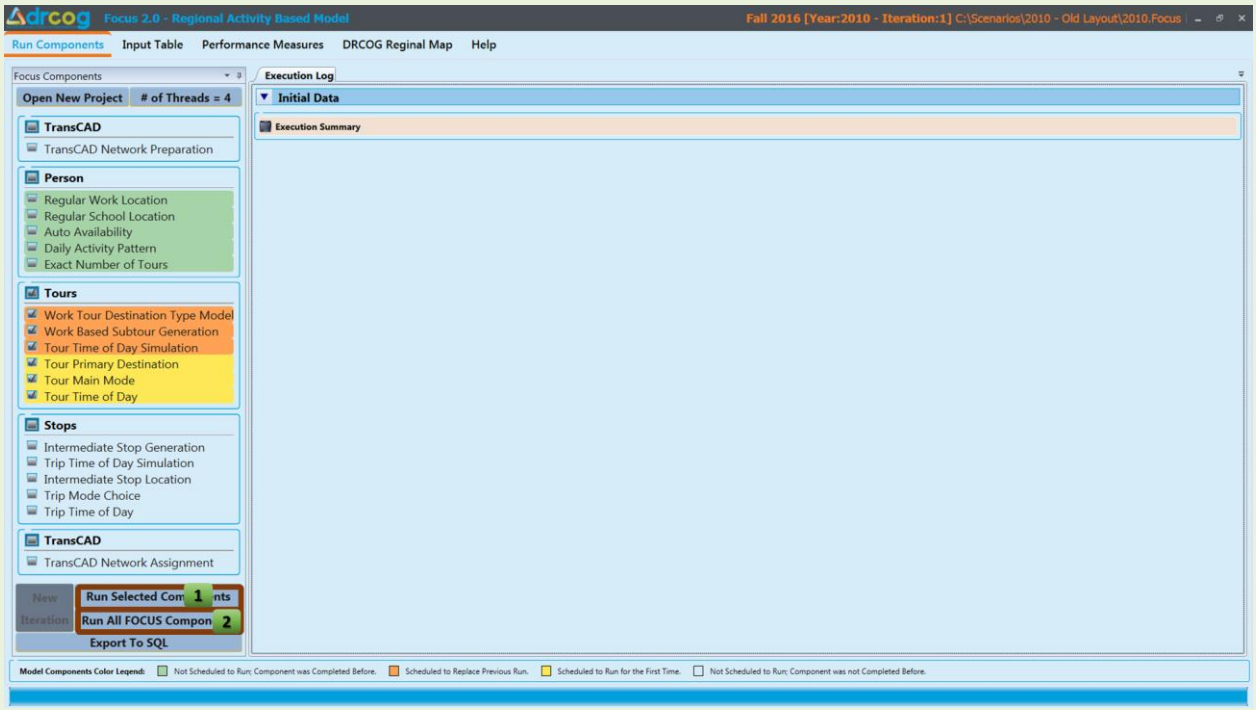
**Note: The configuration file designed in JSON file format, and the fields order is not important. If a file/folder entry is missing, Focus assumes the default name for that file/folder is being used. See Error! Reference s ource not found. for more information.**

1. Describes the scenario being loaded:

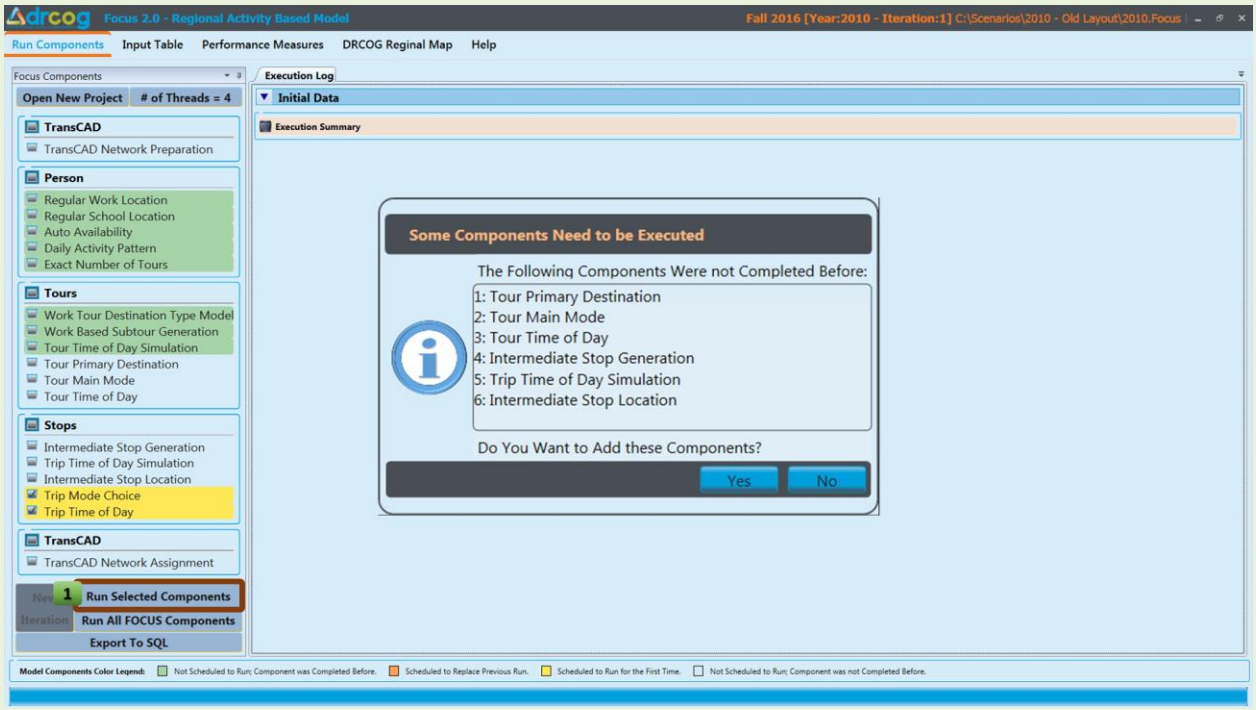
- "ProjectName": Shows a simple description to help the user remember the purpose of the scenario.
- "ModelYear": defines the year of the model.
- "Cycle": Tracks when the run was performed.
- "Iteration": shows how many runs were performed for the selected model year in the process of achieving speed balancing.

3. Describes the layout of scenarios' sub folders.
4. The parameters data used in ***Focus*** software.
5. Defines the file names containing the Land-Use/Demographic data.
6. Defines the Tour/Trip initial choices for different time of day periods.
7. The execution history of ***Focus*** Components is stored in this section.
   - If the Scenario iteration is completed, "ExecutionHistory" will display all the ***Focus*** components along with the date and time they were completed.
   - Only completed components will be displayed here.
   - The user should not modify this section; ***Focus*** software auto generates this list.
   - Once the project configuration file is loaded, ***Focus*** software will check for the correctness of this list.
     - It will omit any component identified as completed if there were no results found for the component.
   - For a full list of the ***Focus*** model component, see page **11**).

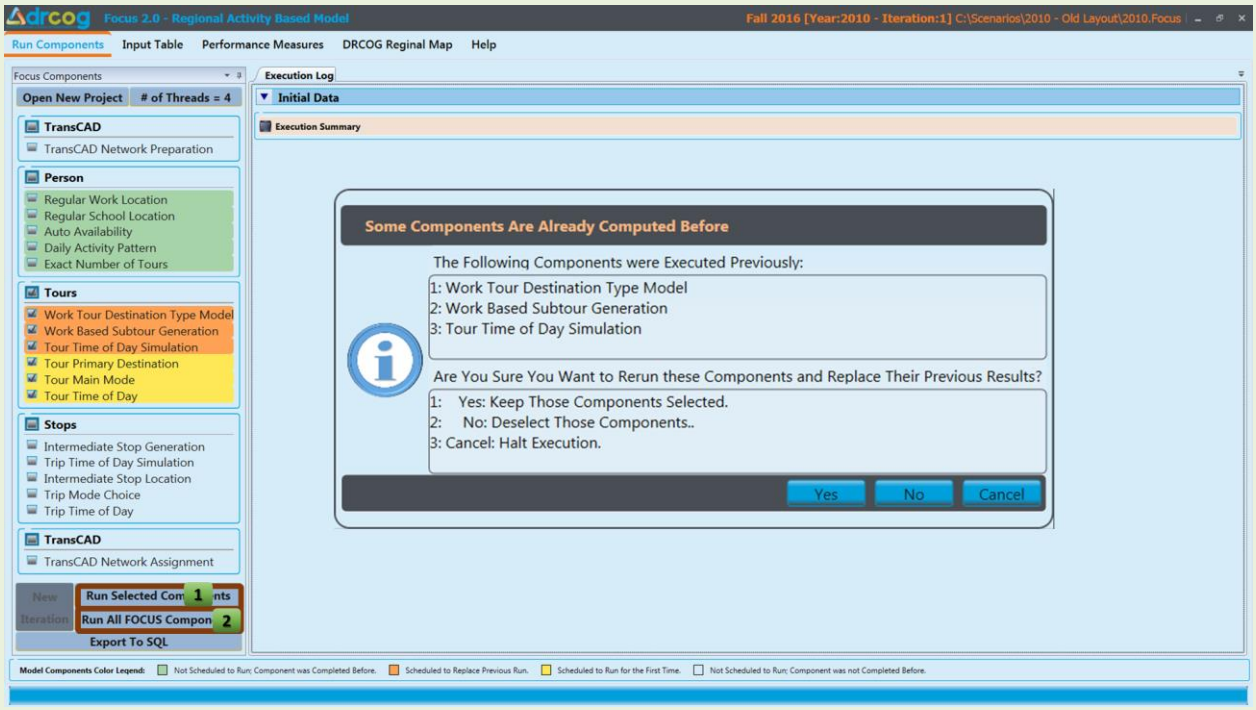
### 5.3.4 Running Focus Components



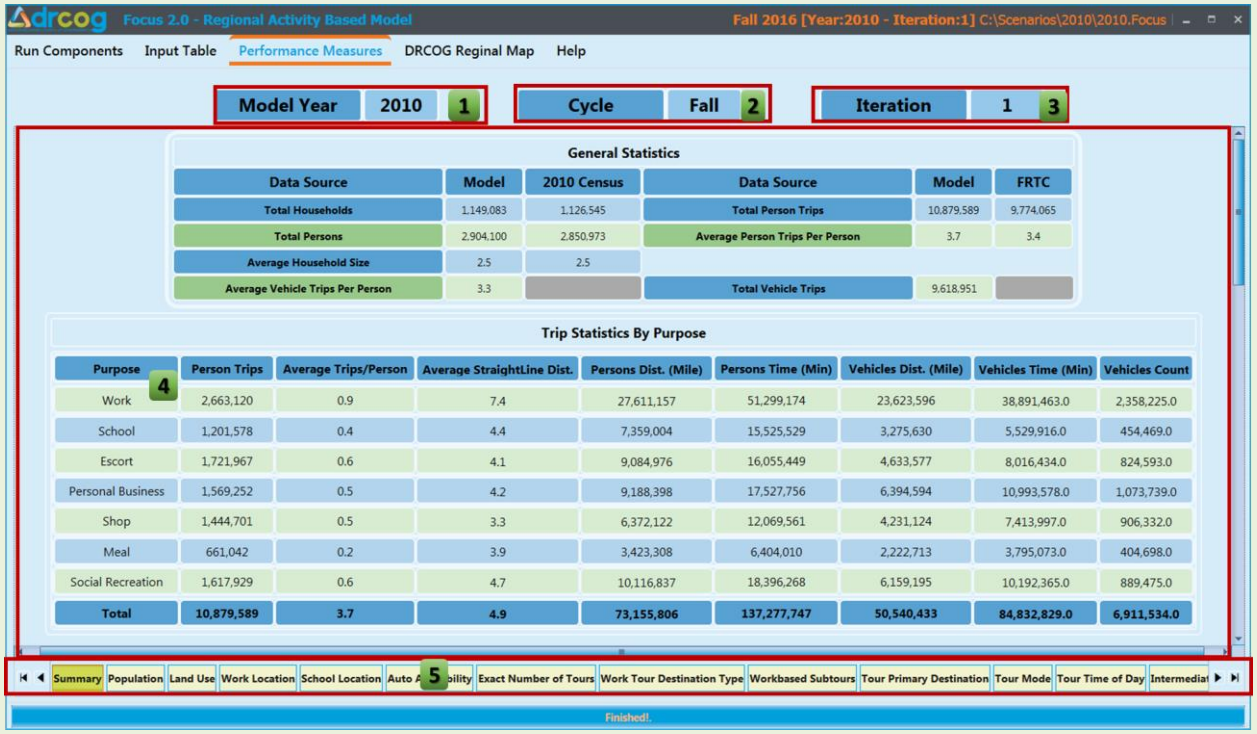

1. The user can start the calculation process by selecting some of the components followed by clicking on "**Run Selected Components**" button.
2. Also, the user can simply click on "**Run All FOCUS Components**" button which will auto select **Person**, **Tours**, and **Stops** components (a total of 16 components) for execution.
   - In the current version of ***Focus***, ***Focus*** software will only open TransCAD interface. Then the user should manually start the TransCAD components (i.e., Network Preparation, and Network Assignment).
   - This goal us to modify this in future versions of ***Focus*** to be fully integrated in the automated process.
3. If the user selects some components without having the predecessor components being completed or selected in the current run., "**Run Selected Components**" will display a message showing which components are required to be added to the current execution process.
   - Clicking on "**Yes**" button will add those components to execution queue.
   - Clicking on "**No**" button will simply cancel the process.


Focus 2.0 - Regional Activity Based Model
Fall 2016 [Year:2010 - Iteration:1] C:\Scenarios\2010 - Old Layout\2010.Focus
Run Components
Input Table
Performance Measures
DRCOG Reginal Map
Help
Focus Components
Execution Log
Open New Project
# of Threads = 4
Initial Data
Execution Summary
TransCAD
TransCAD Network Preparation
Person
Regular Work Location
Regular School Location
Auto Availability
Daily Activity Pattern
Exact Number of Tours
Tours
Work Tour Destination Type Model
Work Based Subtour Generation
Tour Time of Day Simulation
Tour Primary Destination
Tour Main Mode
Tour Time of Day
Stops
Intermediate Stop Generation
Trip Time of Day Simulation
Intermediate Stop Location
Trip Mode Choice
Trip Time of Day
TransCAD
TransCAD Network Assignment
1
Run Selected Components
Run All FOCUS Components
Export To SQL
Some Components Need to be Executed
The Following Components Were not Completed Before:
1: Tour Primary Destination
2: Tour Main Mode
3: Tour Time of Day
4: Intermediate Stop Generation
5: Trip Time of Day Simulation
6: Intermediate Stop Location
Do You Want to Add these Components?
Yes
No
Model Components Color Legend:
Not Scheduled to Run; Component was Completed Before.
Scheduled to Replace Previous Run.
Scheduled to Run for the First Time.
Not Scheduled to Run; Component was not Completed Before.

4. If the user selects some components that were completed before., "**Run Selected Components**" and "**Run All FOCUS Components**" will display a message showing which components are already completed before and still being selected for another execution.
    1. Clicking on "**Yes**" button will keep those components in execution queue. All subsequent components previous results will become invalid and need to rerun again if they were not selected in the current run.
    2. Clicking on "**No**" button will remove those components from execution queue.
    3. Clicking on "**Cancel**" button will simply cancel the process.



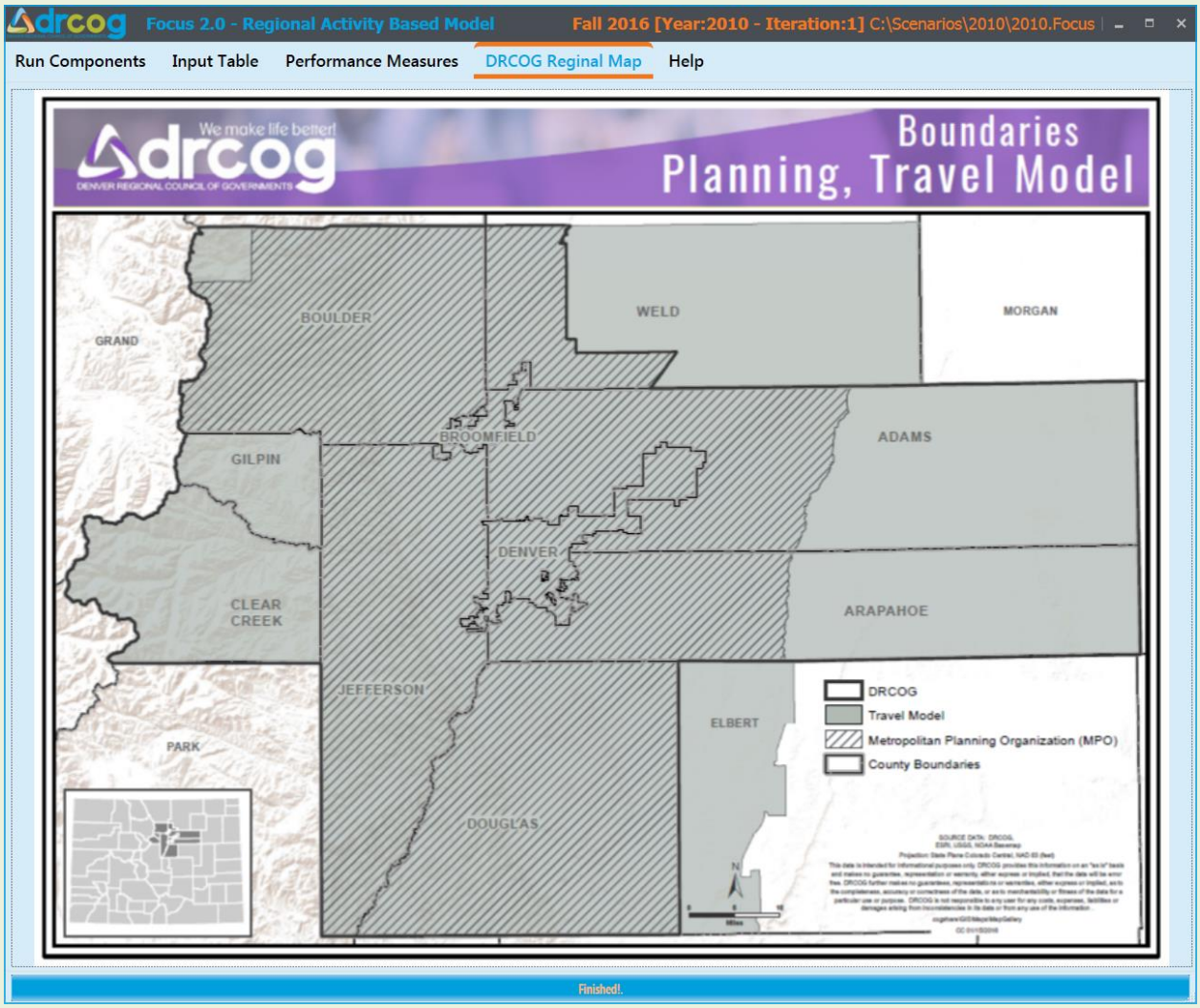
# 5.4 Performance Measures TAB




- ***Focus*** will generate a set of performance measures associated with each component, and compare them to the existing households survey data (if available).
- The results are also exported to Excel spreadsheet document (named "**Performance Analysis_Year#Iteration#.xlsx**") and saved at the output folder.
    1. Model year represents the year selected to estimate/predict its traffic volumes, speeds, and counts.
    2. This field represents the time of year the run when run was performed.
    3. The iteration field shows how many runs were performed for the selected model year in the process of achieving speed balancing.
    4. This section displays the performance measures generated for the selected performance category in 5.
    5. ***Focus*** software provides the user with the capability to change the performance measures.

- Clicking on any of the yellow colored button will change the contents displayed in 4.
- ◀ Button will scroll the performance categories bar to the left side
- ▶ Button will scroll the performance categories bar to the right side
- |◀ Button will scroll the performance categories bar to the left most
- ▶| Button will scroll the performance categories bar to the right most

# 5.5 DRCOG Regional Map TAB




This "**Tab**" page shows the region modeled in ***Focus***.

# 5.6 Help TAB


This "**Tab**" page displays abstract definitions of the codes related to **Facility Type**, **Mode Choice**, **Location Type**, **Time of Day**, and **Purpose**.

# Chapter 6: Working with Scenarios in Tripod

## 6.1 Introduction

The ***Focus*** Activity-Based Model allows users to forecast transportation-related outcomes in the Denver region based on certain input assumptions regarding socioeconomic activity, transportation networks and travel behavior. Often it is useful to compare multiple hypothetical outcomes to determine the most desirable policies and investment strategies.

## 6.2 What are Scenarios and Forecasts Sets?

For the ***Focus*** model, we define a scenario to represent a single forecast run using a combination of inputs – socioeconomics, transportation networks, behavioral assumptions represented by model parameters, and typically by a horizon year. More specifically, a scenario is identified by the following inputs, which may have unique file names if desired:

1. A TransCAD geographic layer representing the highway network
2. A TransCAD route system representing the fixed-route transit services
3. A collection of socioeconomic inputs (persons, households, establishments, schools, and zonal summaries) – however, this file must end with an underscore and the four-digit horizon year, and match the name of the UrbanSim *.csv zone table
4. The horizon year of the forecast being made (represented by a four-digit integer rather than a file name)

There are some additional files that may vary because of differences in the above inputs. Currently, some of these files have common default names. These files include:

1. **Transit fare** tables and zonal fare matrices
2. **Transit mode** information and transfer tables
3. **Transit route layover** tables, indicating routes and locations where extra in-vehicle time is incurred because buses (typically) wait at a rail station or other transfer center to allow passengers to make scheduled connections. This file may also be used to calibrate route travel times to match published schedules

4. **Park-n-Ride** "shadow price" tables, which are typically used to indicate which **PnR** locations should receive special treatment as more attractive end-of-line stations on rapid transit corridors, or other special transfer centers. These files can also be used to assess a time penalty for accessing a **Park-n-Ride** lots that typically fills up early in the day.
5. Highway turn penalty and prohibition tables.
6. **Mode choice** model specification files for the various airport trip purposes.

The term "**forecast set**" refers to a collection of related scenarios that typically were created around the same time, have a common topic, and were modeled using the same set of assumptions and software versions. For example, within DRCOG, forecast sets in the past have corresponded to our Regional Transportation Plan update cycles. The different scenarios correspond to the different staging years within the plan. For our planning partners and their consultants, forecast sets will typically represent corridor and area-wide studies (including NEPA and PEL efforts), FTA New Starts applications, or other study contracts. The scenarios within such a forecast set may include a base year calibration forecast, a future year no-action or baseline scenario, and multiple future year alternatives. The future years considered may be a long-run horizon year or an intermediate year for understanding phasing and staging options.

## 6.3 What are the advantages of using them?

Using forecast sets and scenarios is one method of organizing modeling and forecasting records in a way that facilitates documentation and recall should the forecasts need to be reviewed at some future time. For example, source code and compiled User Interface (UI) databases may be stored with the forecast set they were used to create. Future releases of ***Focus*** are planned to have common locations for certain invariant files (such as travel behavior parameters, zone boundaries, and other boundaries, such as of air quality study areas or the Regional Transportation District), thus reducing disk space requirements.

## 6.4 How are they treated in Focus?

***Focus*** requires scenarios to be organized in a particular manner, which makes it easier to distinguish between input files, intermediate calculations, and final forecast products.

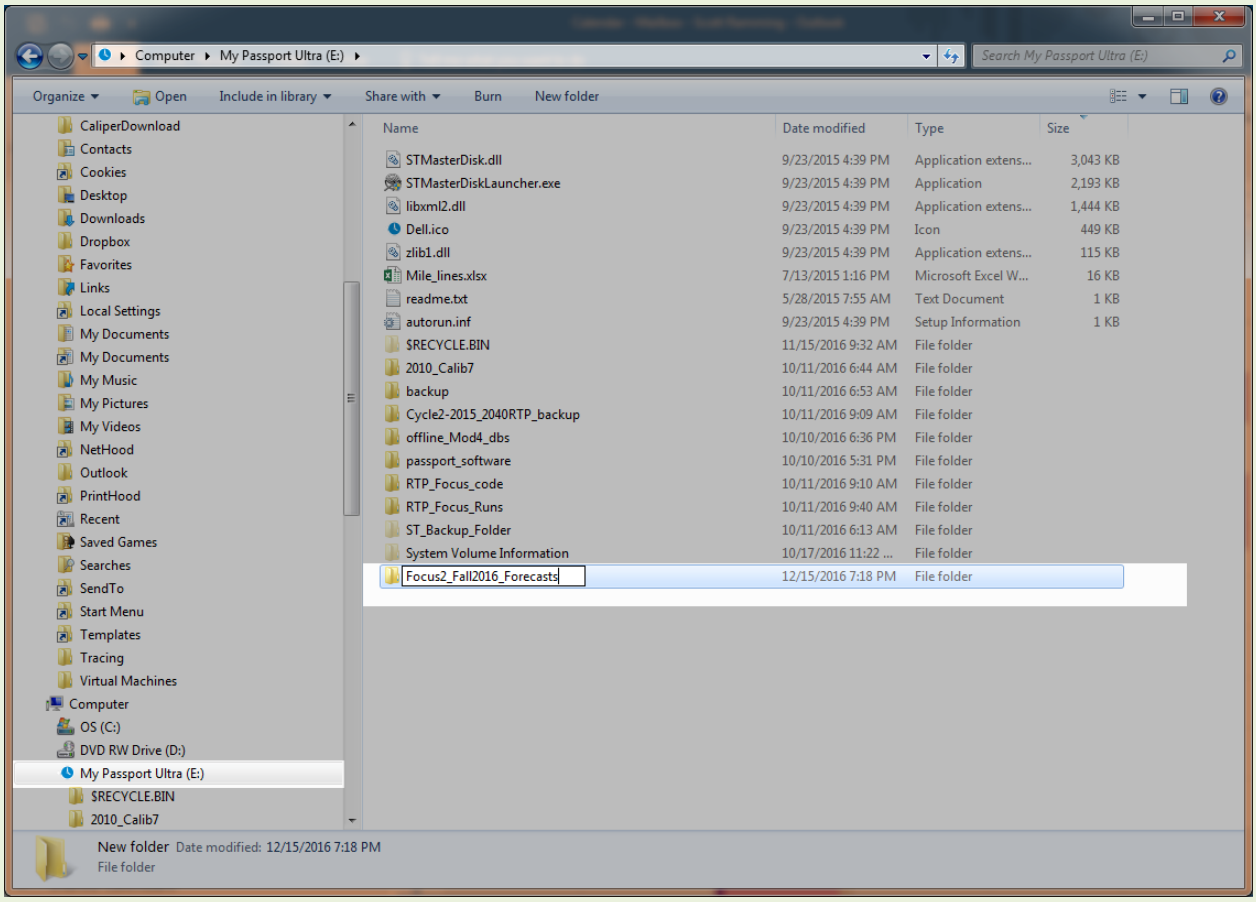
Future releases of ***Focus*** are anticipated to provide even better organization of various TransCAD files.

While every scenario of a particular forecast set is not required to reside in the same folder, such a practice is useful for organization and archiving.

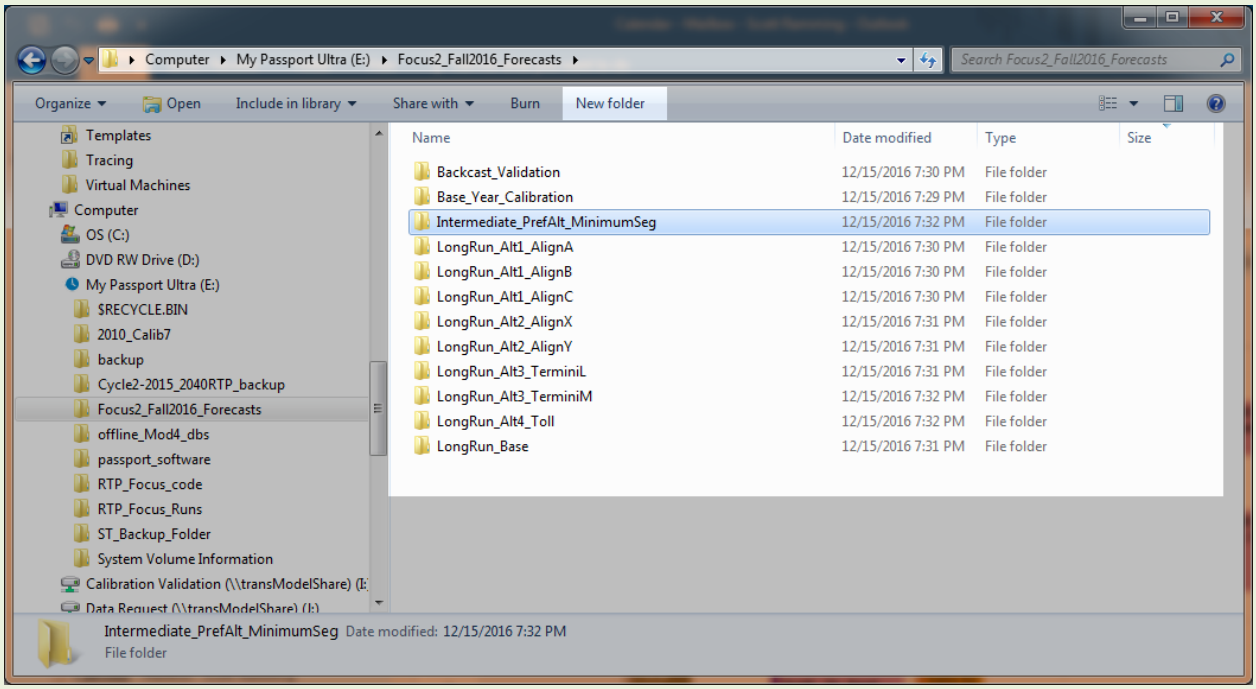
## 6.5 Getting Started

### 6.5.1 Create Forecast Set and Scenario Directories

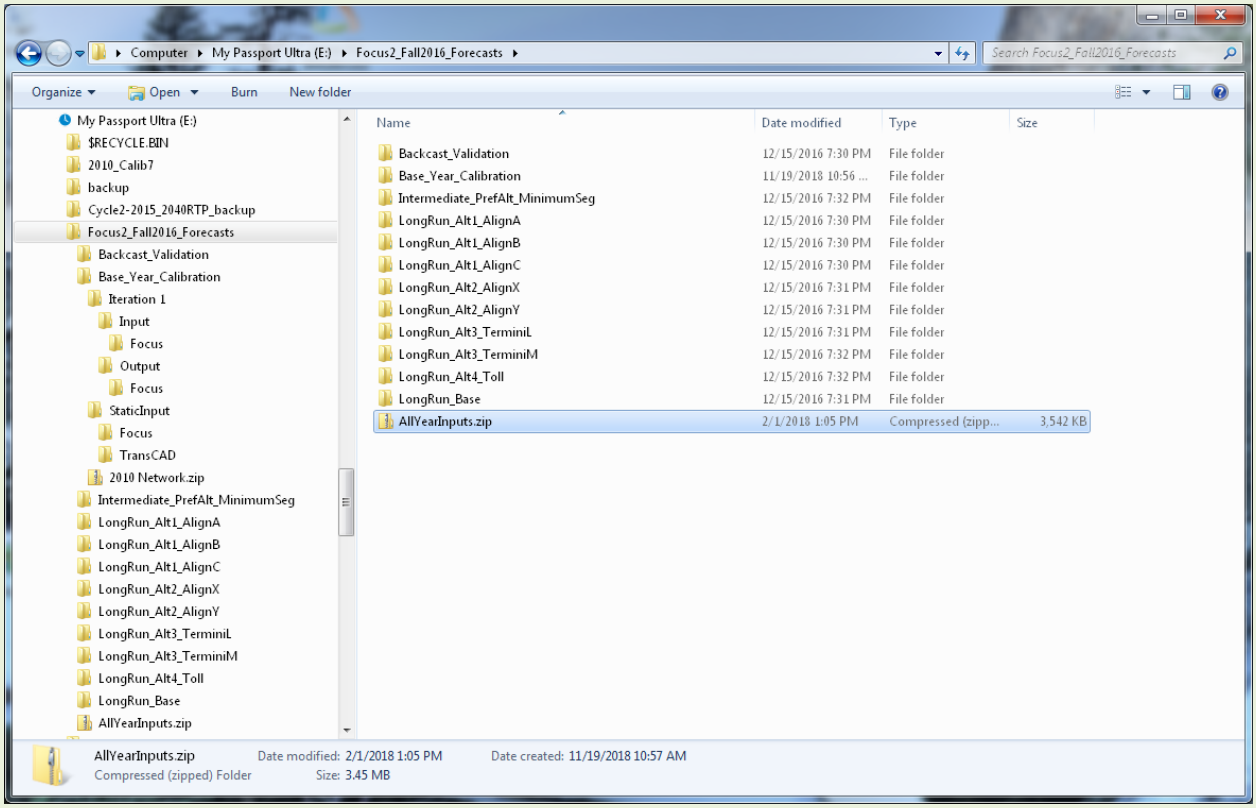
The first step in working with ***Focus*** is to create a Forecast Set directory on either a local or network drive. The drive should have sufficient space available. A single speed feedback iteration can generate files that take up to **30 GB** of disk space. A typical scenario may require three to five iterations to converge, depending on the convergence criteria. If multiple sensitivity, coding, or other tests are run, as might happen for a calibration effort, the scenario directory might reach **500 GB** if all the intermediate files are retained. Planning ahead can avoid frustrations caused by failed runs or having to spend time copying files to a new, larger location. The following figure shows a Forecast Set directory on a removable hard drive. The directory name is identified by the time the forecasts were generated.




Next, within the forecast set folder you just created, you'll want to create one directory for each scenario you anticipate testing. You'll typically want a base year for calibration. You may want to make a back-cast for validation, or use another recent year. You'll typically create a future year scenario with all the anticipated improvements that aren't related to the project or corridor under study. Different sources may call this a No Action alternative, a baseline condition, an Existing Plus Committed network and so on. Also consider the number of different alternatives you wish to test, which may be identified by modal concept, facility extents (termini, width), alignment, operations plan, or even financing options (for example, general purpose versus managed or toll lanes). The following screen shot shows one possible organization.


Computer ▸ My Passport Ultra (E:) ▸ Focus2_Fall2016_Forecasts ▸
Search Focus2_Fall2016_Forecasts
Organize
Open
Include in library
Share with
Burn
New folder
Templates
Tracing
Virtual Machines
Computer
OS (C:)
DVD RW Drive (D:)
My Passport Ultra (E:)
$RECYCLE.BIN
2010_Calib7
backup
Cycle2-2015_2040RTP_backup
Focus2_Fall2016_Forecasts
offline_Mod4_dbs
passport_software
RTP_Focus_code
RTP_Focus_Runs
ST_Backup_Folder
System Volume Information
Calibration Validation (\\transModelShare) (I:
Data Request (\\transModelShare) (J:)
Name
Date modified
Type
Size
Backcast_Validation 12/15/2016 7:30 PM File folder
Base_Year_Calibration 12/15/2016 7:29 PM File folder
Intermediate_PrefAlt_MinimumSeg 12/15/2016 7:32 PM File folder
LongRun_Alt1_AlignA 12/15/2016 7:30 PM File folder
LongRun_Alt1_AlignB 12/15/2016 7:30 PM File folder
LongRun_Alt1_AlignC 12/15/2016 7:30 PM File folder
LongRun_Alt2_AlignX 12/15/2016 7:31 PM File folder
LongRun_Alt2_AlignY 12/15/2016 7:31 PM File folder
LongRun_Alt3_TerminiL 12/15/2016 7:31 PM File folder
LongRun_Alt3_TerminiM 12/15/2016 7:32 PM File folder
LongRun_Alt4_Toll 12/15/2016 7:32 PM File folder
LongRun_Base 12/15/2016 7:31 PM File folder
Intermediate_PrefAlt_MinimumSeg Date modified: 12/15/2016 7:32 PM
File folder

The following screen shot shows the directory structure in the “Base_Year_Calibration” scenario directory expanded to illustrate the folders used in a Focus run.




Preparation for a new scenario generally occurs within the “StaticInput” folder beneath the scenario directory. The “StaticInput” folder in turn has two folders: “Focus” and “TransCAD”. The StaticInput\TransCAD\ structure will look familiar to analysts who have used Focus 1.0 or the trip-based Compass model.

## 6.5.2 Populate Scenario Directories

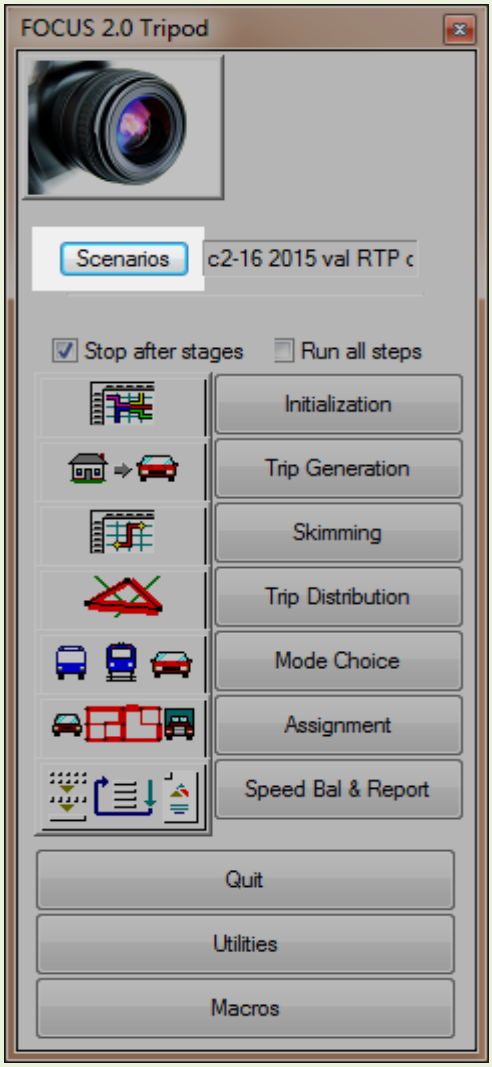
You’ll typically fill your base year calibration and future year baseline directories with files received from DRCOG. Other future year scenarios will often be created by copying from a similar scenario and then making edits in TransCAD.

Note that for each route system you copy, you may wish to execute **GUI Modify Route System**, as described in Appendix A Compiling and Using GUI Modify Route System.

Unlike previous versions of ***Focus***, this step is performed automatically, but you may wish to execute it manually for certain purposes.

### 6.5.3 Structure within Scenario Directories

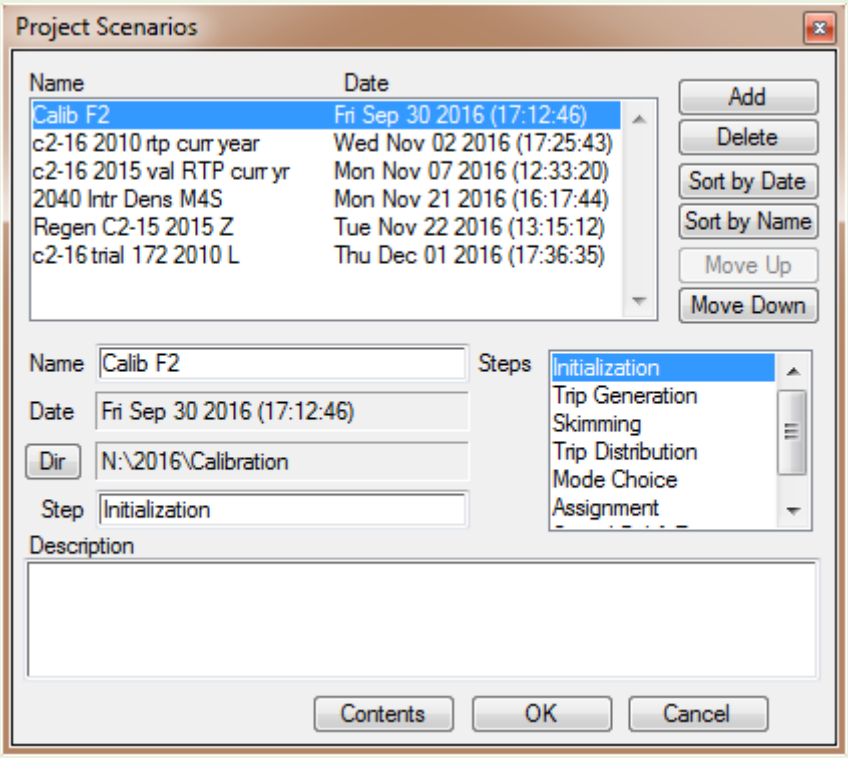
You will also need to define your scenario within **Tripod**. Here the definitions will be slightly different from the ***Focus*** configuration file, because you'll be primarily concerned with TransCAD files. If you've used the Compass model before, the process for **Tripod** will be familiar. First, launch the **Tripod Toolbox** by selecting the add-in you created under TransCAD's Tools menu. The **Tripod Toolbox** will appear. Press the "**Scenario**" button, which is highlighted in the following screen shot.



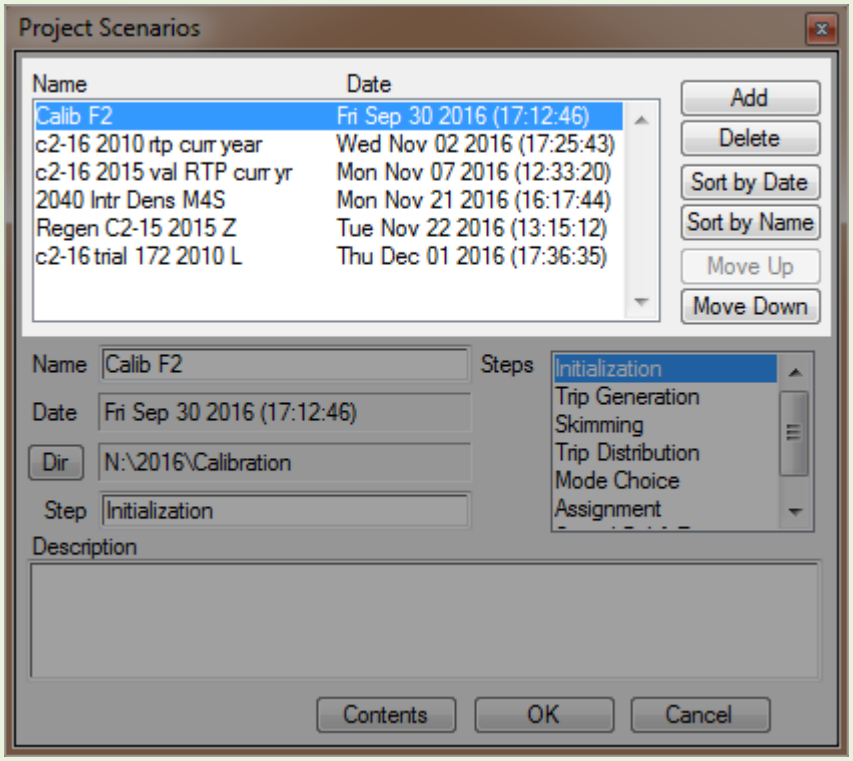

The **Project Scenarios** Dialog Box will appear. It is described in the next section.

### 6.5.4 The Project Scenarios Dialog Box

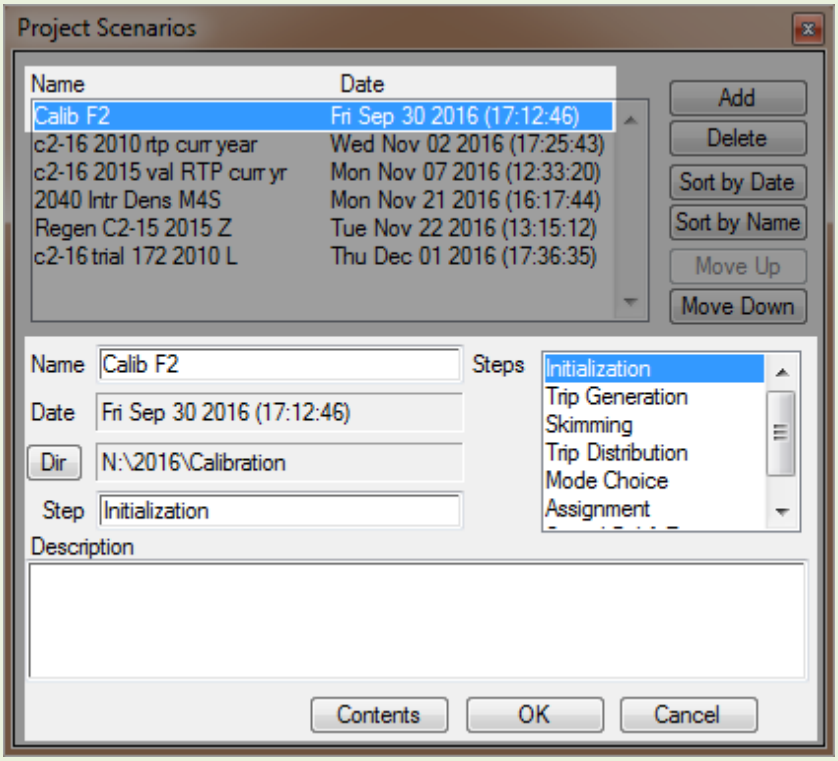
The **Project Scenarios** Dialog Box looks something like the following screenshot. The contents of the upper frame will likely be different because it depends on which scenarios you've created.



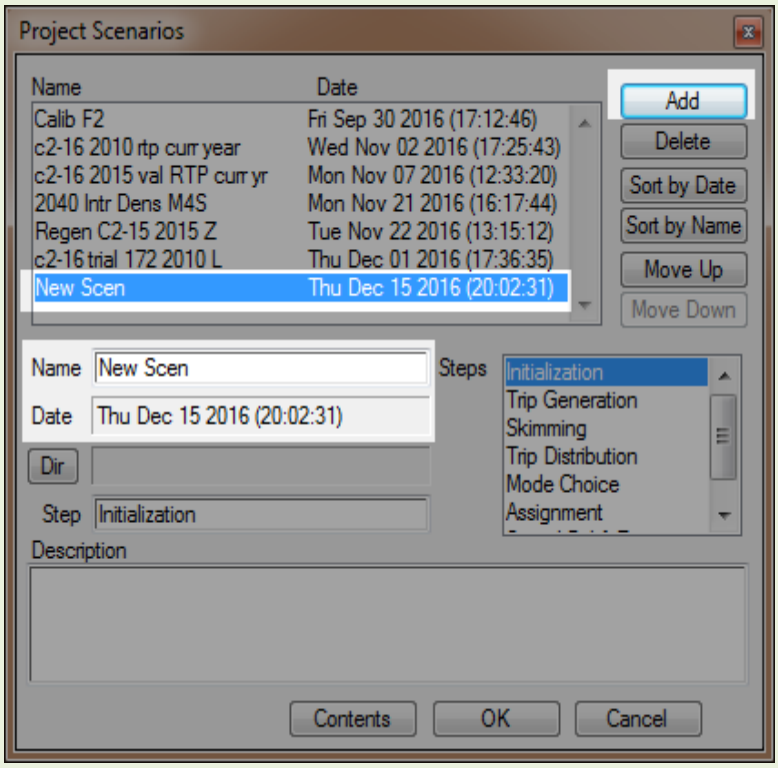

The **Project Scenarios** Dialog Box can be divided into two general areas by an imaginary horizontal line.



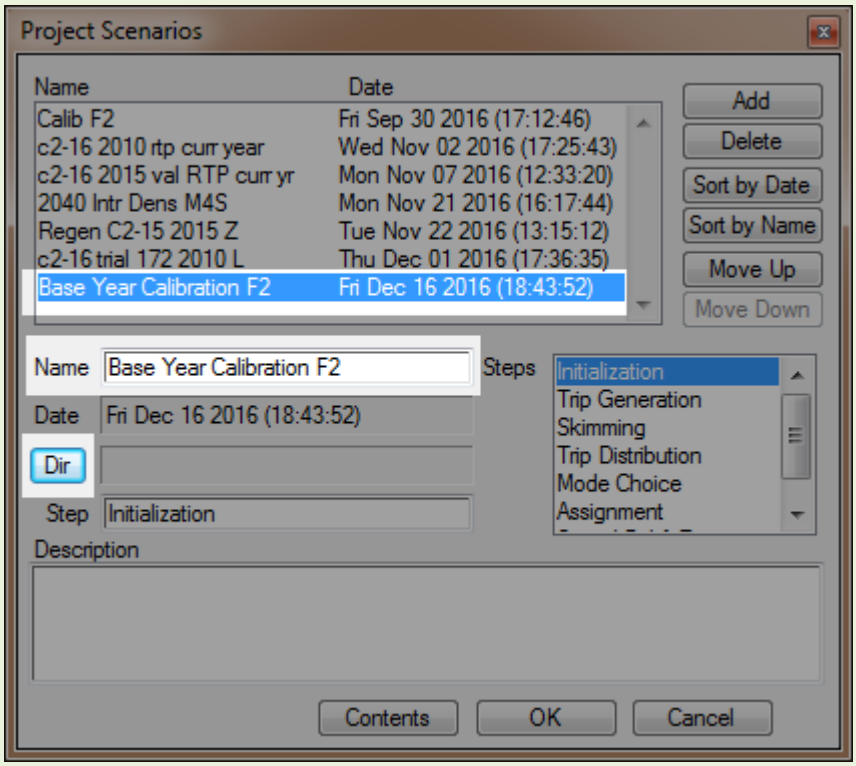

The top portion of the dialog box has tools to help you create and organize multiple scenarios.




The lower portion of the dialog box allows you to define the details of the scenario selected in the upper scroll box.



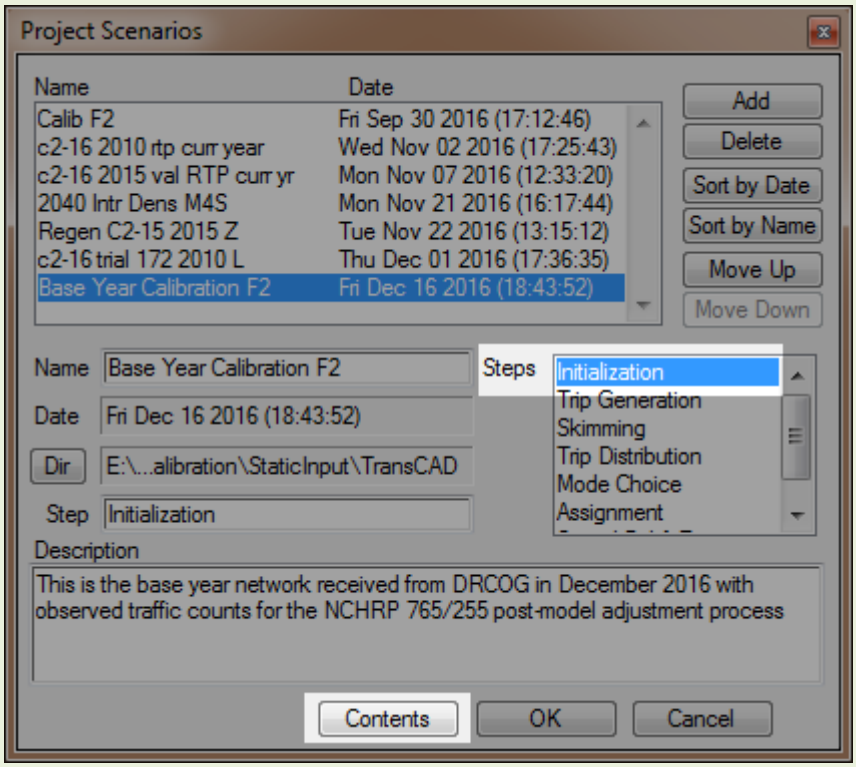

To create a new scenario, press the "**Add**" button in the upper right corner. A scenario with the default name of "**New Scen**" appears. The name can be changed in the "**Name**" text box in the middle of the **Project Scenarios** dialog box. You may want to include information about the forecast set and scenario, such as the horizon year. You may also wish to include computer-specific information, such as the drive letter where the working files are located. The "**Date**" field shows the time when the scenario was created, and thus cannot be changed. You may use the large "**Description**" box to provide any explanation you think will be helpful to you and your colleagues in the future.



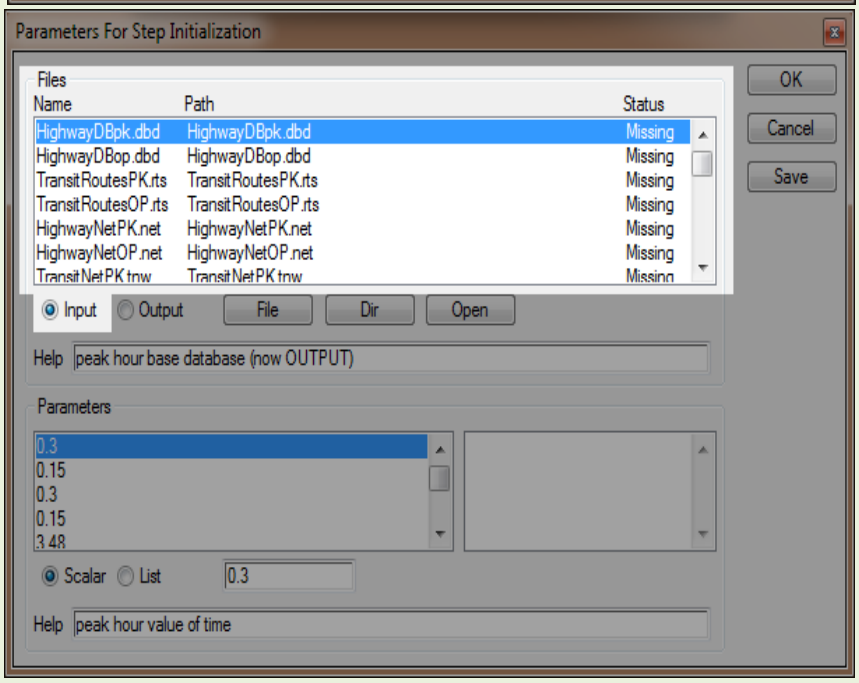

Press the "**Dir**" button. A windows folder selector dialog appears, allowing you to select the folder of interest. (The selected directory should include the StaticInput\TransCAD folders within the larger scenario.)

Once you've selected the scenario directory, you can start defining the scenario using the "**Steps**" scroll box at right, and the "**Contents**" button. At a minimum, the four entries you'll need to change appear in the Initialization and Trip Generation Stages.

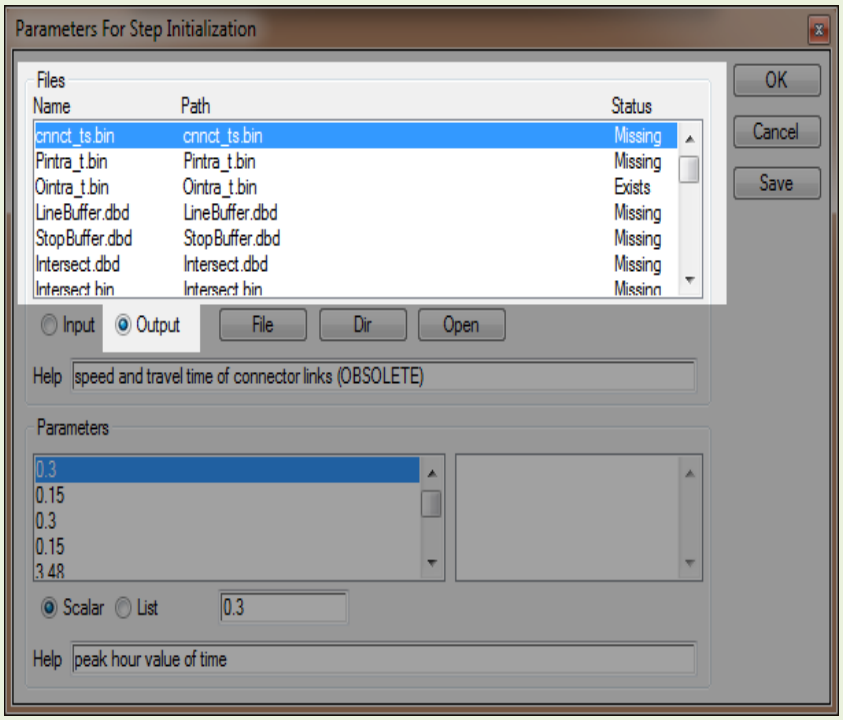
## 6.5.5 The Initialization Stage Contents



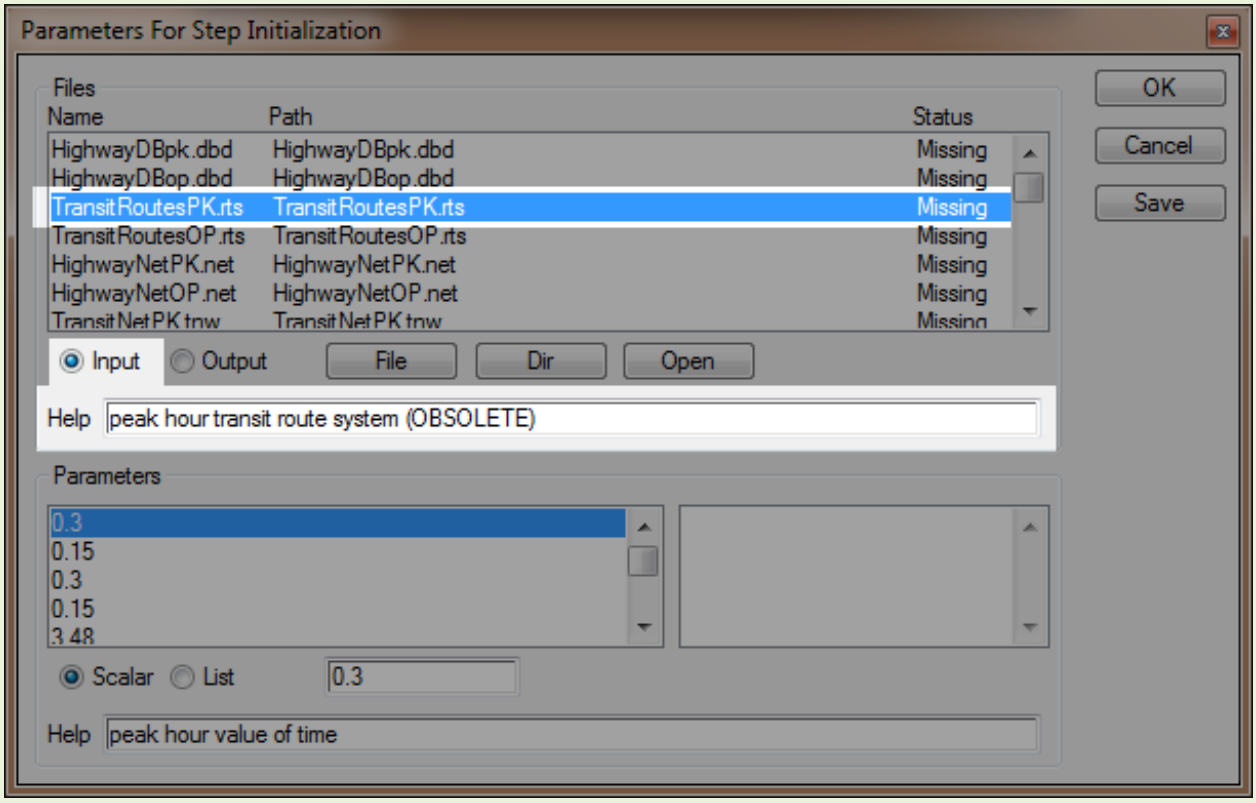

Within the "**Steps**" scroll box, make sure the **Initialization** stage is selected. Then click the "**Contents**" button.

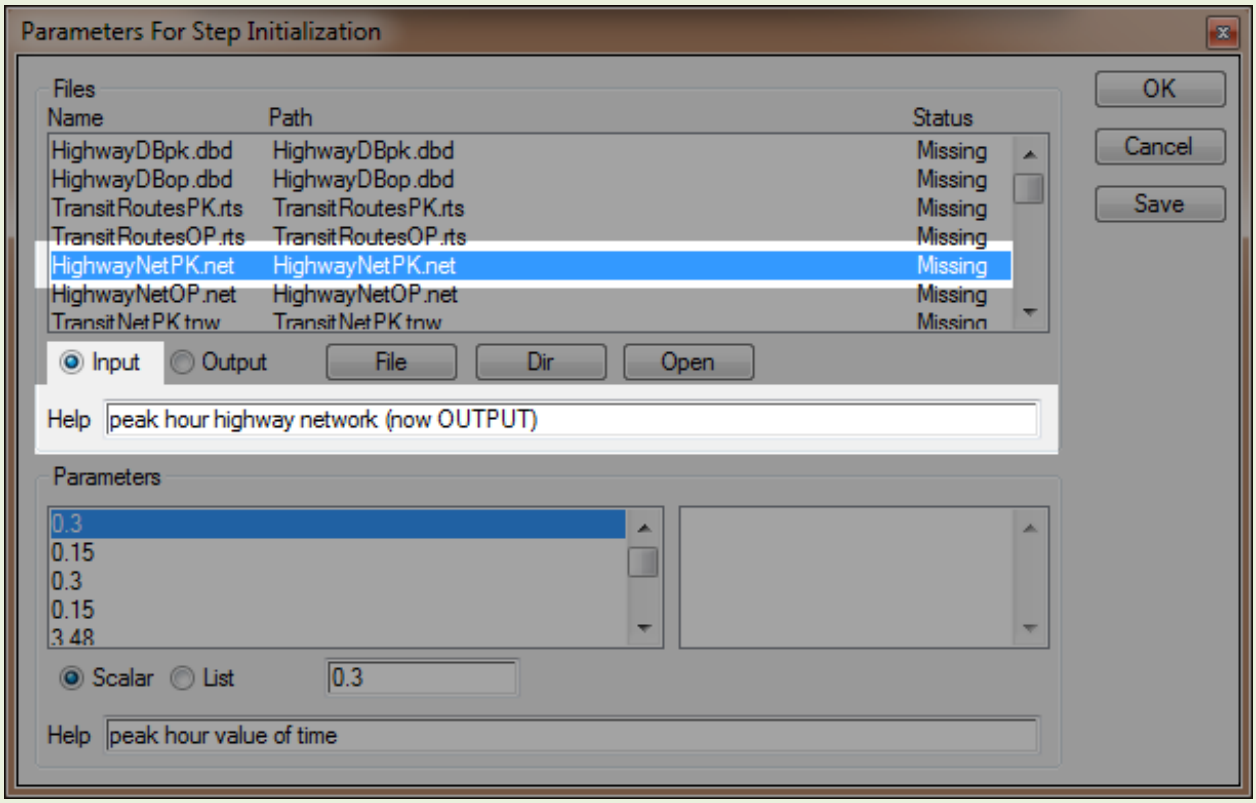



The **Initialization Stage Contents** Dialog Box appears. The dialog box has an upper half for files and a lower half for parameter values. Notice that you can use a radio button to select whether to work defining input files or output files. The first few files for each option are shown in screen shots below.



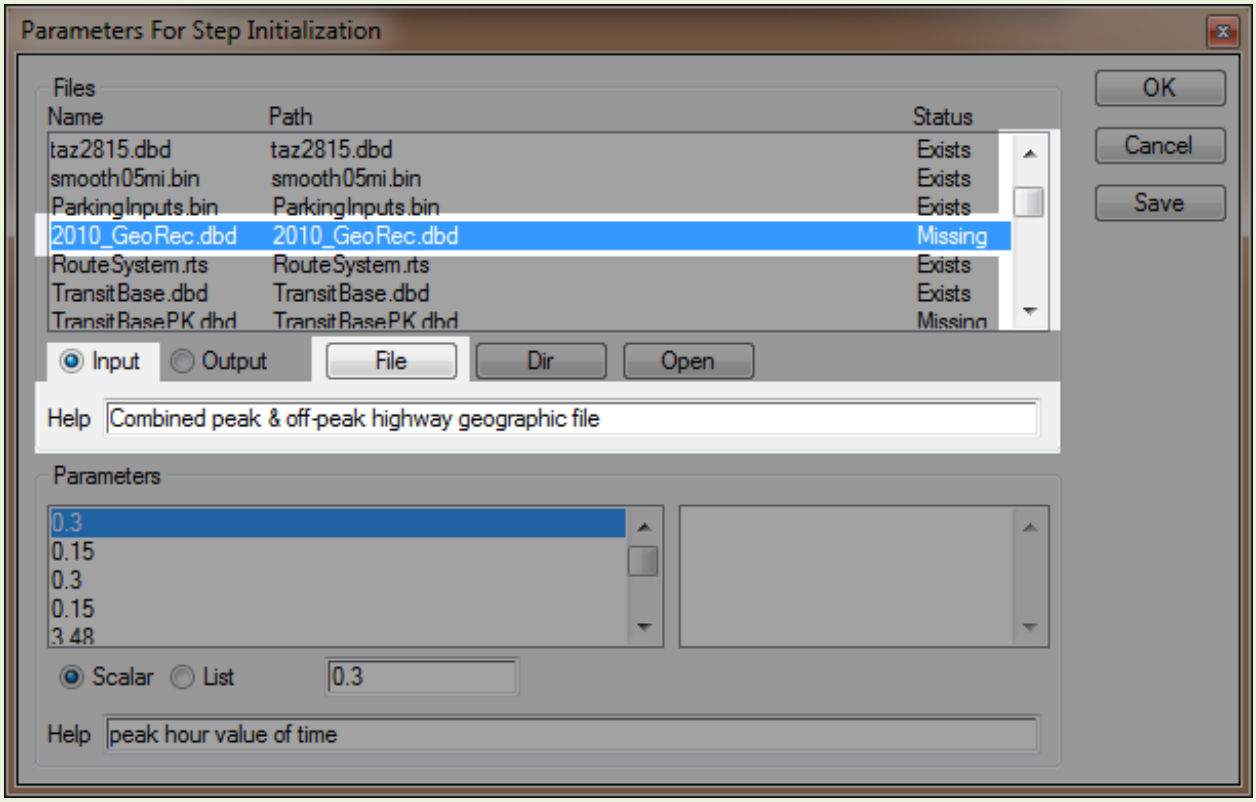

In general, you won't need to change any of the output files from their default names. Change the radio button back to "**Input**". The two files with custom names for this stage are the combined highway network file and the combined transit route system. However, these aren't the first two input files in the file scroll box. In fact, you'll see from the **Help** Text-Block that some of the files in the scroll box are no longer used, or are now output files rather than inputs. Also notice that the file scroll box lets you now whether files are available or missing.

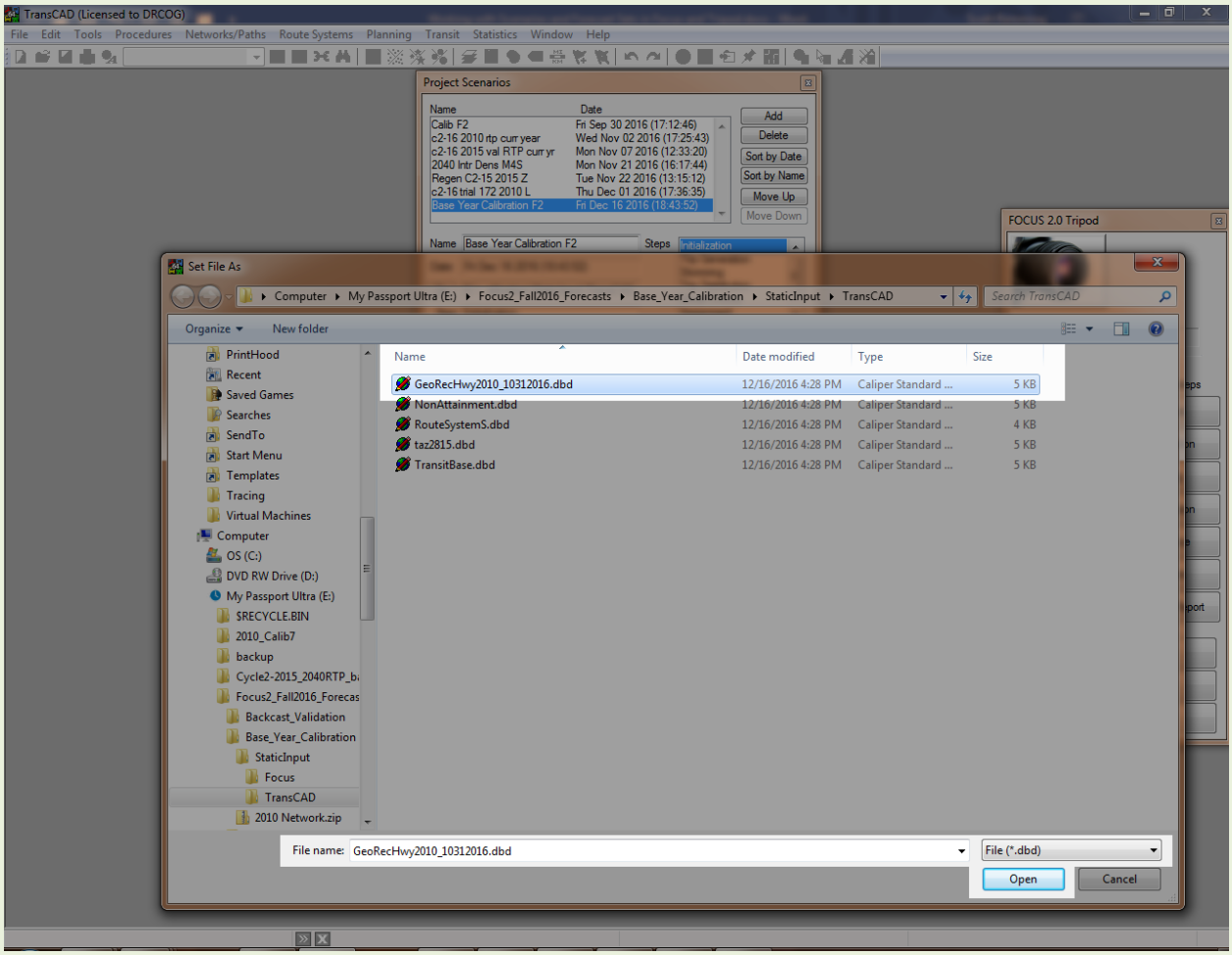




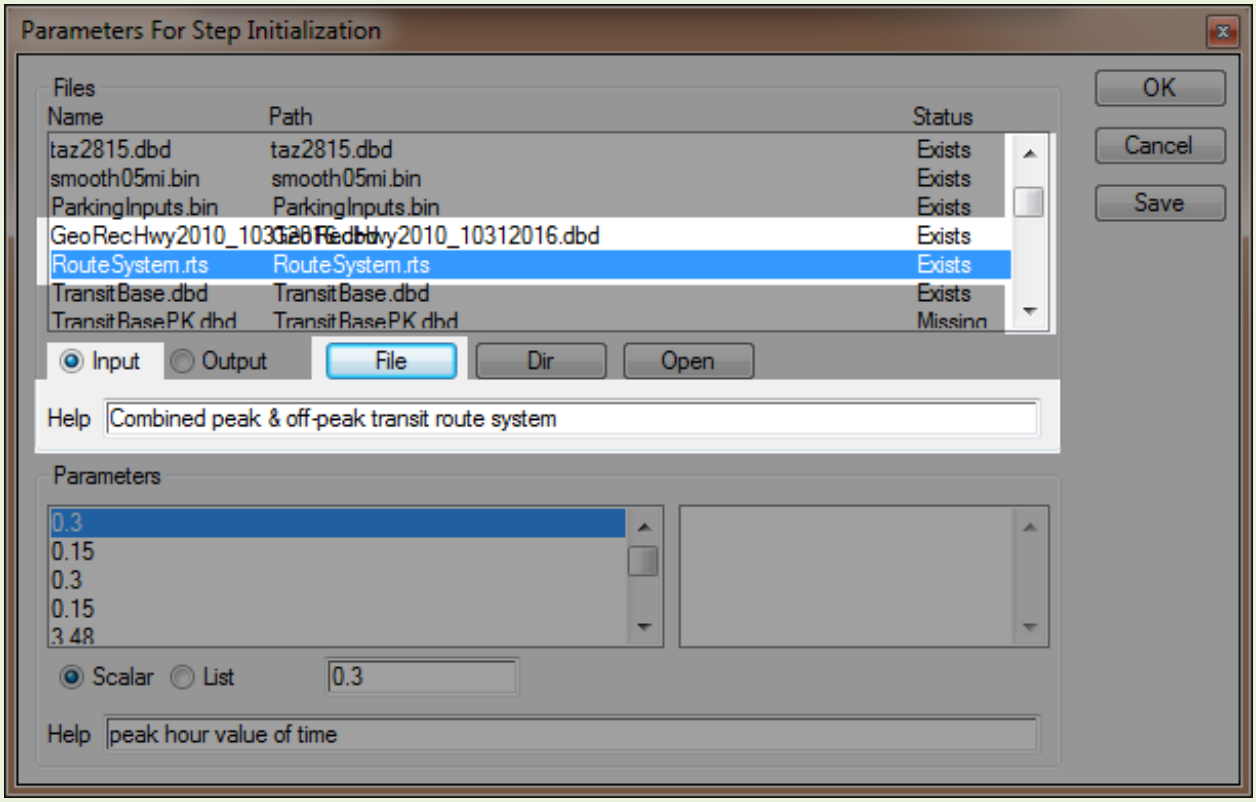

This result is an unfortunate limitation of the current scenario manager, which uses numeric indices to keep track of the files. Changing the file indices or order would require a complicated re-writing of the **Tripod GISDK** scripts. DRCOG is investigating a more flexible keyword-based scenario manager, but it wasn't ready for release with ***Focus 2.3***. Look for it in a future release.

To find the files you'll need to customize, scroll down the file scroll box about four or five times. The default name of the combined highway link layer is "**2010_GeoRec.dbd**". Click the file button to bring up a Windows file selector and choose your actual highway layer. Click the "**Open**" button.

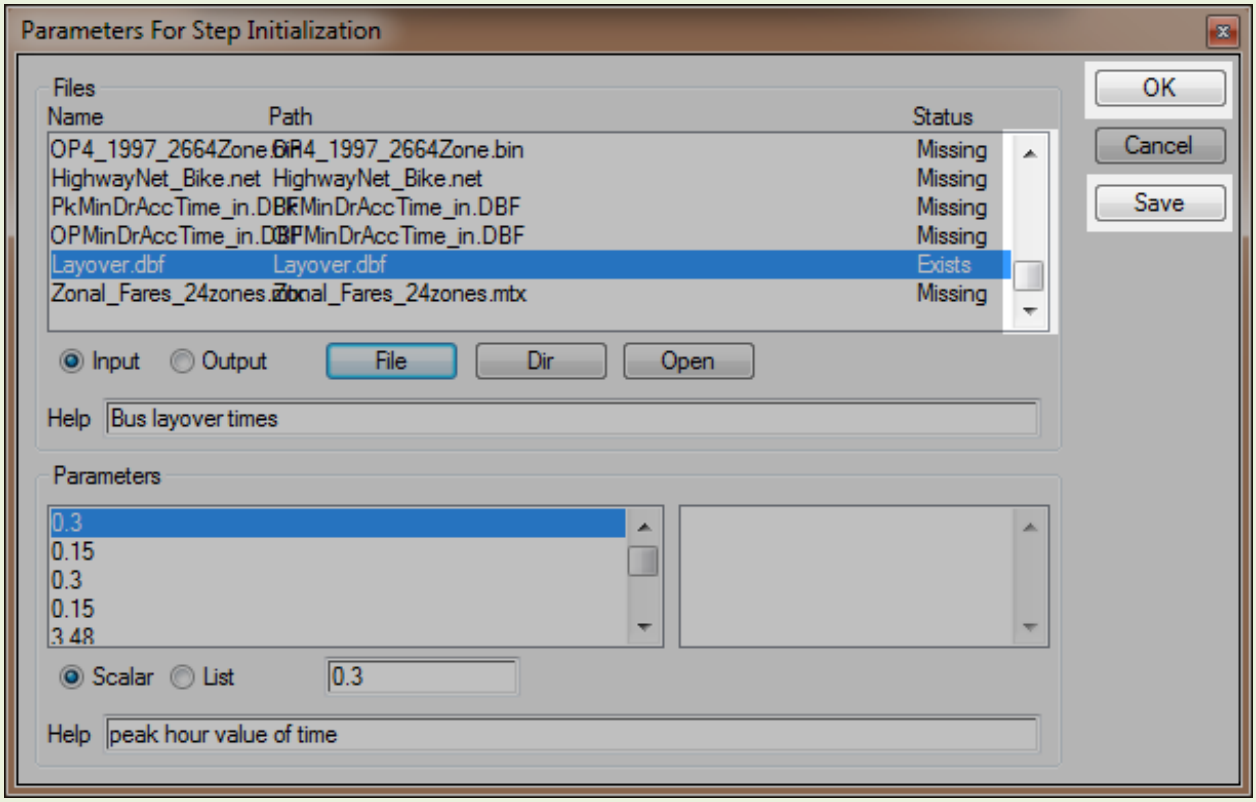

Parameters For Step Initialization
Files
Name
Path
Status
taz2815.dbd taz2815.dbd Exists
smooth05mi.bin smooth05mi.bin Exists
ParkingInputs.bin ParkingInputs.bin Exists
2010_GeoRec.dbd 2010_GeoRec.dbd Missing
RouteSystem.rts RouteSystem.rts Exists
TransitBase.dbd TransitBase.dbd Exists
OK
Cancel
Save
Input
Output
File
Dir
Open
Help
Combined peak & off-peak highway geographic file
Parameters
0.3
0.15
0.3
0.15
Scalar
List
0.3
Help
peak hour value of time




The next entry to customize, the combined route system is on the following line. The default name is "**RouteSystem.rts**". Click on that line, and then click the "**File**" button. Another Windows file selector appears from which to choose the actual route system layer.

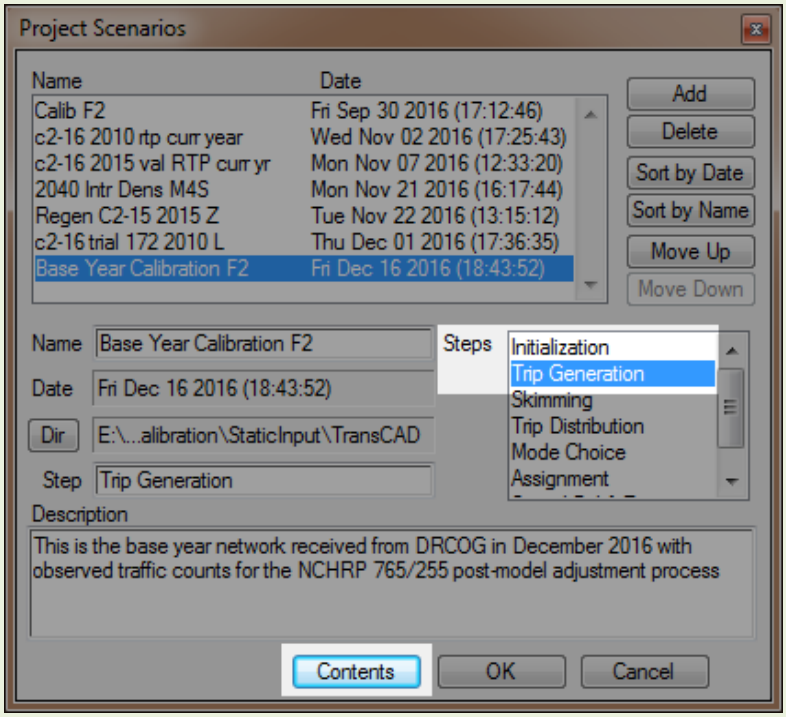



You may wish to scroll through other input files to see which ones are provided. When you are done, click on the "**OK**" or "**Save**" button. This returns you to the **Project Scenarios** Dialog Box.


Parameters For Step Initialization
Files
Name
Path
Status
OP4_1997_2664Zone.bin
OP4_1997_2664Zone.bin
Missing
HighwayNet_Bike.net
HighwayNet_Bike.net
Missing
PkMinDrAccTime_in.DBF
PkMinDrAccTime_in.DBF
Missing
OPMinDrAccTime_in.DBF
OPMinDrAccTime_in.DBF
Missing
Layover.dbf
Layover.dbf
Exists
Zonal_Fares_24zones.mtx
Zonal_Fares_24zones.mtx
Missing
Input
Output
File
Dir
Open
Help
Bus layover times
Parameters
0.3
0.15
0.3
0.15
3.48
Scalar
List
0.3
Help
peak hour value of time
OK
Cancel
Save

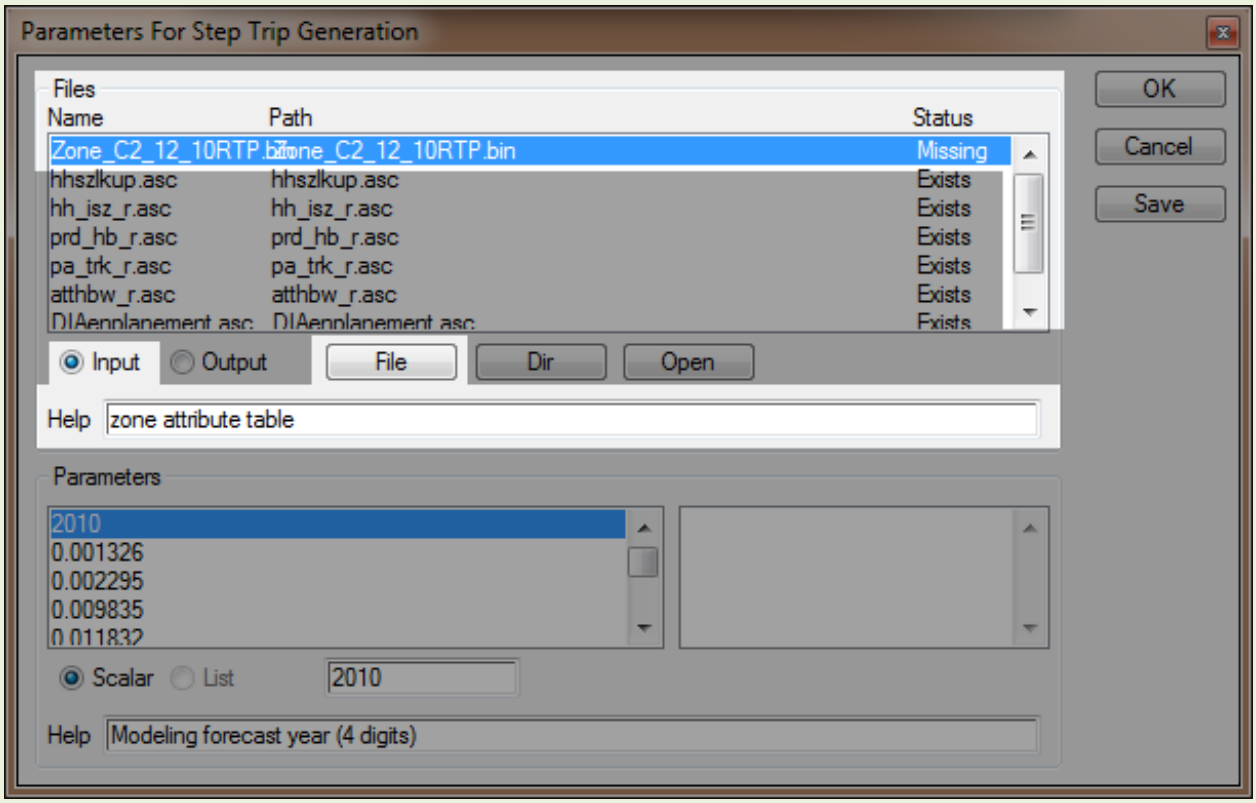
### 6.5.6 The Trip Generation Stage Contents

In the "**Steps**" scroll box, choose the second stage, "**Trip Generation**." Click the "**Contents**" button. The Trip Generation Stage Contents Dialog Box appears.



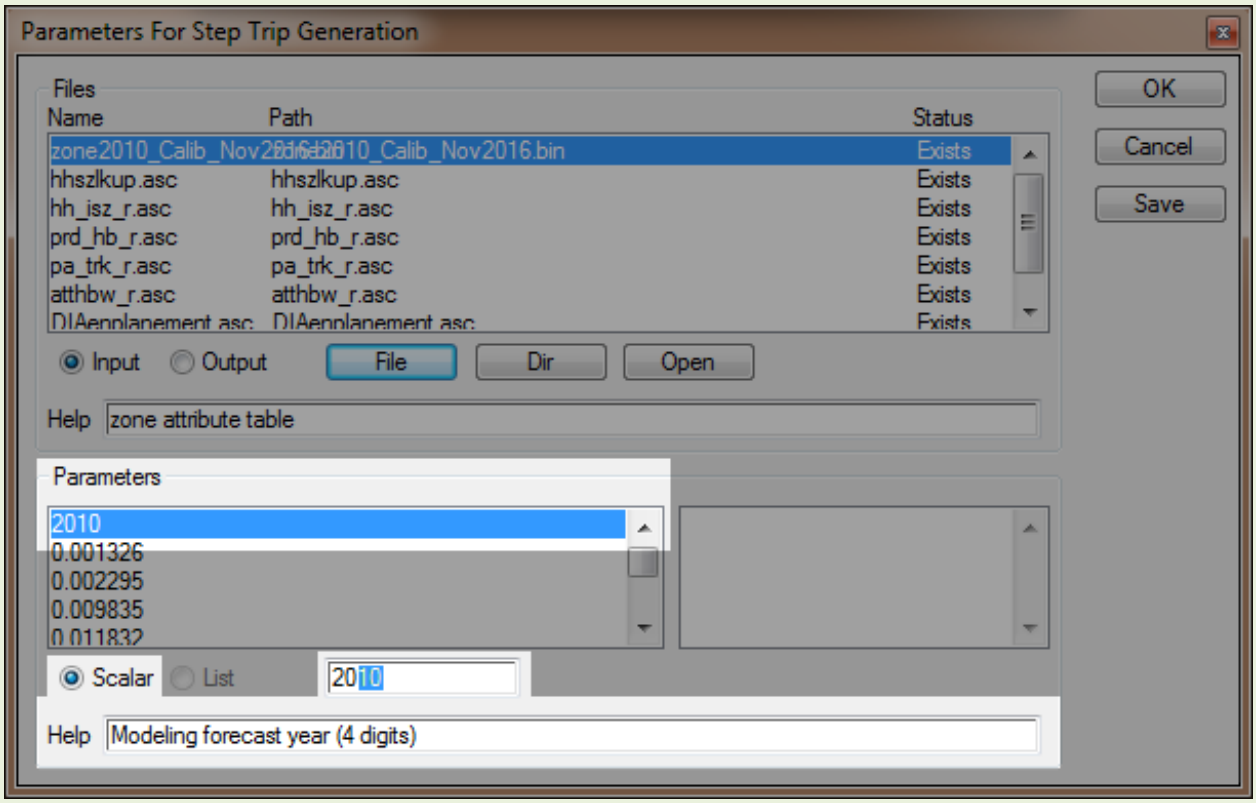

Here, you'll need to change one file in the upper part of the dialog box, and to change one parameter in the lower part of the dialog box.

Make sure the file type radio button is set to "**Input**", and select the first row of the file scroll box, with the default name of "**Zone2010_RTP.bin**". Click on the "**File**" button.

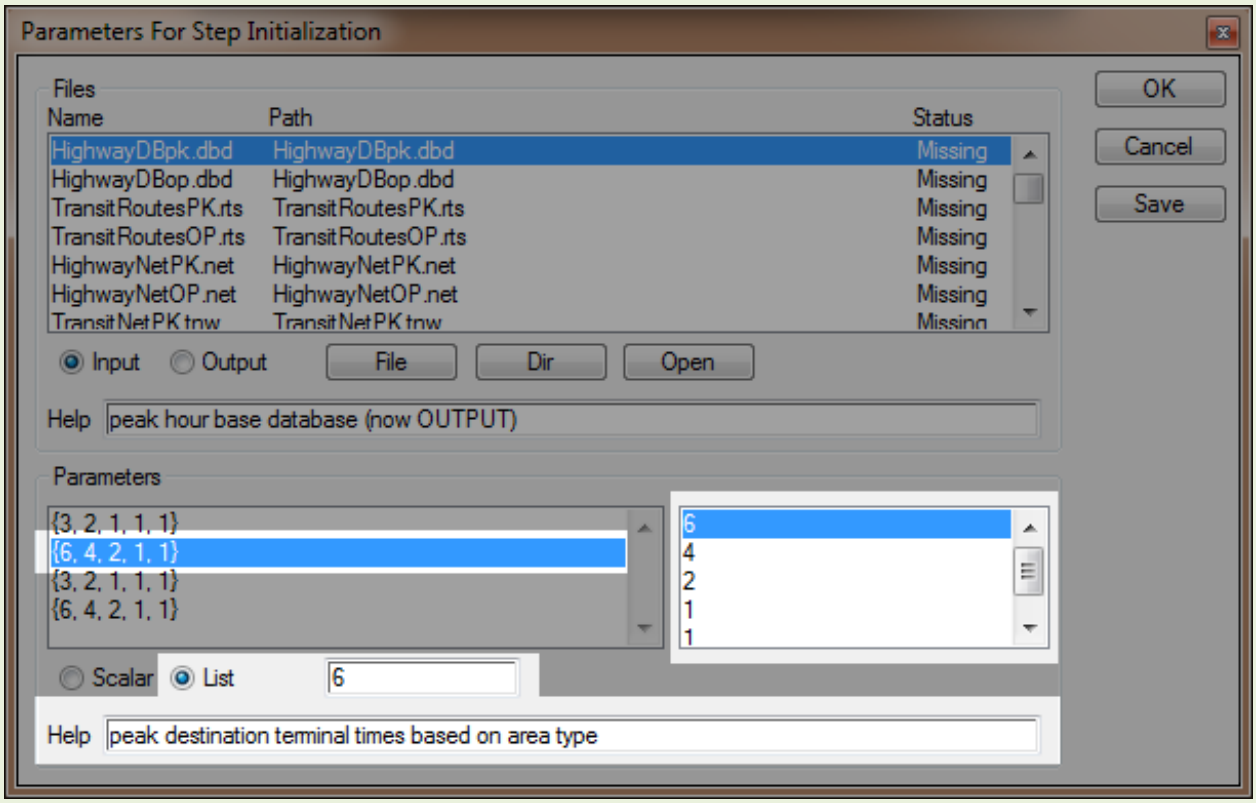



A Windows file selection dialog box appears with a list of "***.bin**" files. Scroll down to the end, since these files are typically named "**Zone*.bin**", with the file name also indicating the horizon year. Additional information about DRCOG's forecast set may also be included in the file name. Click on the appropriate file and then click on the "**Open**" button.

Now we'll need to set one of the model parameters. Most of the others generally don't need to be changed, unless you're performing a custom calibration. The parameter you'll need to change is the horizon year – expressed as a four-digit number – and it's the first parameter shown. Click on the first row of the parameter scroll box. Notice the value is copied to the editing box below. Type the correct value and then press tab to see it reflected above in the parameter scroll box.




Note that this scenario manager allows parameters to be stored and edited as either single, independent values (with the radio button in the "**Scalar**" position), or as related tables of values (with the radio button in the "**List**" position). Many parameter tables are indexed by area type, facility type, time period, or some other scheme. The following screen shot shows how a value within a table may be edited. Note that the lower right value scroll box becomes active when the radio button is set in the "**Table**" position. The lower left scroll box selects the table to edit, and the lower right scroll box selects the element of that table to edit in the editing box below. (The screen shot shows the table or list parameters from the **Initialization** Stage since the **Trip Generation** Stage doesn't have any.)




Press the "**OK**" button to return to the **Project Scenarios** Dialog Box. Then press that dialog box's "**OK**" button to select the scenario you just defined.

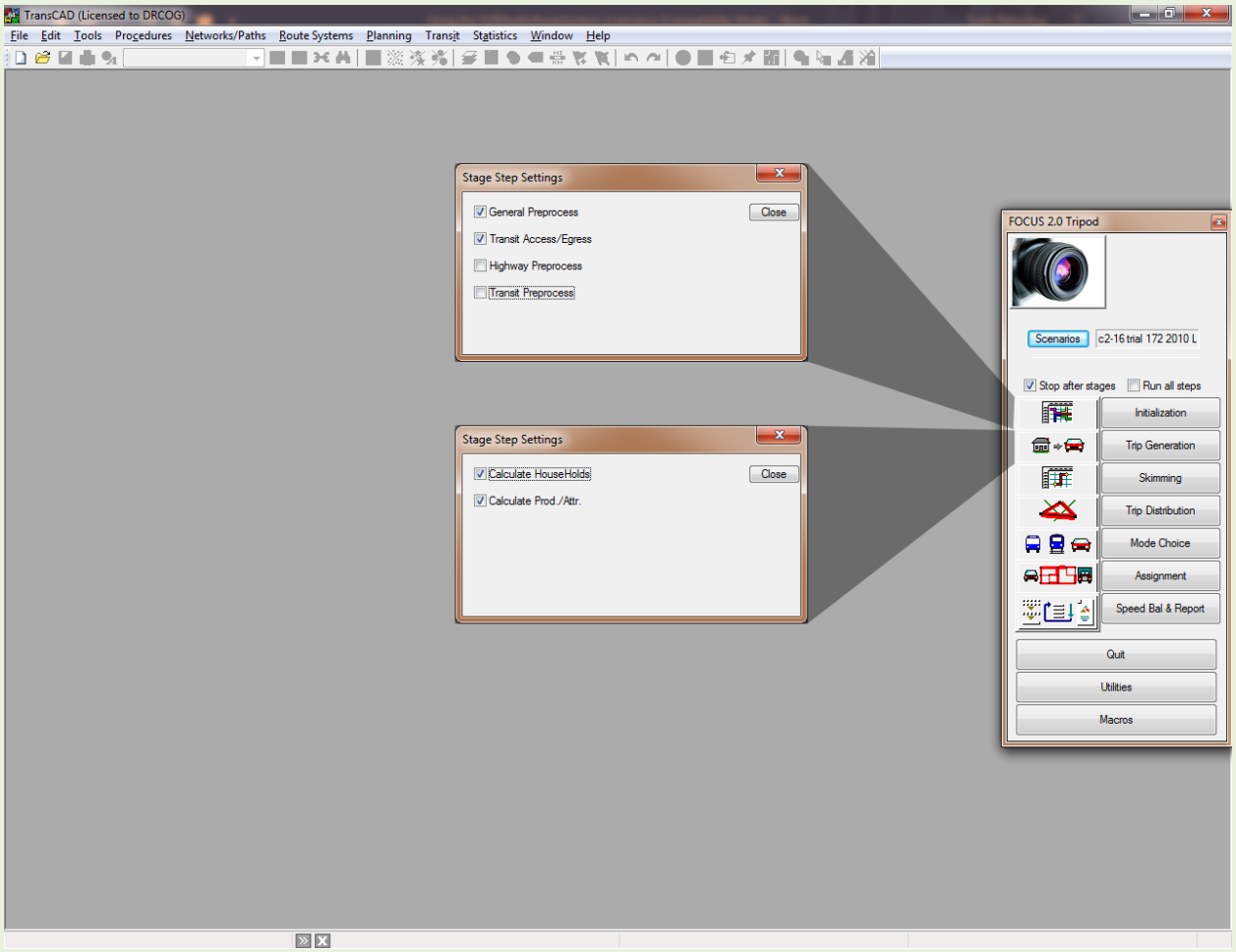
### 6.5.7 Starting a Scenario – Outside the Speed Feedback Loop

You are now back at the main **Tripod** Toolbox. The named buttons along the right column allow you to execute various stages of the models, while the graphic buttons along the left column allow you to select some or all the steps within a stage to execute when the corresponding button on the right is pressed. One checkbox ("**Stop after stages**") at the top allow you to choose between running a single stage or all stages through the end of the model. The other checkbox provides a convenient way of selecting all steps within the stages.

When you begin a new scenario, there are a few stages that need only be run once, or may be thought of as running before or outside of the speed feedback loop. That is, ***Focus*** is a recursive model since input speeds must be assumed for generating travel time skims, which determine a variety of travel behavior, which is ultimately assigned to the highway network to generate a new set of link speeds and travel times. The loop iterates

until the input and output speeds have sufficiently converged, as is indicated in the converge_rpt.txt file.

The steps and stages that operate before or outside of the speed feedback loop are shown in the screen shot below. They are the General Preprocess and Transit Access and Egress steps of the **Initialization** stage, and the Calculate Households and Calculate Productions and Attractions steps of the **Trip Generation** stage.




## 6.5.8 Within the Initialization Stage

The **General Preprocess** step fills in missing attributes from lookup tables after editing, and makes period copies of the highway link layer and transit route system. Estimated (post-assignment) speeds are one of the attributes that are filled in. It is sometimes possible to obtain faster convergence by using speeds from an earlier forecast. Please see

section 6.5.19 on tagging speeds from a previous assignment for a discussion of this capability. Because it will overwrite period speeds, it should not be executed after one feedback loop has completed and another started.

The Transit Access and Egress step calculates the percentages of each zone that are within walking distance to transit lines and stops. Regional and SkyRide Routes, which stop infrequently, are treated differently from local and limited routes with more frequent stops. These zone percentages are later used in the Mode Choice stage to adjust for the portions of zones that shouldn't have Walk-to-Transit as an available alternative, and thus the Walk-to-Transit share is reduced accordingly. Since the zonal walk access percentages depend upon the transit route geography and not speed, they need only be calculated once.

### 6.5.9 The Trip Generation Stage

The input **zone*.bin** file has information about the number of households by income group in each zone, and through the household population field, information about the average household size. The Calculate Households step disaggregates each zone's information to a two-dimensional tabulation of households by income group and household size. The output household tabulation is used in the Calculate Productions and Attractions step by multiplying by a similarly stratified (income and household size) table of trip generation rates.

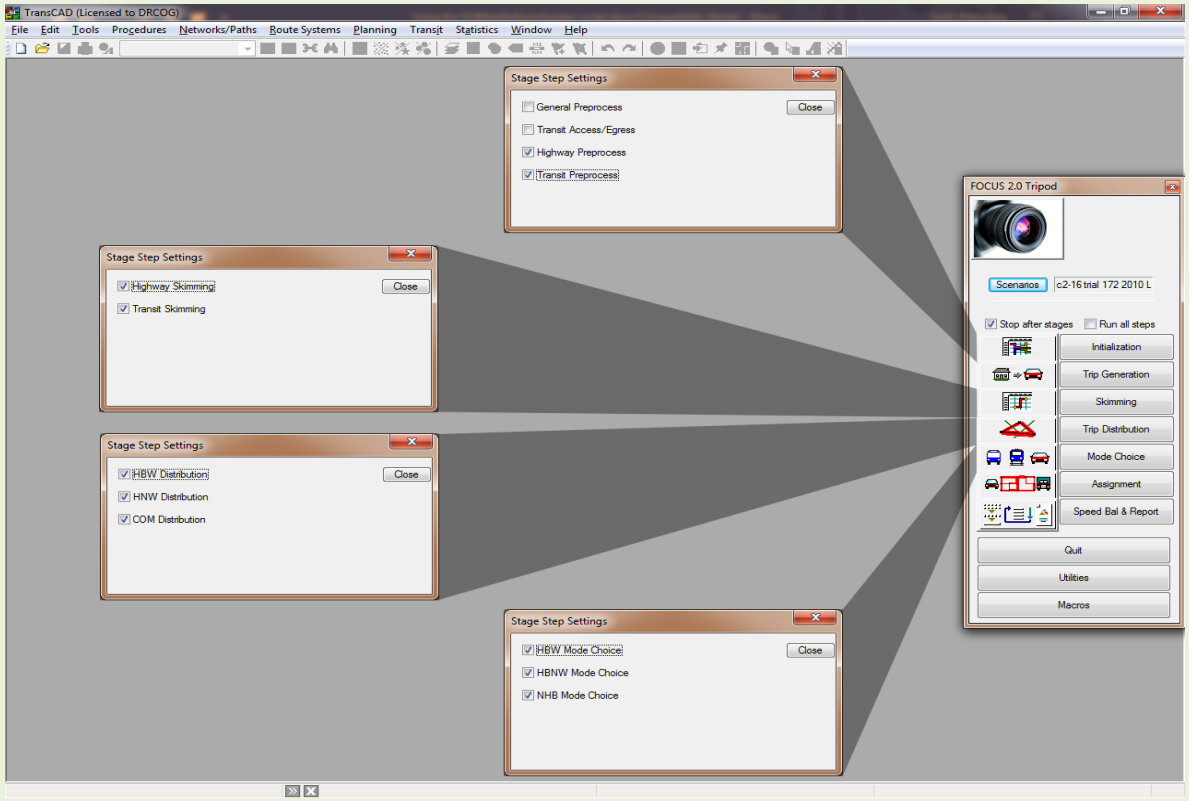
The Calculate Households step does not depend on network speeds, and can thus occur before (or outside) the speed feedback loop. Unlike the ***Focus*** **ABM** components concerned with the quantity of travel (these components analogous to trip generation are Daily Activity Pattern Choice, Exact Number of Tours, Work-Based Sub-Tour Generation, and Intermediate Stop Generation), which use mode choice logsums as accessibility measures, the trip generation rates for the ancillary purposes handled by Tripod (Airport, Commercial Vehicle, Internal-External/External-Internal, and External-External) are assumed to be insensitive to network accessibility or congestion measures. Thus they can also be calculated before (or outside) the speed feedback loop.

### 6.5.10 Inside the Feedback Loop

With the exception of the Trip Generation Stage and the two steps of the Initialization Stage discussed above, most of the Tripod steps occur within the speed feedback loop. That is, they are involved in the process of going from one set of input highway link speeds to creating a new estimate of such speeds, or even testing how closely the two sets of links speeds match. These Tripod steps can be differentiated by whether they need to run before the ***Focus*** **ABM** runs (because they produce inputs to the **ABM**) or whether they must run after the ***Focus*** **ABM** because they use **ABM** outputs (trip tables for household travel purposes) as their inputs. DRCOG typically refers to the first set of Tripod steps as Network Preparation and Skimming and the second set as Assignment and Reporting.

### 6.5.11 Network Preparation and Skimming

The steps associated with Network Preparation and Skimming are shown in the following screen shot. Note that only the Initialization stage requires a subset of its steps to be selected. All steps of the Skimming, Trip Distribution, and Mode Choice stages are selected.



### 6.5.12 The Initialization Stage

The Highway Preprocess step takes link speeds either from the General Preprocess Step (if this is the first iteration) or from the Speed Balance step of the previous iteration. It calculates a number of internal variables, many of which or impedances (also called generalized time) which combine link travel times with auto operating costs and tolls. Different impedances are calculated based on income (value of time) and auto occupancy level. This step also creates impedances used for the bike mode. Finally, it builds the "***.net**" files that are used by later skimming and assignment steps.

The Transit Preprocess step updates bus (and conceivably streetcar) link times based on the latest highway speeds. It also creates the highway skim matrices for the drive access and drive egress (on the return or inbound half tour) portions of Drive-to-Transit tours.

Note that since the **Trip Generation** steps don't depend on speeds, it doesn't matter whether all the **Initialization** steps are run in order during the first iteration, or if the **Trip Generation** stage is run before the final two steps of the **Initialization** stage.

### 6.5.13 The Skimming Stage

As its name suggests, the Highway Skimming step creates skim matrices for various periods of the auto modes. Auto occupancy level also stratifies the skim matrices: drive alone (**SOV**), shared-ride-2 (**HOV**), and shared-ride-3+ (**HOV3+**).
Several operations take place during the Transit Skimming step:

1. Various weights are applied to access links in the transit networks
2. Drive access times are weighted per various procedures to discourage "back-tracking"
3. The ***.tnw** files used for skimming and assignment are created
4. So-called "layover" times – where buses wait for transferring passengers at rail stations and other major transit centers – are applied
5. The transit skim files are created after identifying the optimal Walk-to-Transit or Drive-to-Transit paths. Note that the current transit skimming process allows for what is known as "multi-pathing." If there are transit paths with sufficiently similar

utilities (determined by a path overlap threshold parameter, which is currently set at 30 percent), then all such similar paths are assumed to be used. The resulting skims are based on an average of the path skims, weighted by their relative service frequencies (headways).

6. Various calculations on the raw skim matrices are performed to simplify their later use. For example, vehicle-in-motion time is combined with dwell (deceleration, waiting at a station or stop, and acceleration) time to produce overall in-vehicle time (**IVT**).

The ***Focus*** **ABM** can technically be run at this point, since it depends on modal skim matrices as inputs. While the following two stages can be run in parallel, they're typically run after skimming since they are relatively short.

### 6.5.14 The Trip Distribution Stage

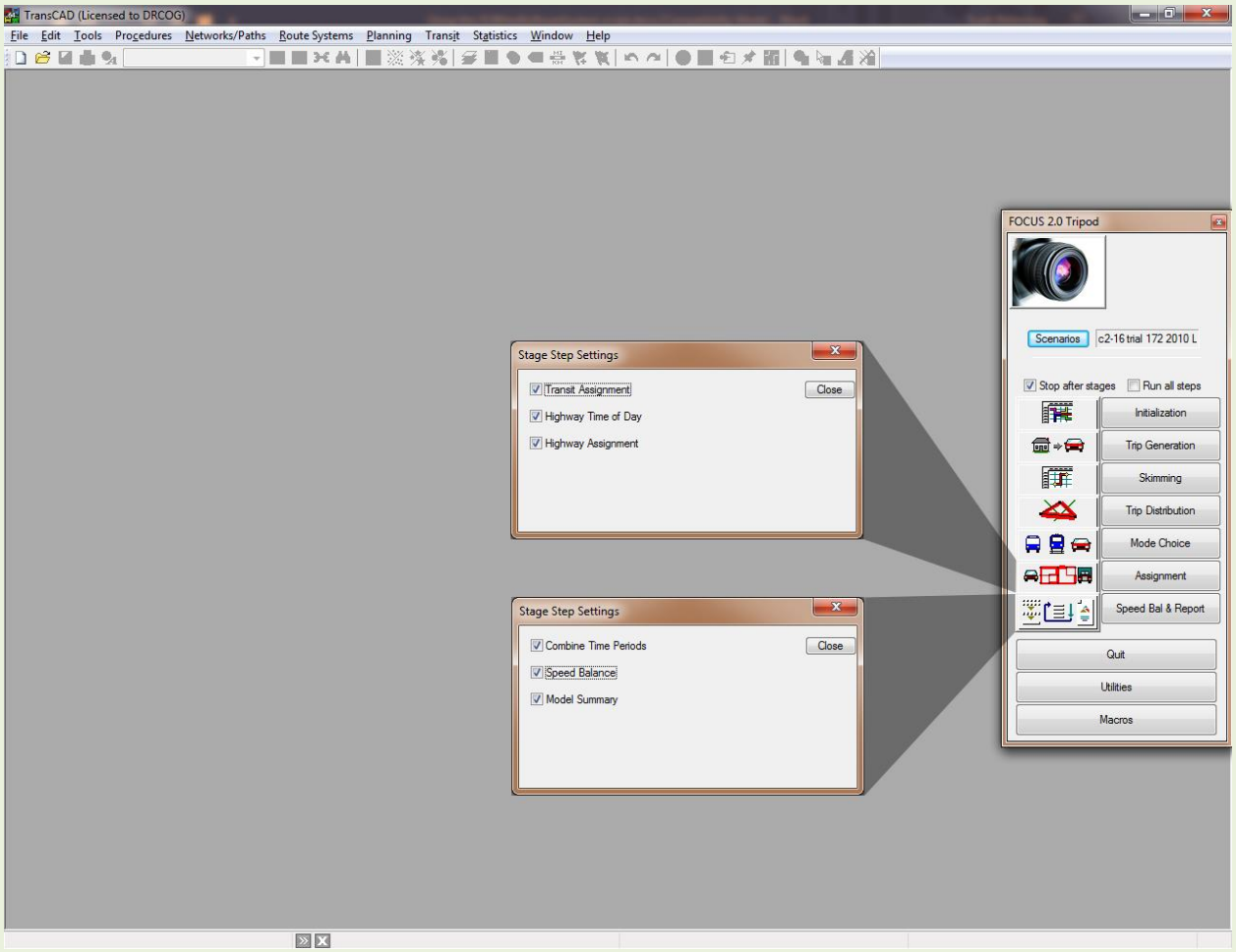
The Trip Distribution stage applied the gravity model to airport, commercial vehicle, and Internal-External/External-Internal trips. It also applies the growth factor method (also known as Fratar in North American and Furness in Europe) to the External-External vehicle trips table. This stage also includes options to analyze internal circulation within Denver Airport by re-allocating various trip ends (for example, to airport employee parking lots, cargo terminals, and so on).

### 6.5.15 The Mode Choice Stage

The **Mode Choice** stage applies logit models for airport person trips. There are also options to analyze internal circulation at Denver International Airport by reallocating various trips.

### 6.5.16 Assignment and Interpreting Results

The ***Focus*** **ABM** produces 15 trip table matrices: 10 for specific highway periods, four for specific transit periods, and an all-day summary. At this point, the **Tripod Assignment** and **Speed Balancing** and Reporting stages may be run. The steps making up these stages are shown in the following screen shot.




## 6.5.17 The Assignment Stage

The Transit Assignment step also includes time of day procedures for the Tripod airport trips, and conversion of airport Drive-to-Transit trips into their drive access/egress and transit line-haul legs by the PnRSplit.exe auxiliary program. Transit trips are assigned for four periods and two access modes.

The Highway Time of Day step converts vehicle trip tables from the **Tripod** ancillary purposes – airport, commercial vehicle, internal-external/external-internal, and external-external – into trip tables for the ten highway periods. Time of day factors are used to convert daily trips into trips by the three major time periods: AM, PM, and off-peak. Additional factors convert the three major period trip tables into trip tables for the ten highway periods.

The **Highway Assignment** step does the actual loading of vehicular trip tables to highway networks. Commercial vehicles are assigned to a single least-impedance path. The resulting commercial vehicle volumes are used as a "pre-loading" for the passenger vehicle assignments. The passenger vehicle assignments make use of TransCAD's multi-modal and multi-class assignment capabilities. Currently, the different occupancy levels and value-of-time ranges define the various classes. The Highway Assignment step produces twenty sets of assignment results – two for each of the ten highway time period. Each time period has a commercial vehicle and a passenger vehicle assignment result.

If you would like to perform a select link assignment, use the TransCAD menu to select **"Planning → Assignment Utilities → Select Link/Zone Query Builder"** to activate the built-in toolbox. Save the results to a file named **"SelectLink.qry"** in either the StaticInput/TransCAD or the StaticInput/TransCAD/Report folder. Tripod will detect this file and activate the additional computations for select link analysis. Be, because each query can increase the time required for highway assignment by as much as the time required to run highway assignment without any select link queries.

### 6.5.18 The Speed Balancing and Reporting Stage

The **Combine Time Periods** step consolidates the 20 highway assignment results in sequence:

1. First, the commercial vehicle and passenger vehicle results are combined for each time period.
2. Second, the ten time periods are summarized to the three major time periods: AM, PM, and Off Peak. A midday summary is also created
3. Finally, an all-day summary is created from the three major time periods

The **Combine Time Periods** step also includes procedures to generate all-day transit boarding and link flow files.

The **Speed Balance** step is not automatically selected by default. As was the case with the Compass model, this setting is designed for quicker single-feedback-iteration forecasts. However, DRCOG hopes that the faster speed of ***Focus*** allows for more forecasts to be run to speed feedback convergence.

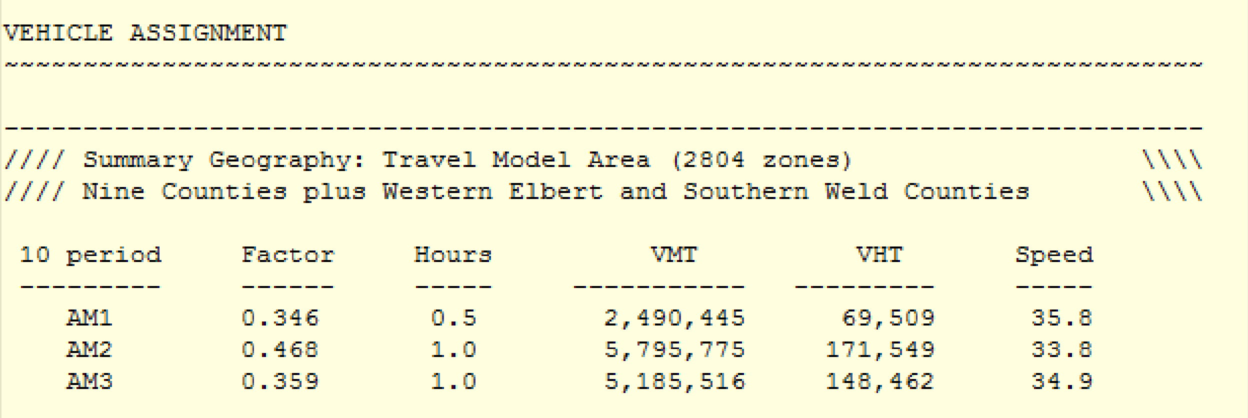
The first process of the Speed Balance step checks whether the assigned speeds have sufficiently converged with the speeds assumed at the beginning of the iteration. A proposed speed is calculated (on a directional basis) as the simple average of the speed at the beginning of the iteration and the assignment speed. If the proposed speed is greater than ten percent different from the speed at the beginning of the iteration, then the link (in that particular direction) is considered flagged. No more than 2.5 percent of all highway links (excluding centroid connectors) may be flagged for either direction and for either the AM or Midday periods in order for the forecast to be considered converged. Various statistics from the comparison are appended to the converge_rpt.txt file.

The second process of the **Speed Balance** step copies the proposed speeds from various "**Converge*.bin**" files for each of the ten highway periods to the ten copies of the highway link layer. Based on the calculation of the proposed speed described above, the following table shows the weights on the speeds from the current and previous iterations used to calculate the proposed speed after each iteration. The weights are powers of one-half. These weights represent a variation of the Method of Successive Averages, which has been theoretically proven to converge. However, the Method of Successive Averages may converge more slowly (require more iterations) than more advanced methods that dynamically calculate each iteration's weight for speed averaging based on the specific iteration assignment results.

| Feedback Iteration | Calculation of Proposed Speed |
|---|---|
| 1 | 50% of Original Speed + 50% of Iteration 1 Assigned Speed |
| 2 | 25% of Original Speed + 25% of Iteration 1 Assigned Speed + 50% of Iteration 2 Assigned Speed |
| 3 | 12.5% of Original Speed + 12.5% of Iteration 1 Assigned Speed + 25% of Iteration 2 Assigned Speed + 50% of Iteration 3 Assigned Speed |

| | |
|---|---|
| 4 | 6.25% of Original Speed + 6.25% of Iteration 1 Assigned Speed + 12.5% of Iteration 2 Assigned Speed + 25% of Iteration 3 Assigned Speed + 50% of Iteration 4 Assigned Speed |
| 5 | 3.125% of Original Speed + 3.125% of Iteration 1 Assigned Speed + 6.25% of Iteration 2 Assigned Speed + 12.5 % of Iteration 3 Assigned Speed + 25% of iteration 4 Assigned Speed + 50% of Iteration 5 Assigned Speed |

Finally, the **Model Summary** step produces the **ModelSummary.txt** file that will be familiar to Compass users. The **ModelSummary.txt** file is intended to be used in conjunction with the **PerformanceAnalysis.xlsx** file produced by the ***Focus*** **ABM**. The **ModelSummary.txt** file has tabulations from the Tripod stages. The assignment tabulations are probably of the greatest interest. Under ***Focus***, Tripod adds customizations for highway assignment tabulations to be repeated for different geographic areas, such as the DRCOG region, the ozone non-conformity area, and individual counties. In the **ModelSummary.txt** file, the highway assignment tabulations are separated by headers as shown in the following screen shot.



```
VEHICLE ASSIGNMENT
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

----------------------------------------------------------------------------
//// Summary Geography: Travel Model Area (2804 zones)                  \\\\
//// Nine Counties plus Western Elbert and Southern Weld Counties       \\\\

 10 period     Factor     Hours          VMT          VHT        Speed
 ---------     ------     -----     -----------   ---------      -----
    AM1        0.346       0.5        2,490,445      69,509       35.8
    AM2        0.468       1.0        5,795,775     171,549       33.8
    AM3        0.359       1.0        5,185,516     148,462       34.9
```

Proficient **GISDK** programmers will be able to activate some of the custom summaries that are provided but turned off by default. Additional summaries can also be created, such as for a study area or corridor. Contact DRCOG for assistance if you would like to take advantage of these capabilities.

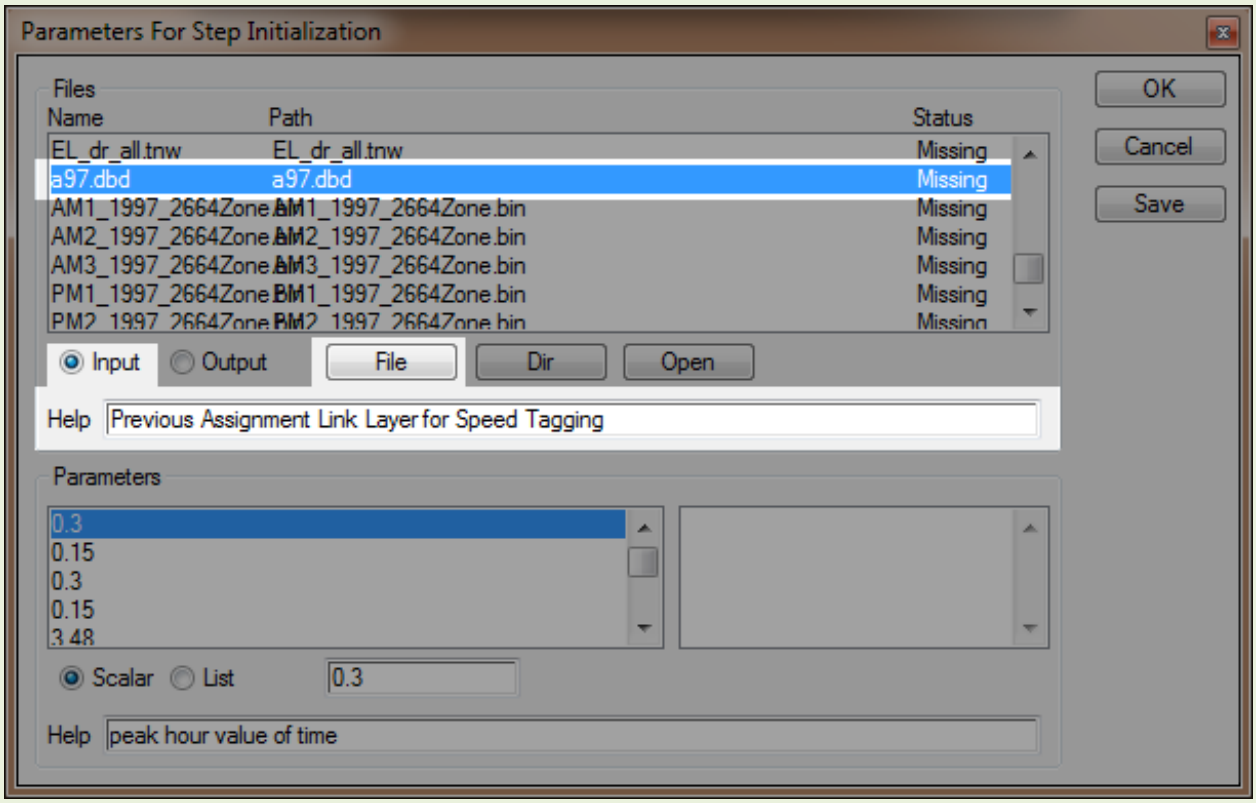
### 6.5.19 Tagging Speeds from a Previous Assignment

The input file "**Speed_Tb.dbf**" contains a lookup table by facility type and area type of estimated speeds after assignment. This lookup table was developed years ago based on assigned and observed speeds. As such, it is probably more appropriate to base years not too far removed from today. More distant horizon years with limited infrastructure investment (for instance, a 2040 No Action scenario) would be expected to have greater levels of congestion and thus slower speeds.

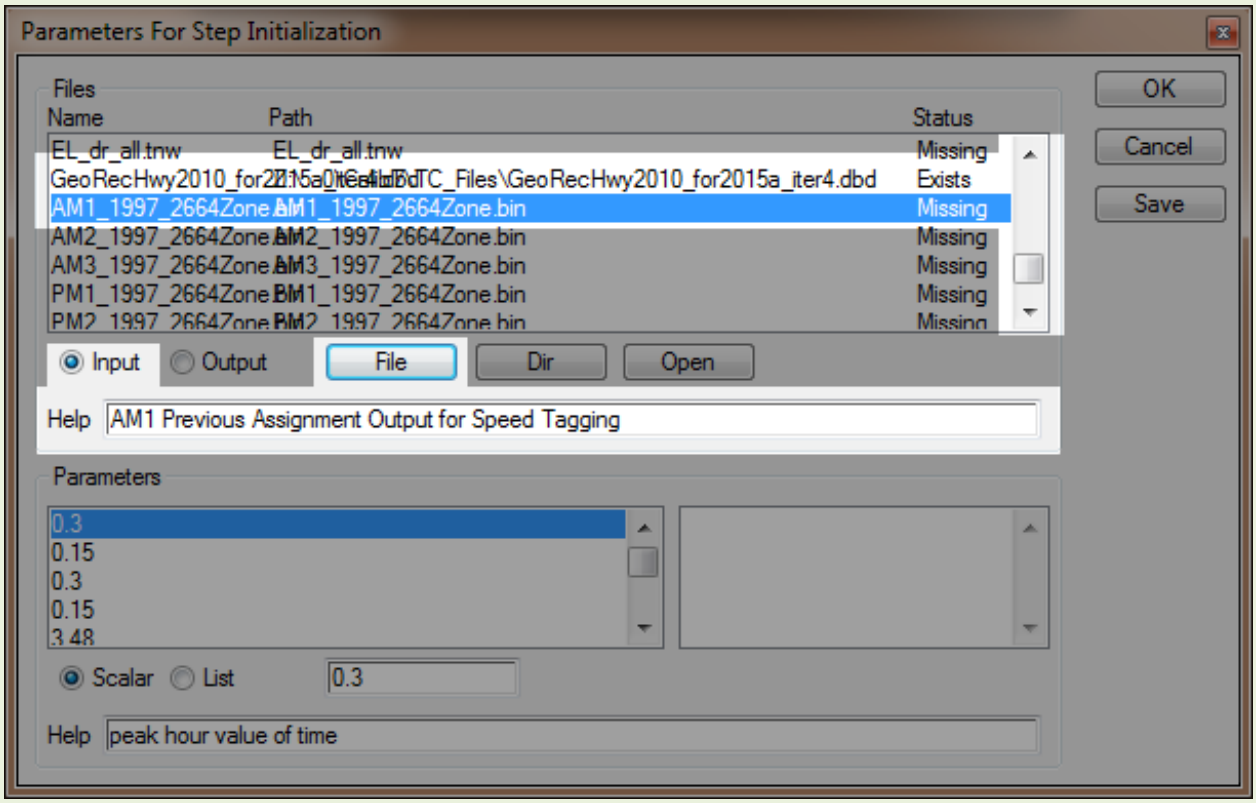
It may be possible to reach speed feedback convergence more quickly by starting with speeds from a similar run – either an analogous scenario in another forecast set, or a similar scenario already completed from the current forecast set – rather than those from the default lookup table described in the previous paragraph. To do this, you will need to use the Tripod speed tagging utility. However, you will first need to set up the locations of the previous assignment files in your scenario definition.

From the **Tripod Toolbox**, press the "**Scenario**" button to bring up the **Project Scenarios** dialog box. Find your current scenario in the upper scroll box. (Unfortunately, this defaults to the first scenario in your list; DRCOG does not have the resource code necessary to change this behavior.) Make sure the step (stage) scroll box in the lower right has "**Initialization**" selected and press the "**Contents**" button at the bottom of the dialog box.

You'll now see the **Initialization** Stage parameters dialog box. Check that the files radio button is set to "**Input**" and scroll most of the way to the end. You'll come to an entry with the help text of "**Previous Assignment Link Layer for Speed Tagging**" and a default entry of "**a97.dbd**". Select this row and press the "**File**" button. Use the Windows file selection dialog box to navigate to the appropriate link layer. It's highly possible you'll change to a different directory or even a different drive. Click the "**Open**" button to confirm your choice of file.



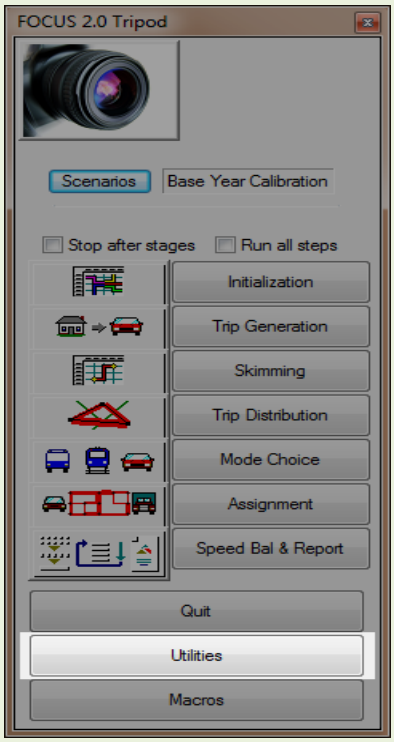

Now you'll need to select each of the ten highway assignment results summary files for the corresponding periods. Starting with the AM1 period, select the row under the entry for the previous assignment link layer. Click the "**File**" button and navigate to the **AM1.bin** file, which is likely in the same directory as you selected for the link layer. Click the "**Open**" button on the Windows file selector.



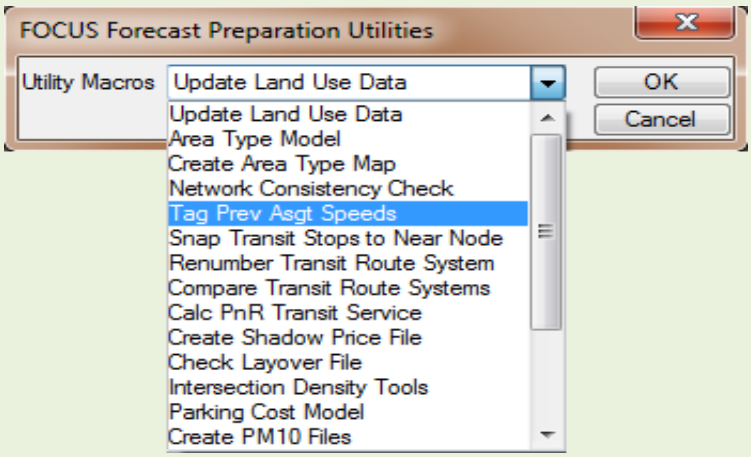

Repeat the above procedure for the remaining assignment time periods. The next rows are for AM2 and AM3, then PM1 through PM3, and finally for OP1 through OP4.

When you have selected all the assignment ***.bin** result files, click "**OK**" or "**Save**" on the **Initialization** Stage parameters dialog box, and then click "**OK**" on the **Project Scenarios** dialog box. You're now back at the **Tripod Toolbox**.

From the **Tripod Toolbox**, click on the large button near the bottom labeled "**Utilities**".




A small dialog box with a drop-down menu appears. Change the drop-down menu to "**Tag Prev Asgt Speeds**". Then click the OK button.




At this point, TransCAD will automatically create a map with both link layers and match the IDs of non-centroid highway links. Then the speeds will be copied over to the combined highway link layer during a series of dataview fills. The batch report will indicate whether the process was successful. At this point you will need to run the General Preprocess step of the Initialization stage to make sure that the speeds you just "**tagged**" get computed.

# Appendix A. Compiling and Using GUI Modify Route System

TransCAD route systems include the absolute path (with drive letter) of the underlying link layer upon which they're based. While this helps maintain the internal consistency of route systems, it can also create confusion when you copy a route system to create a new scenario or even to receive it from DRCOG's servers.

In past versions of Focus, the Tripod toolbox required the installation of **GUI Modify Route System** to update the associations between a route system and its base link layer. Beginning with Focus 2.3, Tripod automatically checks the reported link layer for the transit route system, and automatically changes it if the reported link layer doesn't match the scenario definition. (This check is done in the General Preprocess step, the Model Summary step, and the Check Network Consistency utility.)

While **GUI Modify Route System** is no longer necessary, this appendix is provided for those analysis who wish to continue using it, or who may need it outside of the regular forecasting work flow. Sections A and B below describe how to install the utility

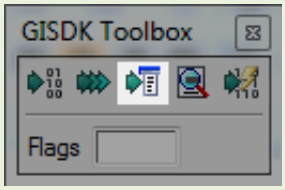
## A. Compiling the GUI Modify Route System GISDK

**GUI Modify Route System** can help clear up potential confusion regarding which link layer a route system is based upon by allowing the analyst to easily specify a new link layer a route system should be referencing. (However, **GUI Modify Route System** can also **CREATE** confusion if the wrong link layer is specified, for example, a non-DRCOG highway link layer.)

DRCOG recommend installing **GUIModifyRouteSystem.rsc** locally on the workstations where it's desired. The following steps describe how to install and configure it, which only needs to be done once per workstation.

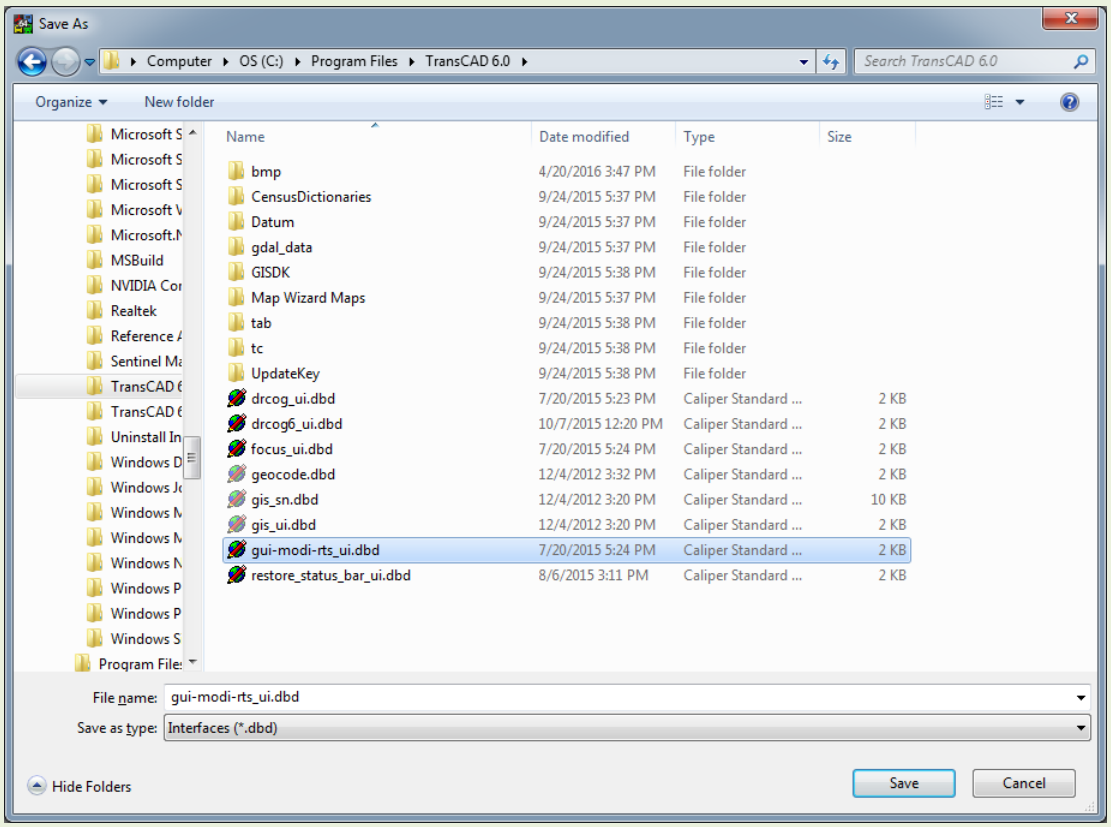
Launch TransCAD if you haven't already.

If you don't see the **GISDK Toolbox**, activate it by selecting the "**Tools --> GIS Developer's Kit**" menu item.




We'll be compiling the **GUIModifyRouteSystem.rsc** script to a user interface (UI) database, so click on the center button of the **GISDK Toolbox**:

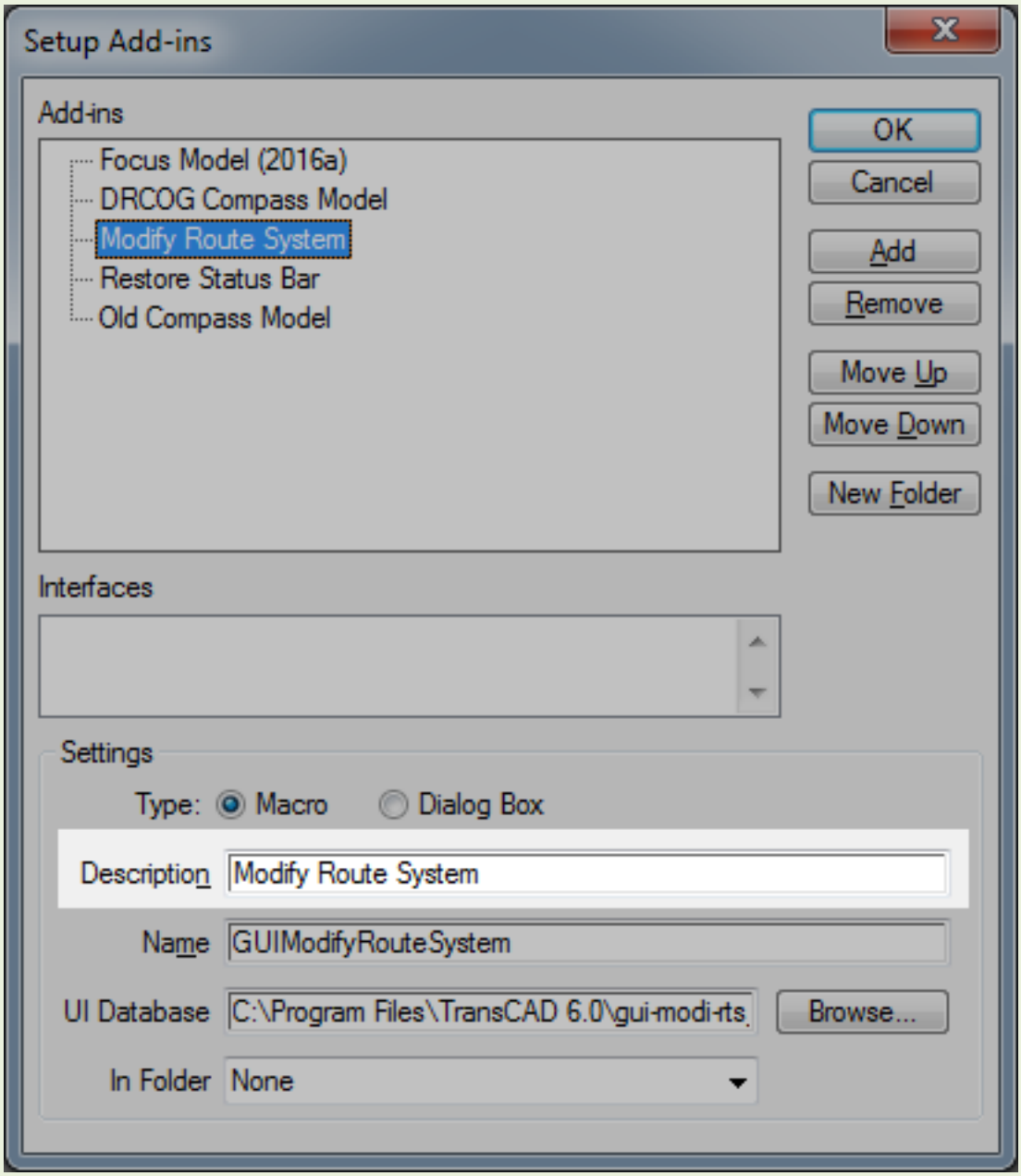
A standard Windows file selection dialog box opens. Use it to locate the **GUIModifyRouteSystem.rsc** macro script. From your Focus installation – typically "**C:\Program Files\Focus**", open the **TripodInstallation** folder and then open the **ResourceCode** folder. Select **GUIModifyRouteSystem.rsc** and press the Open button. Save the compiled UI database file in the same folder where you saved the **Tripod** UI database file. We suggest naming the file **gui-modi-rts_ui.dbd**, but you can use any name that will make sense to you.



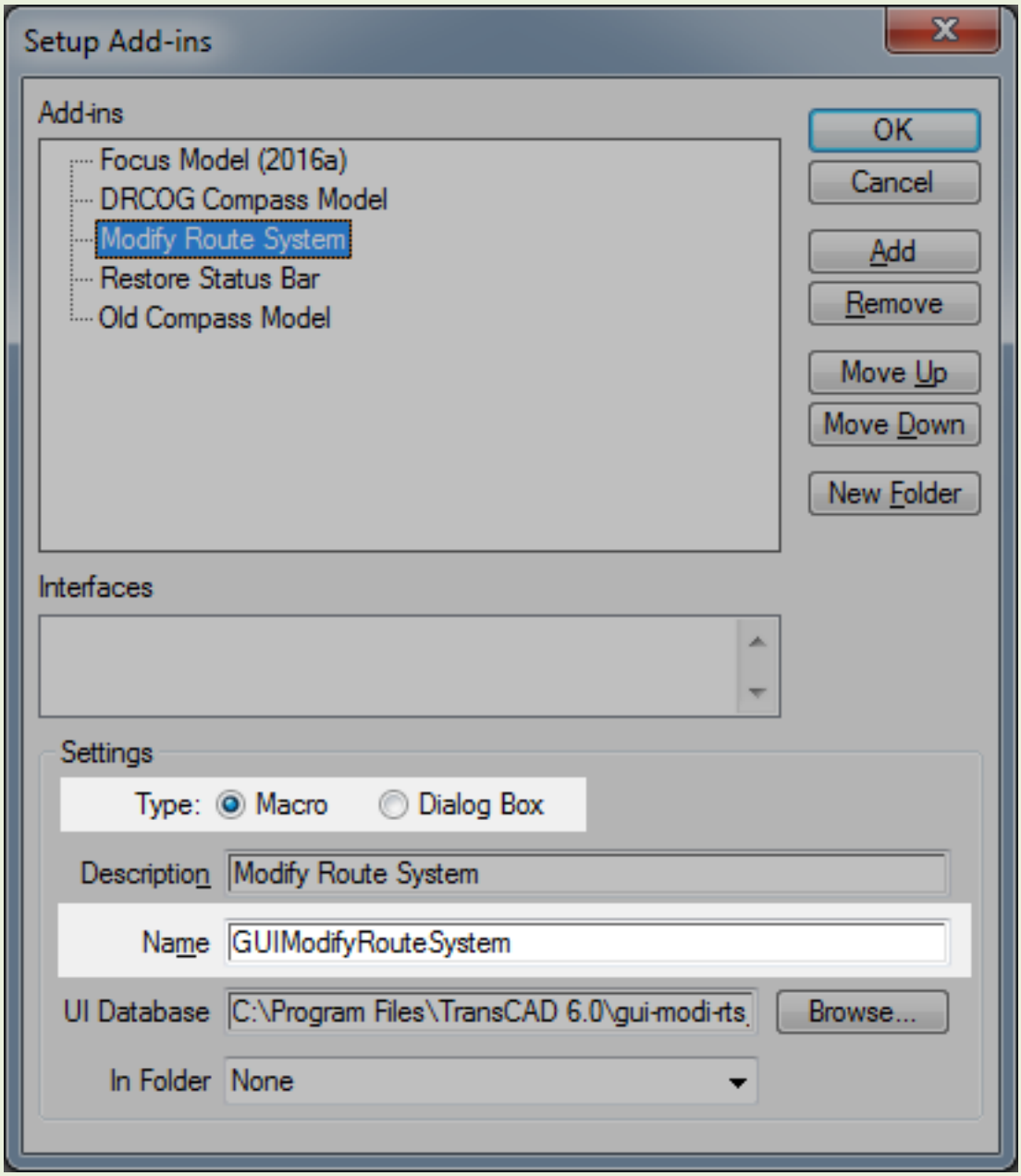
## B. Setting up the GUI Modify Route System Add-In

Select the "**Tools --> Setup Add-Ins**" menu item in TransCAD. Click on the Add button of the dialog box that appears.

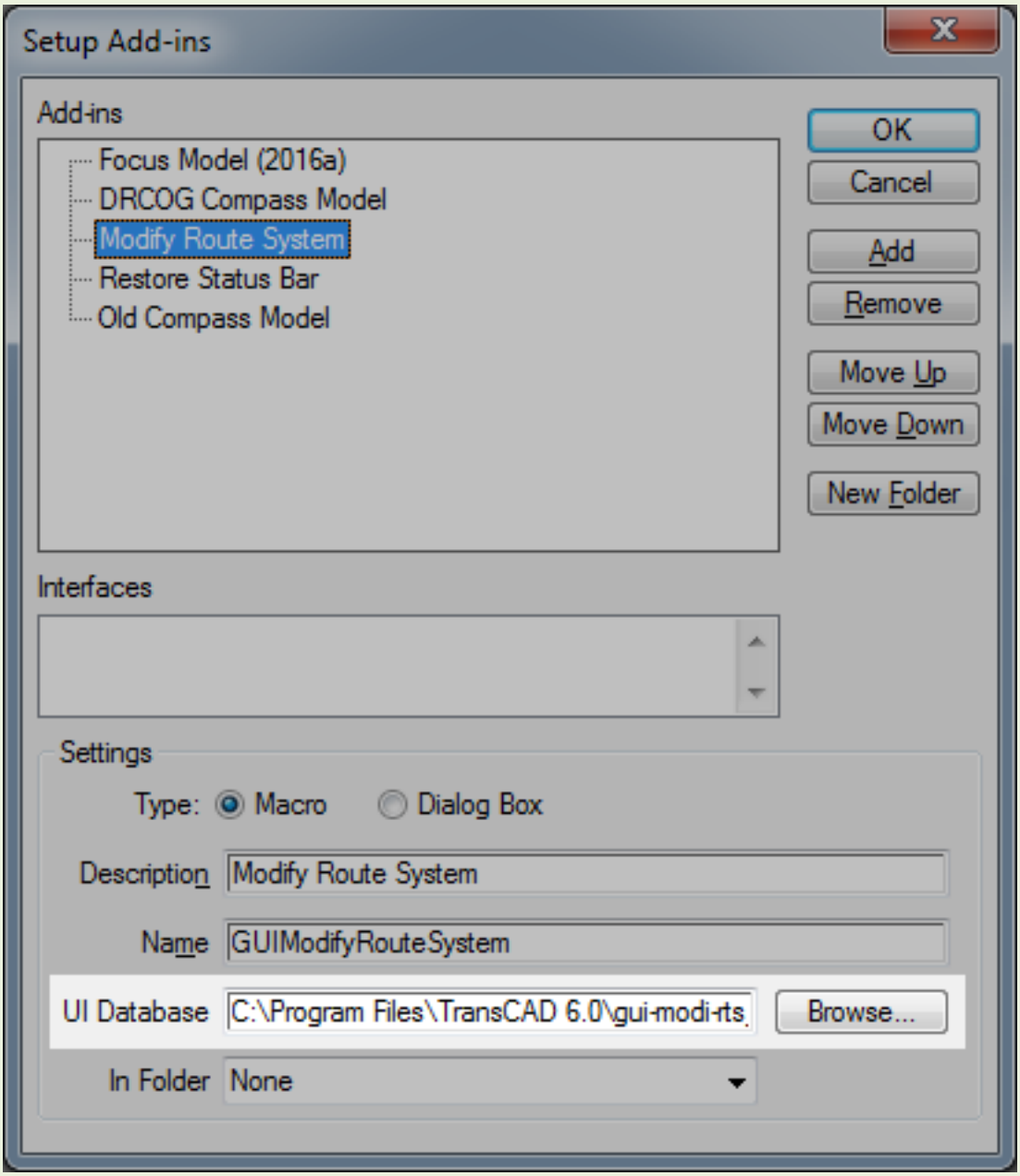
The Description field can be any text entry, such as "**Modify Route System**", that you'd like to see in your TransCAD menu. The text you type will be updated in the Add-ins box.



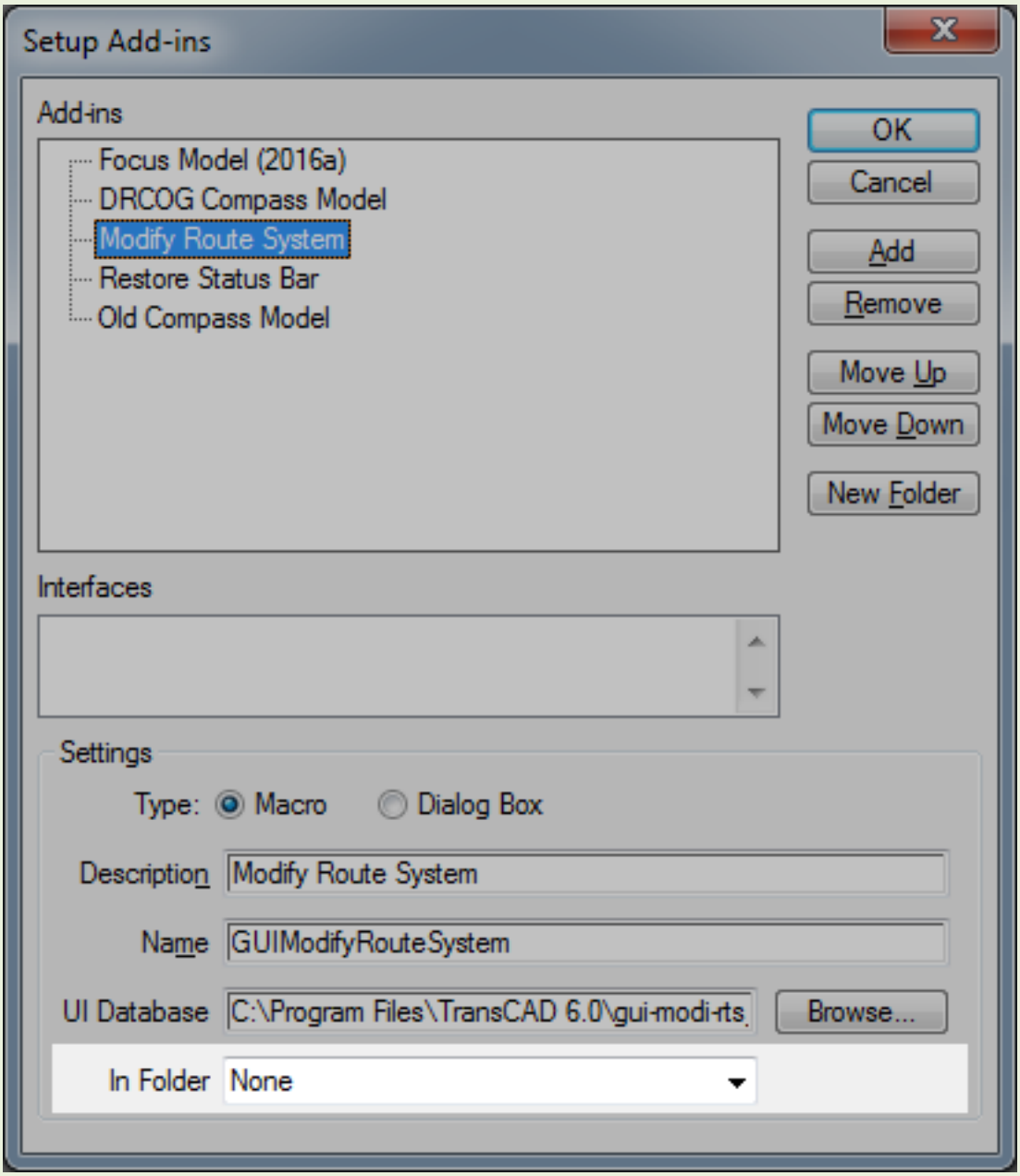
The Name box must be "**GUIModifyRouteSystem**" without spaces or quotes (unless you modify the resource code in a text editor). Also check that the Type radio button is set to "**Macro**."




Using the **Browse** button or typing in the UI Database field, provide the full DOS path to the UI database you saved in the previous step.




It's not usually necessary to specify a location for the "**In Folder**" drop-down. However, you may need to configure this option if you encounter errors trying to run the new add-in. Your IT staff may be helpful in recommending a directory where you have appropriate permissions.




Press the **OK** button to close the Setup Add-ins dialog. You should now be ready to use the GUI **Modify Route System** add-in from TransCAD's "**Tools --> Add-Ins**" menu.

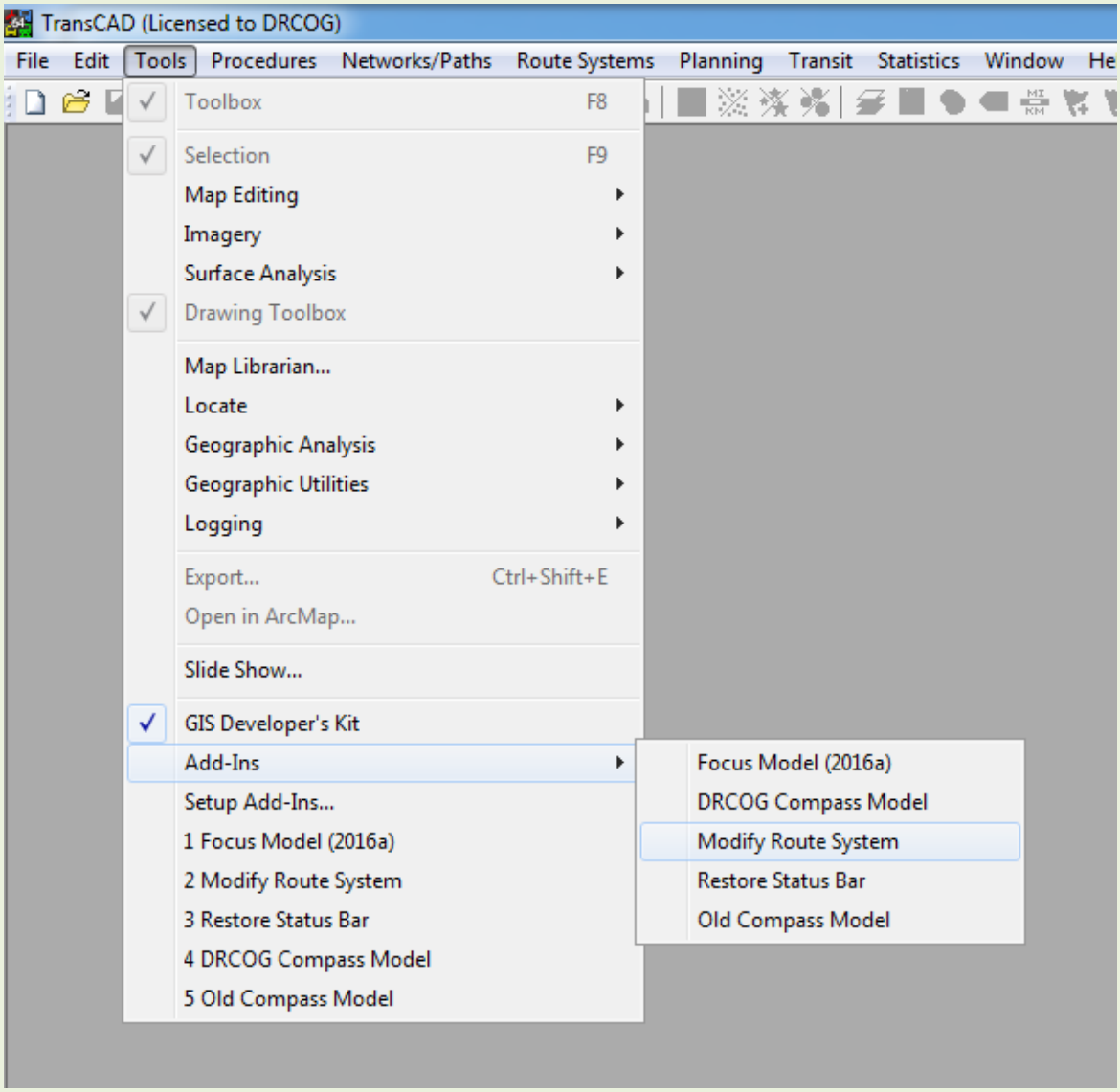
## C. Using GUI Modify Route System

You may run the **GUI Modify Route System** add-in each time you copy a route system to a new scenario directory. You may also need to use it if you open your route system in a map that contains more than one link layer, should TransCAD get confused about which link layer it should be associated with.

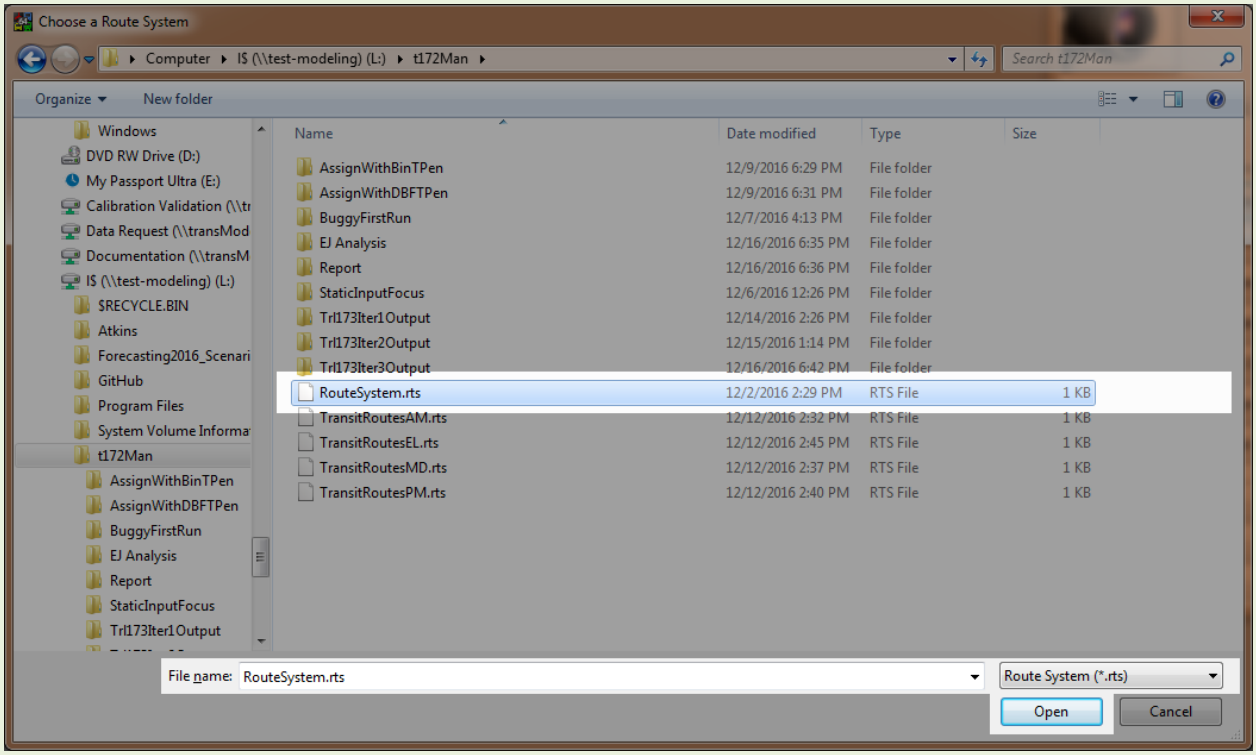
You can always check which link layer TransCAD thinks your route system is associated with by opening it in a new map and using the "**Tools -> Geographic Utilities -> Geographic File**" menu item.

Use the following steps to run the GUI Modify Route System add-in:

1. Launch TransCAD if you haven't already. There is no need to open or create any map file.
2. Select the Tools / Add-Ins menu item and choose "**Modify Route System**" or whatever you chose to name in the add-in.

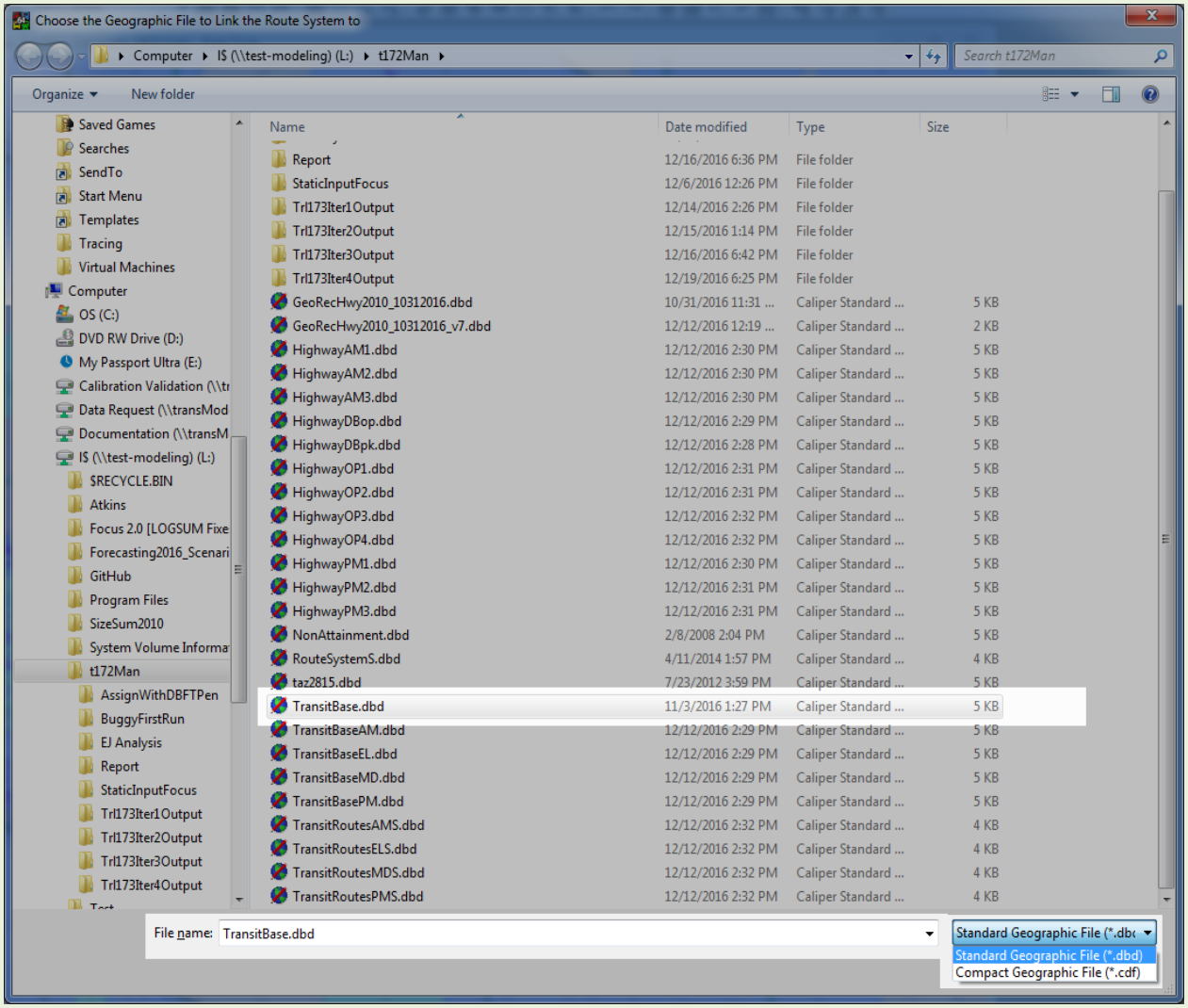

TransCAD (Licensed to DRCOG)
File
Edit
Tools
Procedures
Networks/Paths
Route Systems
Planning
Transit
Statistics
Window
Toolbox F8
Selection F9
Map Editing
Imagery
Surface Analysis
Drawing Toolbox
Map Librarian...
Locate
Geographic Analysis
Geographic Utilities
Logging
Export... Ctrl+Shift+E
Open in ArcMap...
Slide Show...
GIS Developer's Kit
Add-Ins
Setup Add-Ins...
1 Focus Model (2016a)
2 Modify Route System
3 Restore Status Bar
4 DRCOG Compass Model
5 Old Compass Model
Focus Model (2016a)
DRCOG Compass Model
Modify Route System
Restore Status Bar
Old Compass Model

3. A standard Windows file selection dialog box appears. Use it to select your route system.

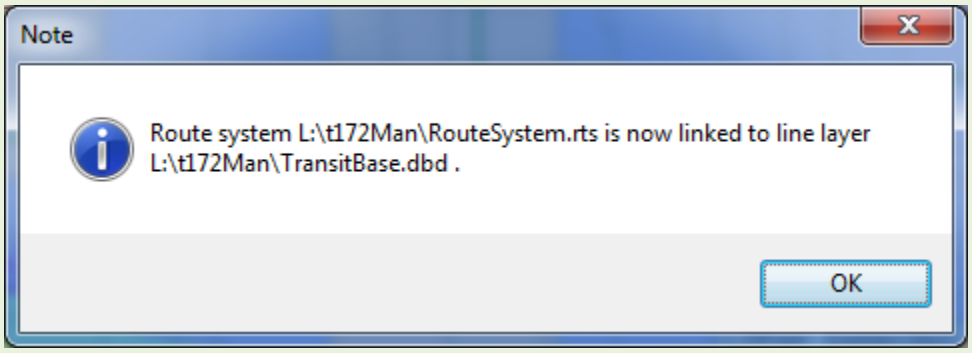



4. Another Windows file selection box appears, starting in the same directory as your route system. Use it to select the link layer that your route system will be based upon. Note that both Standard Geographic Files (***.dbd** files) and read-only Compact Geographic Files (*.cdf) are supported. Typically, you will link

RouteSystem*.rts to TransitBase*.dbd.




5. You will see a confirmation message such as the following. Click **OK**.



6. The next time you open your route system, TransCAD should automatically reload it. If not, you can always select the "**Route System -> Reload**" menu item. DRCOG also recommends selecting the "**Route System -> Verify**" menu item from time to time, especially if you aren't sure you've associated your route system to the correct link layer.
7. The next time you click on the Tools menu header, you'll see that "**Modify Route System**" is now included as a numbered option at the bottom of the Tools menu.

# Appendix B. External Files

1. Focus 2.3 Metadata[CSharp]
2. Focus 2.3 Metadata[TransCAD]