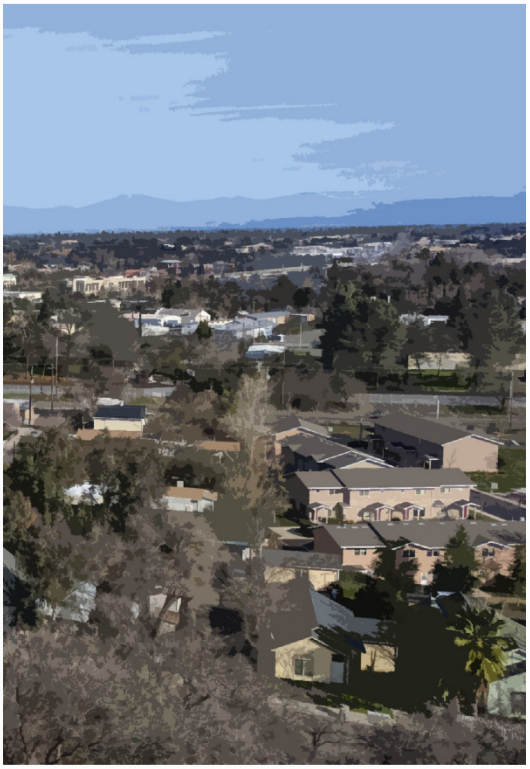

Model Users Guide

ShastaSIM 1.2

Activity Based Travel Demand Model

October 2018

Prepared for Shasta Regional Transportation Agency

SHASTA REGIONAL TRANSPORTATION AGENCY

DKS

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1. SHASTASIM INTRODUCTION

The Shasta Regional Transportation Agency (SRTA), as the designated Metropolitan Planning Organization (MPO) for Shasta County, has primary responsibility for the development and maintenance of travel demand forecasting methods and models for the region. SRTA teamed with DKS Associates, John Bowman, Mark Bradley, and Resource Systems Group Inc. (RSG) to develop a new activity-based (AB) travel demand model, henceforth referred to as ShastaSIM, for the Shasta County region. This document is the model user guide, which provides step-by-step instructions for application of the ShastaSIM model. The *ShastaSIM Model Development Report*, which describes the model in detail, is a separate document that is included with the ShastaSIM CD and can be found on SRTA's website at http://www.srta.ca.gov/174/Travel-Demand-Modeling.

ShastaSIM Software Requirements

The ShastaSIM model is an Activity Based (AB) model built using a combination of software packages. The following software packages are required for utilizing the ShastaSIM model:

- CUBE Base/Voyager 6.1 or 6.4 (Citilabs)
- DAYSIM08 (Bowman and Bradley)
- Excel 2010 or later (Microsoft)

DAYSIM08 is included with the ShastaSIM model package users receive. It is assumed that users have their own copy of Citilabs' CUBE Base/Voyager and Microsoft Excel software. Other software packages, such as ArcMap (ESRI) and utilities such as text editors can also be useful for working with GIS (geographic information systems) and text files. Minimum and recommended hardware requirements have been identified in the *ShastaSIM Model Development Report, and are as follows:*

- Intel Core 2 Duo
- 4GB of RAM
- 15GB of hard drive space
- 32-bit Operating system
- **Windows 10**

SRTA currently runs the model using the following computer system†:

- Dell Precison T5600
- Intel® Xeon® CPU E5-2643 0 @ 3.30 GHz (2 processors)
- 32GB of RAM
- 64-bit Operating System
- Windows 7

†Model run times average 5.5 hours per model year with SRTA's current setup.

Best Practices

Throughout this document users will find various recommended "best practices." These are identified by ***bold and italic, light blue*** text. While most are only recommended actions users should take, they are provided – based on experience developing and using ShastaSIM – to help make modeling and analysis of results easier for the user. Users should consider some "best practices" as 'shall do this' or 'shall not do this' statements, either due to their impact on later steps in the modeling process or model applications. Users will find these as ***bold and italic, dark-red*** text and generally additional comments will be provided to provide reasoning or explanation. Changes that have occurred in Version 1.2 of the model are highlighted in ***bold and italic, green*** text.

It should be noted that most of the images in this document are illustrative in nature and may not exactly reflect data in the current release of the model.

2. ShastaSIM User Interface and Structure

CUBE GUI

The basic GUI (graphical user interface) of Citilabs' CUBE software is depicted in **Figure 1**. The figure depicts the major elements of the GUI. At the top of the GUI is the **RIBBON**, an element common to programs developed for use in the Windows 7 and 8 environments. The ribbon is context sensitive and its buttons change depending on the tab selected. Tabs available are depending on the file type open (application, network, script, etc.). To the left are three main sections – the **SCENARIO PANE, APPLICATION PANE** and **APPLICATIONS KEYS PANE**.

The **SCENARIO PANE** shows a "tree" of all scenarios contained in the model. Scenarios can be added (which adds a new directory on the computer), deleted (which deletes the corresponding directory on the computer), or renamed (which renames the corresponding directory on the computer). For the ShastaSIM model, all scenarios are "children" to the "Base" scenario, and alternatives to a specific year should be added as "children" to that year. Scenarios can be added, deleted, or renamed by right clicking on the appropriate scenario or "parent" scenario. A "child" scenario will inherit key values from its parent. For example, if a new scenario called "AltA" was created as a child of the "SH25" scenario, the keys for the new "Alt A" scenario initially would have the same values as the "SH25" scenario. The keys should be modified to reflect the correct inputs for the new model run. More details are available in Chapter 3 - Model Scenarios.

The **APPLICATION PANE** shows all of the applications and sub-applications contained in the model for each respective catalog (.cat) file. For ShastaSIM, it shows the six main applications, including Buffer and Pop (buffering and population synthesizer), FBLOOP (feedback loops of numerous sub-applications), TRANSASN (transit assignment), PEAKHOUR (peak hour assignments), and DAILY (combining all assignments into one daily network). Double clicking on any application will open it.

The **APPLICATION KEYS PANE** shows a list of "keys" which are text fields dependent on the scenario selected. Keys may represent input and output file names, directory names, numbers, character strings or Boolean flags. More information regarding keys, including how to edit, rename, delete or load keys can be found in Chapter 15 of Citilabs' CUBE Base Model Reference Guide. Two additional keys have been added to the Application Keys Pane called AOC and SelZones. AOC represents the auto ownership cost for the given year. ***The AOC key should only be modified by SRTA staff.*** The SelZones key performs "select zone" analysis whereby trips to and from the selected zone or zones are tracked in a separate volume field in the output loaded networks. A single zone can be identified (260), or a range of zones (260-265), or a series of zones

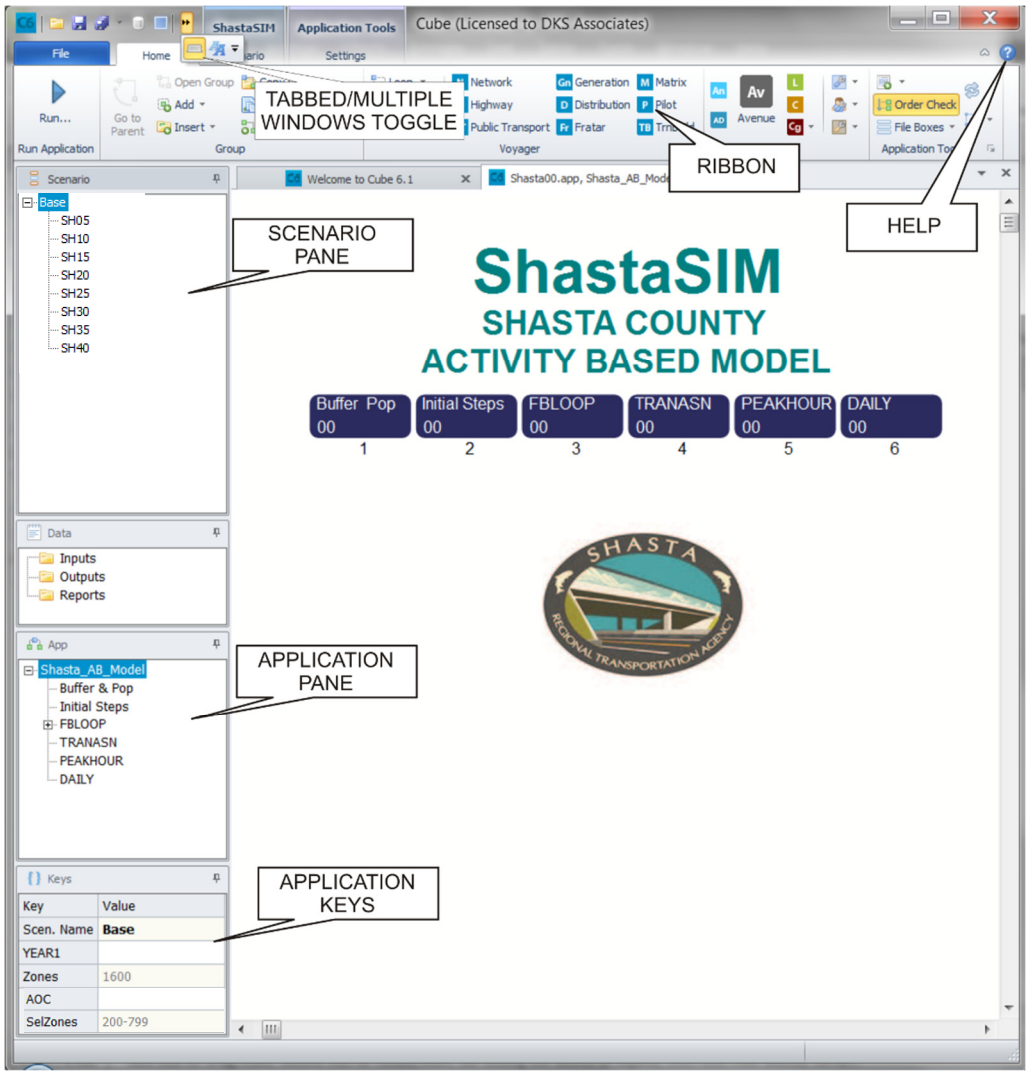
(260,263,265). A series of ranges can also be identified (200-265,270-275). A volume field with the letter "Z" denotes the volumes to and from the selected zones.

Values for the SelZone key should only include zone numbers, dashes (-), or commas (,). The model now automatically performs a select zone analysis for at least one zone and the user should make sure the SelZones key contains at least one zone number.

The **MAP/ APPLICATIONS WINDOW** shows, visually, the data file currently open. This window can visually display many types of files including applications (flow chart style), networks (maps), and scripts (text). Multiple files can be open at the same time and the software has two options for having multiple files open. The tabbed option (as depicted in) has a series of tabs at the top of the window and users can cycle between the tabs. The multi-document view allows the user to see multiple files at the same time and windows can be tiled (vertically or horizontally), cascaded, or synchronized (network maps only). Synchronized views are perfect for comparing "parent" and "child" scenario results at specific locations. These two modes can be toggled in the top menu as shown in **Figure 1**.

It should be noted that this document contains only basic instructions for using CUBE as it relates to the ShastaSIM model. It is not a comprehensive manual on how to use CUBE. More details on using CUBE can be found within the software's **help** feature.

Figure 1: ShastaSIM CUBE Graphical User Interface



Directory and File Structure

Throughout this document, files that reside on the user's hard drive (either input files or output files) are displayed in **BOLD DARK BLUE** text.

ShastaSIM requires a particular file structure to function properly. While the entire CUBE "Catalog" (**SHASTASIM.CAT**) can be located anywhere on a user's hard drive, ***the file structure within the catalog directory must be fixed for the model to operate properly.*** If the directory containing ShastaSIM is copied onto a new computer, the first time it is opened, CUBE asks the user if it is okay to rename all of the directory references in all scripts. This allows for sharing of

the model and its files between computers. The "catalog directory" is the directory in which the ShastaSIM.cat file (and other catalogs) is located. Within this catalog directory, the required file structure is as follows:

- **SHASTASIM**
  - **APPLICATIONS**
    - AB_MODEL
      - DAILY
      - FBLOOP
      - INITIAL
      - PEAKHOUR
      - TRANSASN
    - INPUTS
    - OUTPUTS
    - TRANSIT
  - **BASE**
    - SH05
    - SH10
    - SH15
    - SH20
    - SH25
    - SH30
    - SH35
    - SH40
  - **COMMON_START_FILES**
    - SH05
    - SH10
    - SH15
    - SH20
    - SH25
    - SH30
    - SH35
    - SH40
  - **COMPARE**
    - LU
    - NETWORKS
    - OUTPUTS
      - DELTA

- LOS
- VMT
- VOLUME
- PARCEL
- TRANSIT
- **CREATE PARCELS**
- **GIS**

In the above file structure, the **APPLICATIONS** directory and its subdirectories contain all of the CUBE Application Manager applications (*.APP) and associated scripts (*.S) as well as many of the print files (*.PRN) generated by the model. The **BASE** directory and its subdirectories contain the actual model runs and results files. The **COMPARE** directory and its subdirectories contain scenario comparison output files that will be discussed later (chapter 8) in this document. The **GIS** directory contains geographic information systems (GIS) files for use as backgrounds in CUBE mapping.

In order for a specific scenario to be run, the following 25 files must be in the scenario directory:

Files consistent between all model runs (located in COMMON_START_FILES directory):

1. **PUMS_SHAS_ACS08_12.DBF**
2. **INTERSECTIONS.DBF**
3. **OPEN_SPACE.DBF**
4. **CELPREDFILETEMPLATE.DBF**
5. **COEFFS13.TXT**
6. **EOUTTEMPLATE.DBF**
7. **HWFLOWDISTTEMPLATE.DBF**
8. **HWFLOWRADTEMPLATE.DBF**
9. **PFILETEMPLATE.DBF**
10. **SAMPFTEMPLATE.DBF**
11. **SFILETEMPLATE.DBF**
12. **SHADFILETEMPLATE.DBF**
13. **TFILETEMPLATE.DBF**
14. **COUNTS2010.DBF**
15. **SACFFTPP.TXT**

Files typically the same for all scenarios of a specific year (located in COMMON_START_FILES\SHxx):

16. **20XX_IXXI.DBF**
17. **20XX_TAZ.DBF**

18. **20XX_XXMAT.DBF**

Files that may change between scenarios:

19. **TURN.PEN**
20. **BASE.SUP**
21. **20XX_PNR.DBF**

Files that typically do change between scenarios:

22. **20XXBASE.NET**
23. **PARCEL_UPDATE_ALLOCHH.CSV**
24. **BASE.LIN**
25. **TURNNODES.S**

The first 15 of these files are consistent between all runs (they do not depend on forecast year) and can simply be copied from one scenario directory to another. The next three (16-18) are typically the same for all runs of a specific year ***and can be copied from the "parent" scenario to the "child" scenario of a particular year.***

The next three (19-21) may change if transit or roadway network changes are assumed; although they are not likely to change. File 19 can be modified if the user wants to add turn prohibitions to the model. The file format is:

A B C 1 -1

Where **A** is the "from" node, **B** is the "through" node, and **C** is the "to" node. These three nodes are followed by a **1** and a **-1**. Currently all numbers are separated by two spaces. One row should exist for each prohibited movement at an intersection. Therefore there can be more than one row per intersection.

Files 20 and 21 are only likely to change if the user desires to modify the details of park-and ride access or transfer access between transit lines or modes.

The next three files (22-24) are the most likely to change, as most scenario changes are typically based on land use, roadway network, or transit modifications. The modification of these last three files will be discussed **chapters 4-6** in this document.

The final file (25) allows the user to select which nodes (or intersections) are selected for extracting peak hour turning movement volumes. The file must begin with "turns n=" and contain a list of nodes separated by commas. It can be a blank file if the user does not want to extract any turn movement volumes.

One additional file that should be located in the scenario directory (but is not required for a successful run) is the **DEFAULT.VPR** file. This file results in all input and output networks being opened in the scenario directory having similar color schemes and saved zoom windows.

Catalog Files

ShastaSIM includes four distinct catalog (.cat) files in order to run the model. They are:

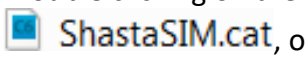
- **ShastaSIM.CAT** – Primary catalog file to run model scenarios.
- **ShastaSIM_COMPARE_INPUTS.CAT** – Evaluates and compares model inputs between two scenarios. ***Typically users choose the "parent" scenario (SHxx) and "child scenario" for the same model run year.***
- **ShastSIM_COMPARE_OUTPUTS.CAT** – Evaluates and compares model outputs between two scenarios. ***Typically users choose the "parent" scenario (SHxx) and "child scenario" for the same model run year.***
- **ShastaSIM_COMPARE_TRANSIT.CAT** – Evaluates transit assignment, transit boardings, and the number of jobs (employment) and households within ¼ and ½ mile of the transit system.

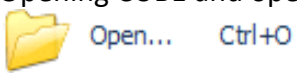
See chapter 3 for more details on **ShastaSIM.CAT**. See chapter 8 for more details for all three "compare" catalogs.

3. RUNNING SHASTASIM

Like the Shasta County four step model before it, ShastaSIM runs in the CUBE Application Manager environment. After a new scenario has been created, as described in chapter 4, all necessary files copied over to the new directory, and the necessary files edited (roadway network, transit lines, and land use), the scenario can be run using the ShastaSIM application in Cube.

In order to run a scenario, conduct the following steps:

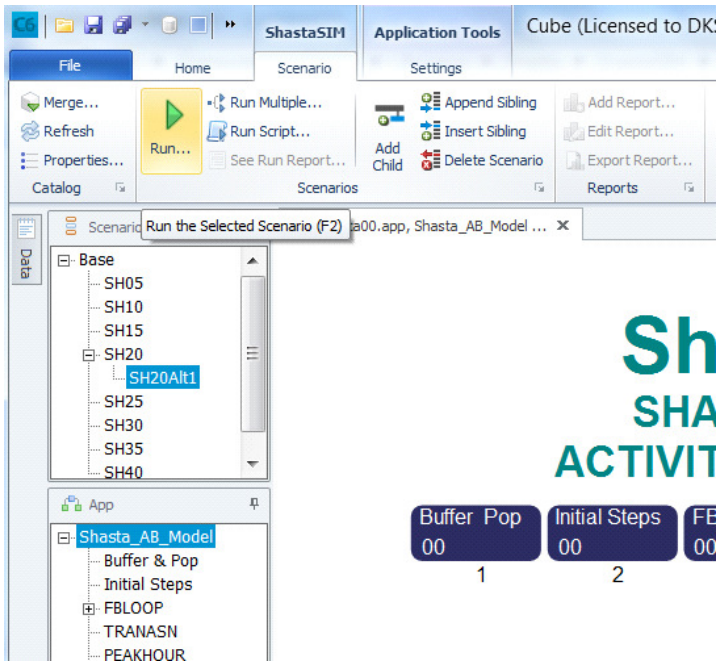
1. Open **SHASTASIM.CAT** by either:
   a. Double clicking on the file in the Catalog Directory
      

      , or;
   b. Opening CUBE and opening the catalog file from within CUBE
      

      If the scenario pane on the left is too small to see all scenarios, it can be stretched.

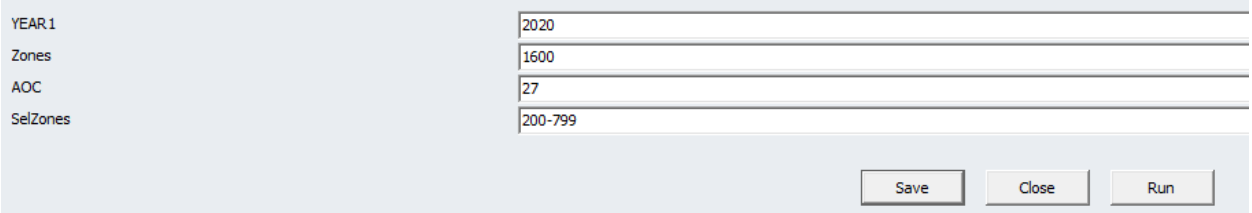
2. There are multiple ways to begin a single model run or series of model runs from within CUBE.
   a. **Method 1**: With ShastaSIM.cat open and the SCENARIO tab selected on the Ribbon (see **Figure 2** below).

Figure 2: Run Model Using Scenario Ribbon



i. Click Run…

ii. The following window will open:



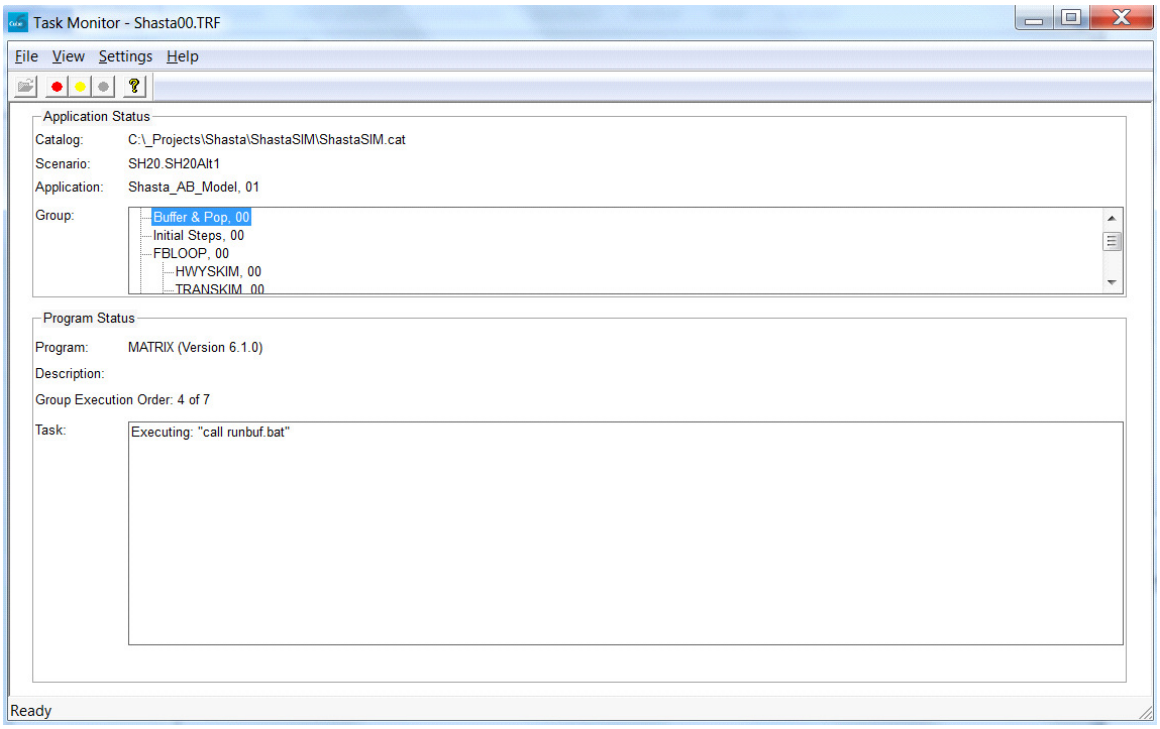
iii. Make sure the correct year is shown in YEAR1 and click Run.

iv. ***AOC*** *(Auto Ownership Cost) should only be changed based on direction from SRTA*

v. *Enter zone(s) or ranges of zones in* ***SelZones*** *to select zones for distribution estimation.*

vi. The single scenario will begin running and a Task Monitor window will open.

Figure 3: Task Monitor Window

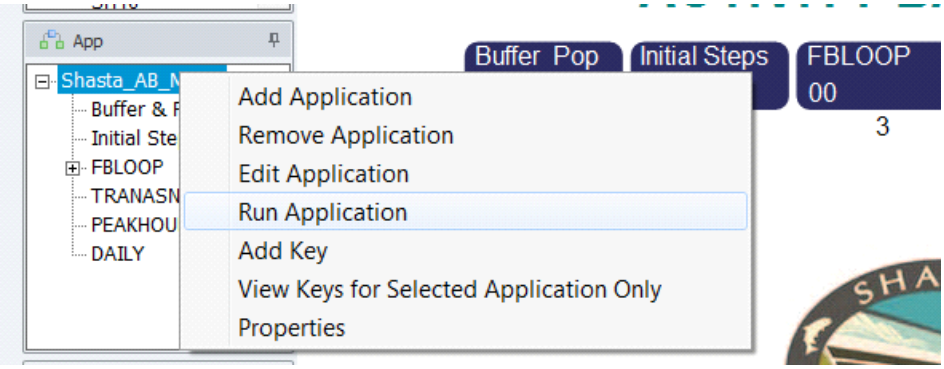


vii. In order to run multiple scenarios using method 1 (one after the other, typically overnight) click Run Multiple… . The Run Catalog window will open.

viii. Multiple runs can be added to the selected list and clicking OK will run all of the selected scenarios one after the other. ***It should be noted that scenarios will run in sequence, not at the same time.***

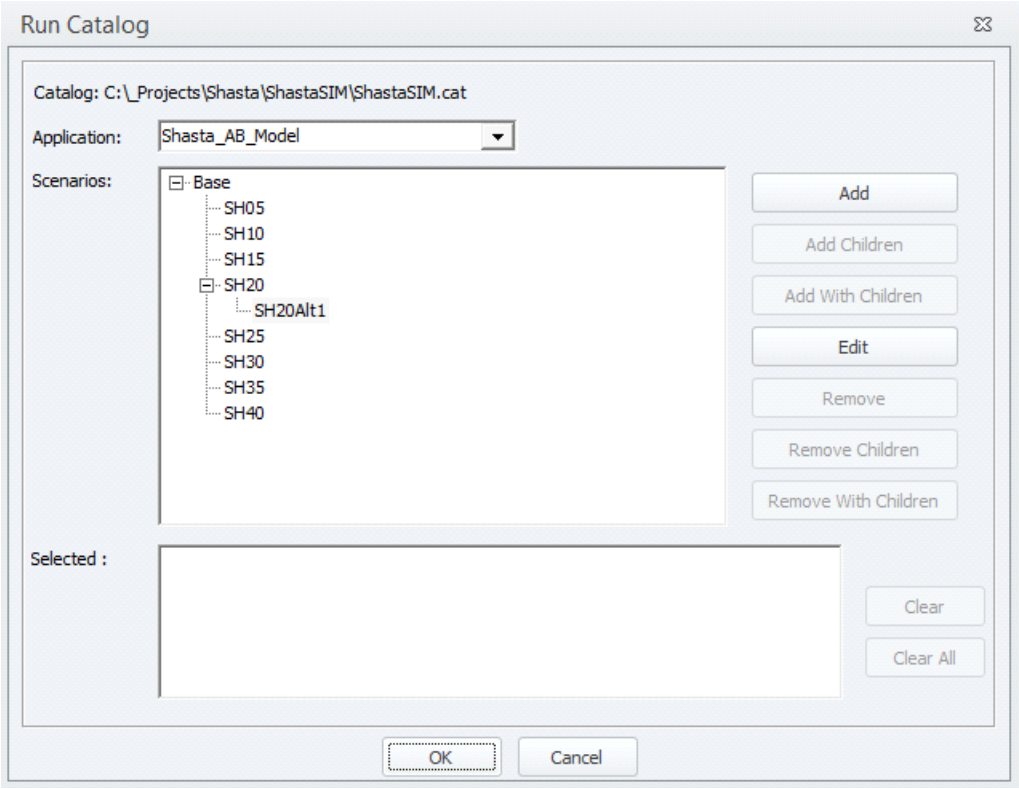
b. **Method 2**: With ShastaSIM open in CUBE, right-click on **Shasta_AB_Model** in the Applications Pane and select Run Application from the drop-down menu (see **Figure 4**)

Figure 4: Run Model from Scenario Pane



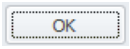
i. The Run Catalog window will open.

Figure 5: Run Catalog Window



ii. If any undesired scenarios appear in the **Selected:** box, click **Clear All** to remove them.

iii. Click on the desired scenario (or multiple scenarios) in the **Scenarios:** box and click **Add** to add it to the **Selected**: box.

iv. Click  to begin the run. Just like Method 1 above, the single (or first of multiple) scenario will begin running and a Task Monitor window will open.

3. Depending on computer hardware, each run will take anywhere between three to six hours.
4. The model will run all six sub-models, which includes generating the synthesized population and associated daily travel tours, as well as peak and daily vehicle assignments.

5. Key output files to be used for future MOE calculations and scenario comparisons include the following files below:

- **TOUT1.DBF**: Tour day-level output file
- **SOUT1.DBF**: Trip day-level output file
- **POUT1.DBF**: Person day-level output file
- **20xxA3VO.NET**: AM period loaded network
- **20xxMDVO.NET**: Midday period loaded network
- **20xxP3VO.NET**: PM period loaded network
- **20xxEVVO.NET**: Evening period loaded network
- **20xxA1VO.NET**: AM peak hour loaded network
- **20xxP1VO.NET**: PM peak hour loaded network
- **20xxA1P1.NET**: AM/PM peak hour validation
- **20xx DAYSUM.NET**: Daily loaded network/ validation
- ***20xxAMTRN.DBF:*** Selected AM peak hour turn movement volumes
- ***20xxPMTRN.DBF:*** Selected PM peak hour turn movement volumes

Details of the contents of these files can be found in the *ShastaSIM Model Development Report*. That document is included with the ShastaSIM CD and can be found on SRTA's website at http://www.srta.ca.gov/174/Travel-Demand-Modeling.

Auto Operating Cost (AOC) and Select Zone (SelZone) Keys

Two new keys have been added, starting with ShastaSIM v1.2 (2018), to the Application Keys Pane called ***AOC*** and ***SelZones***.

AOC represents the auto operating (ownership) cost for the given year. ***The AOC key should only be modified by SRTA staff. Modifications to this key may render the results inconsistent with the adopted Regional Transportation Plan and Sustainable Community Strategy for the region.***

The SelZones key performs "select zone" analysis whereby trips to and from the selected zone or zones are tracked in a separate volume field in the output loaded networks. A single zone can be identified (e.g. 260), or a range of zones (e.g. 260-265), or a series of zones (e.g. 260,263,265). A series of ranges can also be identified (e.g. 200-265,270-275). A volume field with the letter "Z" denotes the volumes to and from the selected zones.

Values for the SelZone key should only include zone numbers, dashes (-), or commas (,). The model now automatically performs a select zone analysis for at least one zone and the user should make sure the SelZones key contains at least one zone number.

MODEL SCENARIOS

As with the previous four step model, scenarios have been developed for five year increments. "Base" scenarios have been developed and run for the years 2005, 2010, 2015, 2020, 2025, 2030, 2035, and 2040.

The most common scenarios the model may be used for are:

1. Making transportation network changes and evaluating results;
2. Making transit network changes and evaluating results;
3. Making land use changes and evaluating the results; and
4. Any combination of the above.

Below we discuss these common scenarios and describe which of the 25 model files (discussed in chapter 2) the model user would typically modify.

The following rules should be observed when creating scenarios in ShastaSIM:

- ***"Base" or "Parent" scenarios should never be edited.***
- Scenarios have to be added to the ShastaSIM catalog, as well as all three COMPARE catalogs. Users will need to manually add the appropriate "child" scenario under each "parent" scenario for each catalog.
- Ensure that the scenario name, description, keys, etc. are the same as those in the ShastaSIM catalog. Be careful to check spelling on scenario names, as slightly different spelling between catalogs will result in scenarios not working correctly.
- Scenario names should be descriptive yet simple.

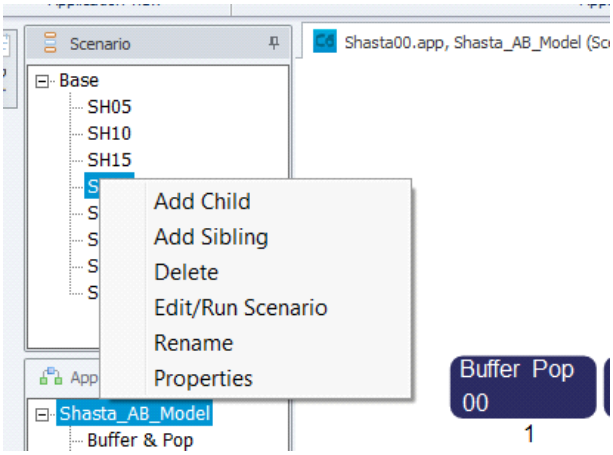
Create New Scenario and Populate Directory

In order to create a new scenario, conduct the following steps:

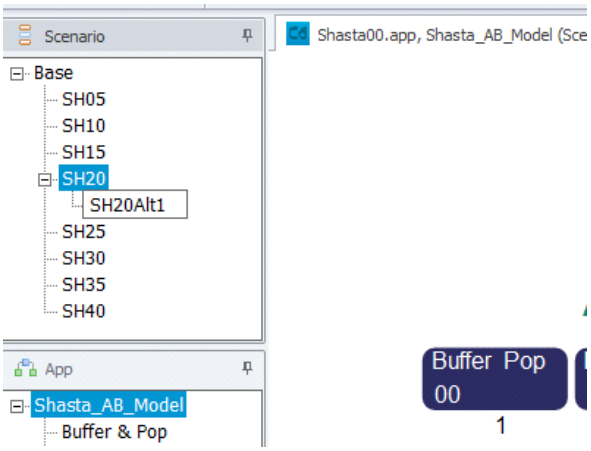
1. Open **SHASTASIM.CAT** by either:
   a. Double clicking on the file in the Catalog Directory
      

      , or
   b. Opening CUBE and opening the catalog file from within CUBE
      

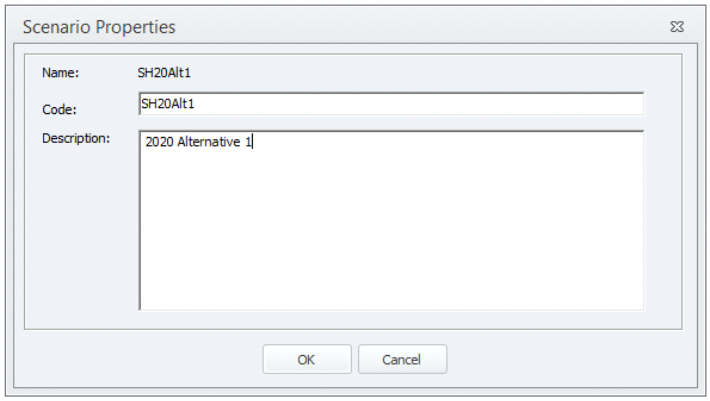
      If the scenario pane on the left is too small to see all scenarios, it can be stretched.
2. Right click on the year for the new scenario (for example SH20) and click "Add Child".



3. Give the scenario a simple, but descriptive name (for example SH20Alt1) and hit return.

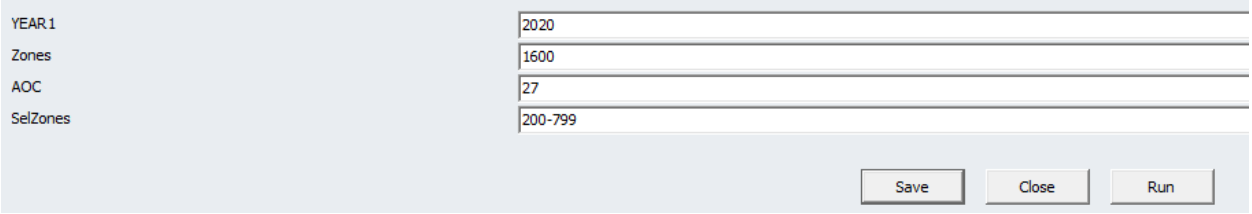


4. The "Scenario Properties" dialog box will appear.

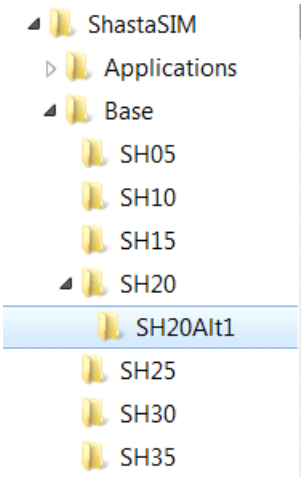


5. Next to "Code:" input the same scenario name as above. ***A description can be entered in the appropriate box, but it is optional.***

6. Click OK.
7. The next screen shows the "Keys" YEAR1, Zones, ***AOC, and SelZones***. *Make sure that* ***YEAR1*** *is correct and* ***Zones*** *is 1600.* ***Do not change AOC. Select zones for distribution using SelZones.***



8. Click Save and Close.
9. Next go into Windows Explorer and make sure that a new directory has been created under CATALOG DIRECTORY\BASE\SHXX\NEWSCENARIO\.



10. Copy the 25 (or 26 if including the default.vpr, if present) required files from the base SHXX directory (located in COMMON_START_FILES\By_Year directory) to the new scenario directory. ***It is good practice to copy all required files to the new directory before attempting to edit any of the files.*** This helps preserve the base runs for each year.

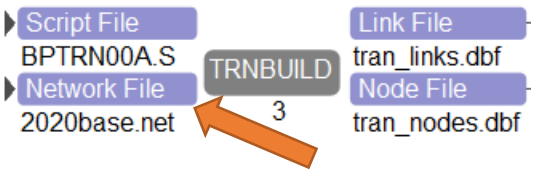
As stated above, the four files most likely to be modified for a new scenario include the base network (base.net), land use input (parcel_update_allocHH.csv), transit network (base.lin), and turn movement selection (turnnodes.s) files. Each of these files has specific steps for updating, while some of them have multiple ways of updating. The following sections describe the various steps to edit the model for a specific project scenario and view model results.

5. View and Edit Base Network

Open and View Network

The base network (**20XXBASE.NET**) file should be edited in CUBE. It can be opened by:

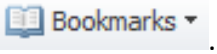
1. Navigating to the scenario directory in Windows Explorer and double clicking the file, or;
2. With CUBE already open:
   a. Using file/ open to open the network
   b. Double-clicking on the network file box from within an application, in the **MAPS/APPLICATIONS WINDOW** (see Figure 1)



Likely edits to the network include:

- Adding or deleting roadways;
- Adding or reducing lanes on roadways;
- Changing speeds on roadways;
- Changing direction of roads (e.g. changing link from two-way to one-way) or;
- Changing functional classification on roadways.

Once open, the network file looks like **Figure 6** (page 17). In this figure, the roadway network links are colored by number of lanes per direction. Roadways with one lane per direction are dark grey, roadways with two lanes per direction are blue, roadways with three lanes per direction are orange, and roadways with more than three lanes per direction are red. TAZ centroid connectors are dashed lines and Class I bike paths are green.

Saved views (bookmarks) can be invoked by clicking 

. This will bring up a choice of saving new bookmarks or restoring existing bookmarks. A number of bookmarks have been saved in the **DEFAULT.VPR** file.

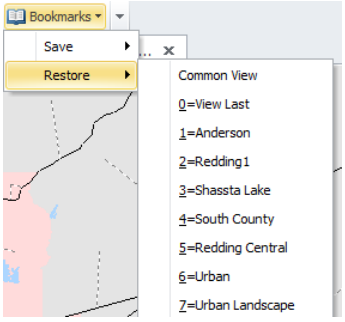
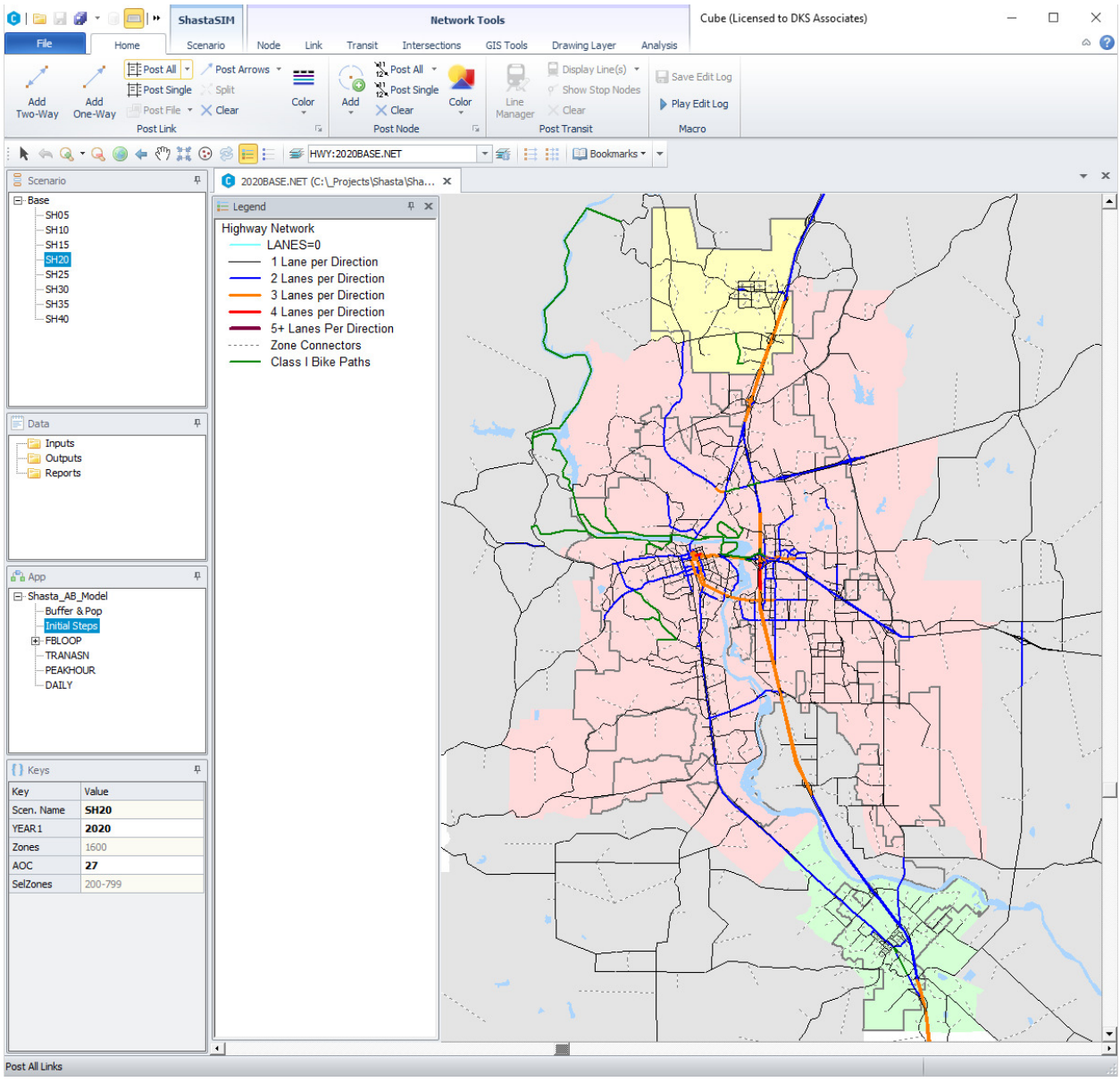


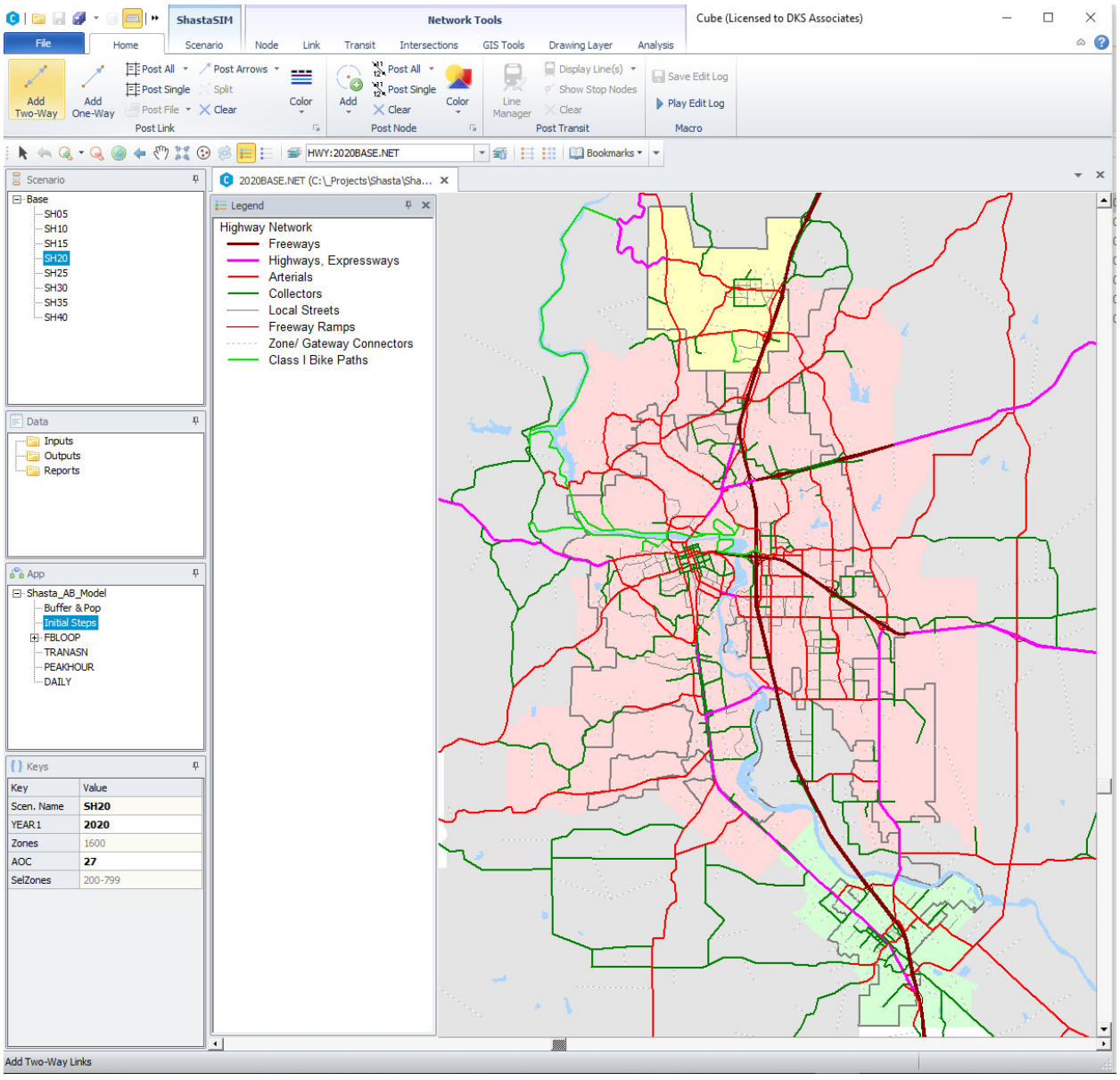
Figure 6: Base Roadway Network Lanes in CUBE



In **Figure 7** (page 18), roadways are shown color coded by facility type. Freeways (FACTYP = 1) are thick dark red, Highways and Expressways (FACTYP = 2 and 3) are magenta, arterials (FACTYP = 4) are red, Collectors (FACTYP = 5) are dark green, Local Streets (FACTYP = 6) are solid grey, Freeway Ramps (FACTYP = 7, 8, and 9) are thin dark red, Zone and Gateway

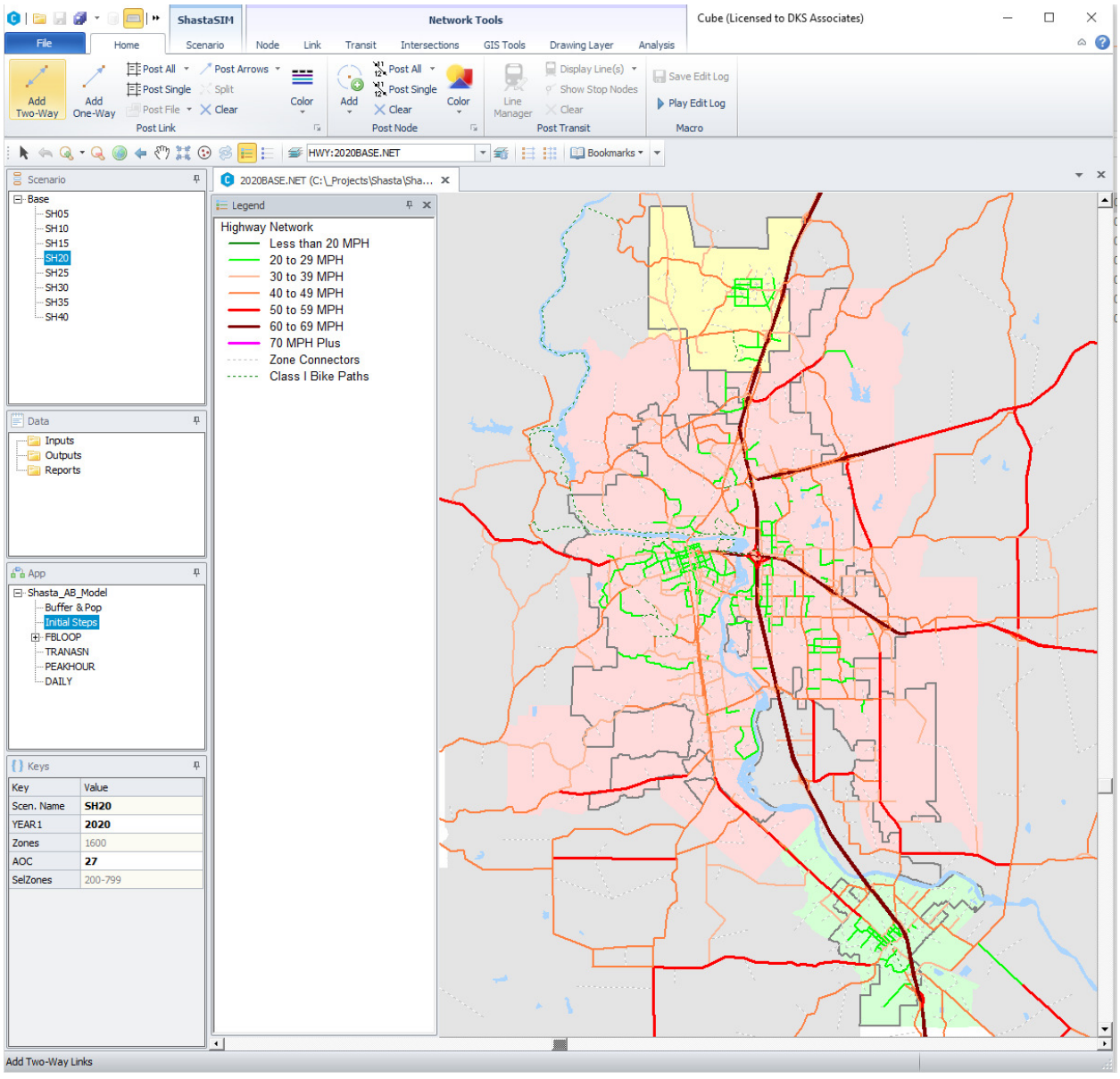
Connectors (FACTYP = 10 and 11) are dashed grey, and Class I bike paths (FACTYP = 21) are light green.

Figure 7: Base Roadway Network Facility Type in CUBE



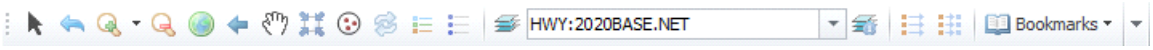
In **Figure 8**, roadways are shown color coded by speed. Slower speeds are in shades of green, medium speeds are in shades of orange, and higher speeds are in shades of red and magenta. Zone connectors and bicycle paths are dashed grey and green, respectively.

Figure 8: Base Roadway Network Speed in CUBE



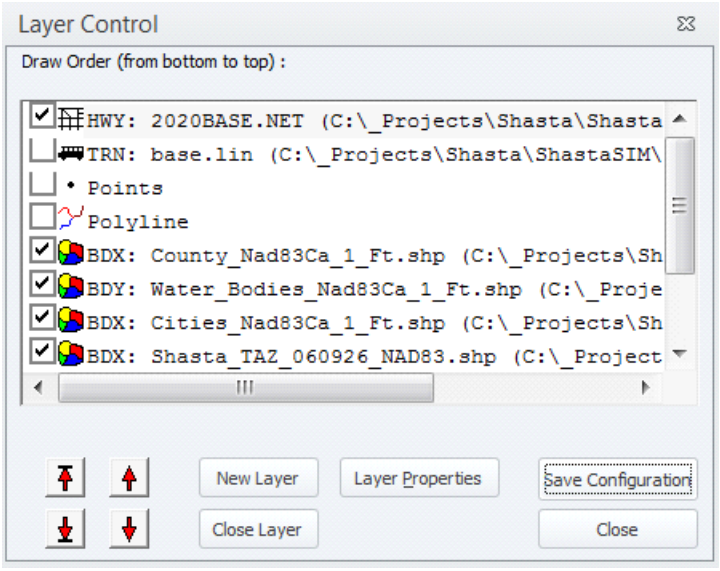
Quick Access Toolbar

The **QUICK ACCESS TOOLBAR** in CUBE contains a number of useful tools, which are discussed below.



1. Individual links can be selected by clicking .
2. Edits to the network can be undone by clicking . Note that this icon is greyed out if no edits have been made.
3. The view can be zoomed in by clicking and zoomed out by clicking .
4. The view can be zoomed to the entire extent of the network by clicking .
5. The view can be zoomed to the previous extent by clicking .
6. The view can be panned by clicking .
7. The view can be zoomed to a particular node by clicking , selecting the desired node, and the desired window width (in feet).
8. Layers (including networks, transit lines, point, polyline, and boundary shapefiles, and images) can be controlled by clicking . This brings up the LAYER CONTROL window (**Figure 9**) where layers can be turned on or off, added or deleted, or sources of layers can be changed.

Figure 9: Layer Control Window



a. Layers can be added by clicking New Layer, which brings up a browse window to find files on the computer's hard drive or network.
b. Layers can be turned on or off by clicking the check box next to the layer.

Layer sources and drawing properties can be changed by selecting a layer and clicking Layer Properties. Color settings (lines and fill) and posting are similar to those described below for networks and are invoked in their own parameters windows. See **Figure 10**, **Figure 11** and **Figure 12**.

Figure 10: Boundary Layer Parameters

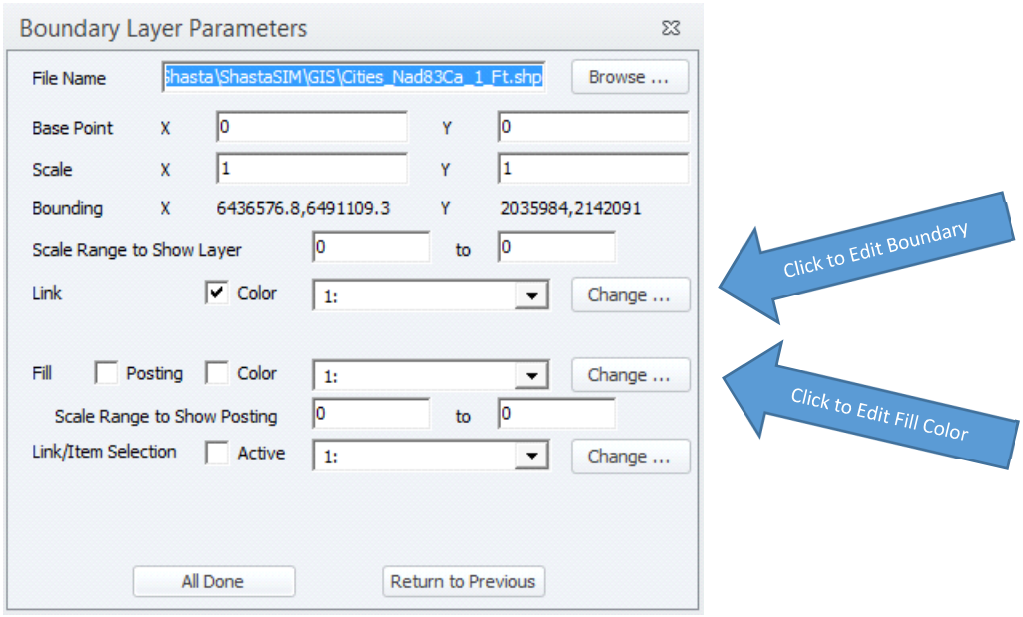


Figure 11: Boundary Layer Link Color Specifications

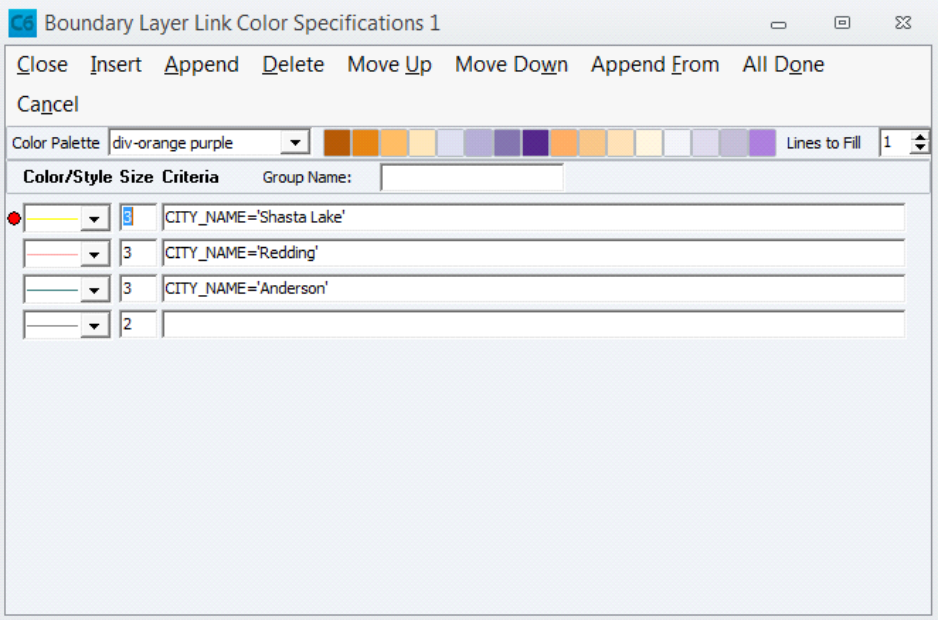
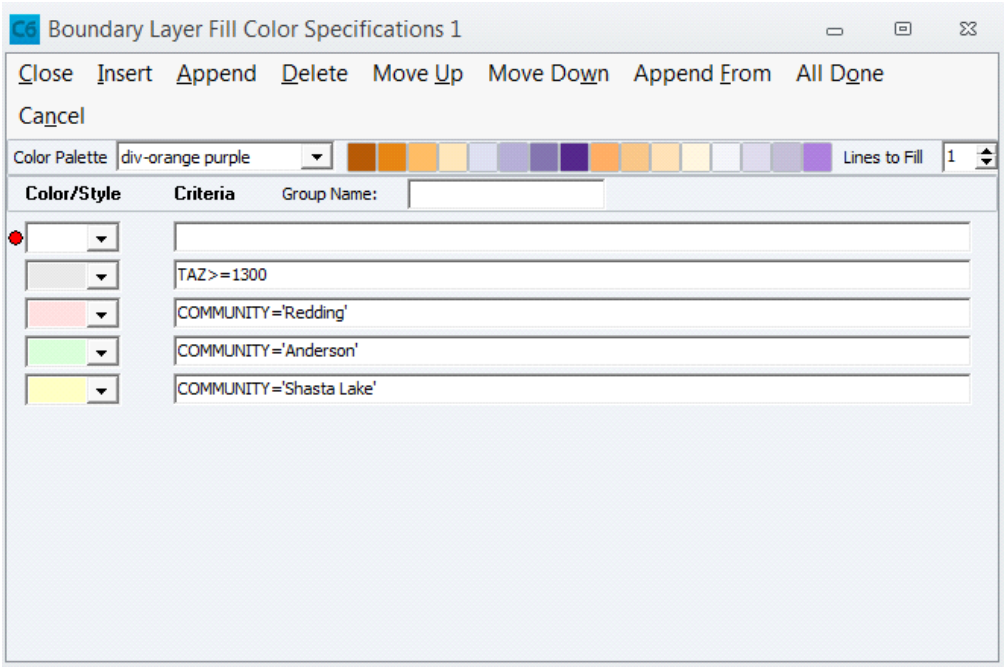


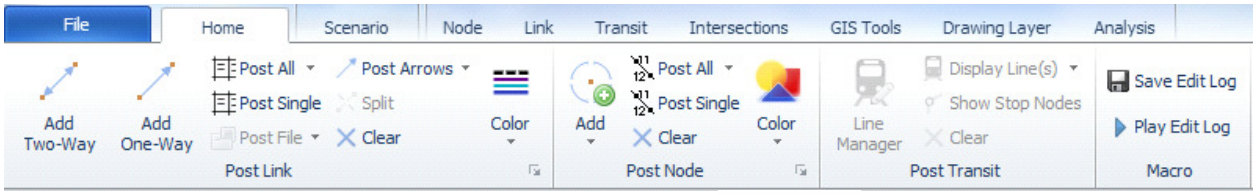
Figure 12: Boundary Layer Fill Color Specifications



Home Ribbon

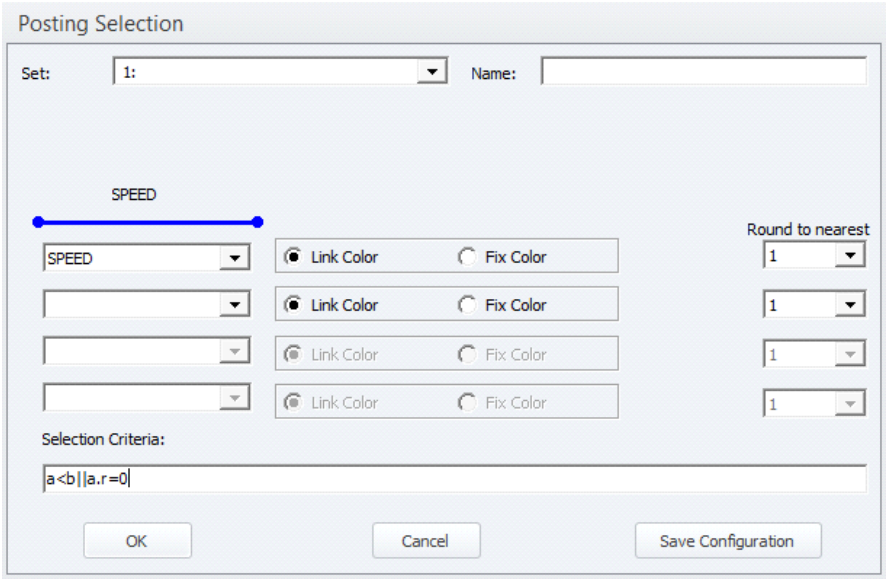
The **HOME** ribbon contains many useful tools for network viewing and editing.

Figure 13: The HOME Ribbon



1. Link attributes for all links can be posted by clicking Post All.
2. Link attributes for particular links can be posted by clicking Post Single.
3. Both of these selections bring up the POSTING SELECTION window (**Figure 14**) in which a variable can be selected for posting. Variables can be posted in the color of the link or by clicking on "Fix Color," which allows the user to specify a posting color. Variables can also be rounded by selecting from the drop down menu. Posting can be filtered by a formula. A typical formula for filtering is **a<b||a.r=0** which posts the variable on one side of the link only. ***Unfortunately there is no "post on one side of link" option so this complicated formula is used.***

Figure 14: Posting Selection Window



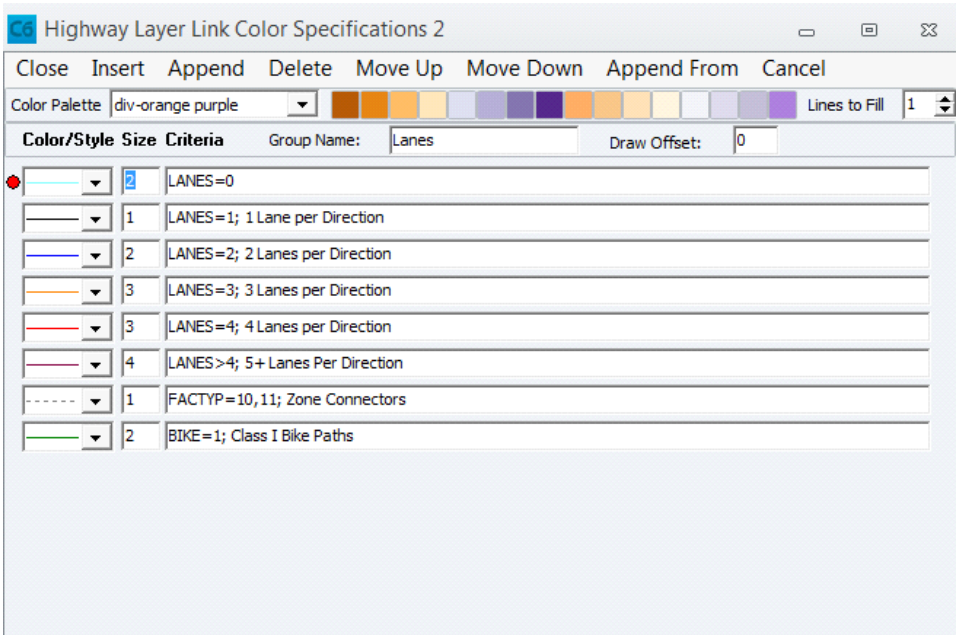
4. If desired, one-way links can be identified by clicking Post Arrows.

5. Link color settings can be changed by clicking 

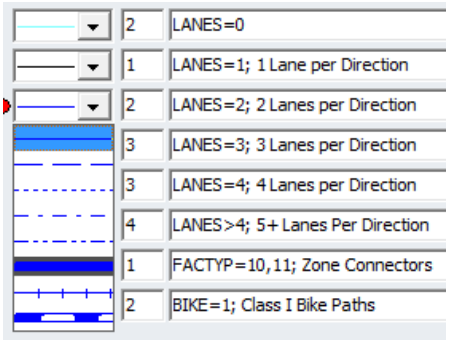
.

   a. Clicking  will bring up a window for changing the current color settings. See **Figure 15** for the standard highway layer link color specifications.

Figure 15: Highway Layer Link Color Specifications

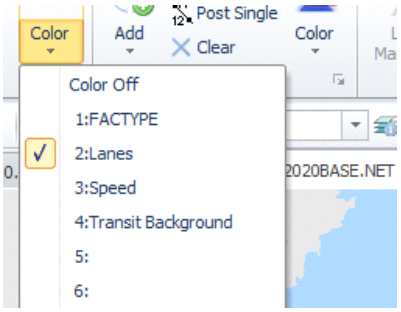


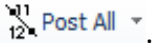
In this window, color and line style can be changed by clicking on the colored lines. Additional line styles can be inserted or appended, and definitions (including legend text) can be set for links with different characteristics – such as lanes. Text after a semi-colon will be displayed in the table of comments instead of the actual selection formula.

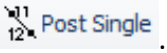


b. Clicking 

will bring up a list of available color settings that have been saved in the .VPR file. Any additional color settings added will show up in this list.

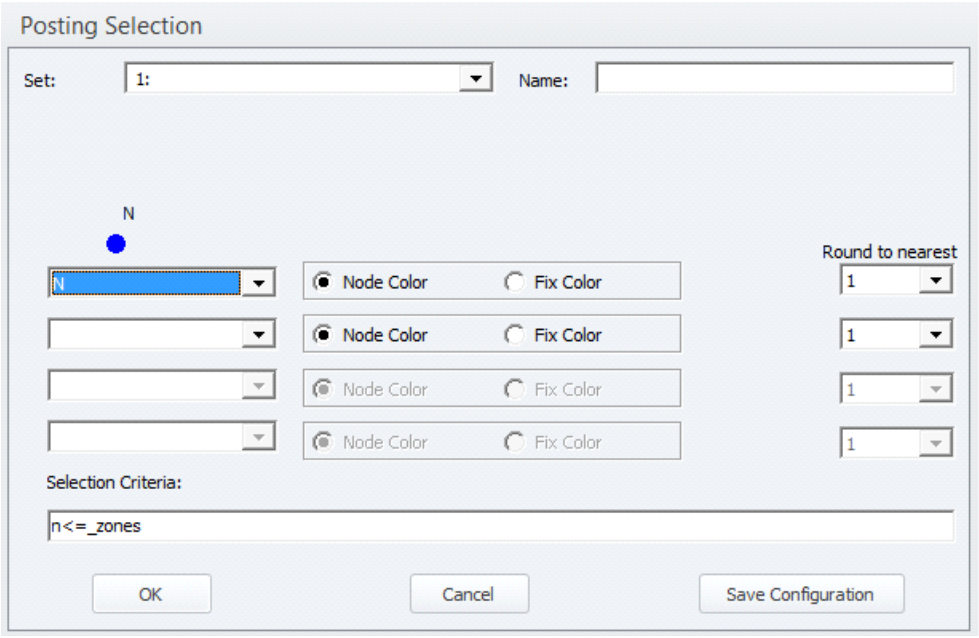


6. Node attributes on all nodes can be posted on links by clicking 

.
7. Node attributes on particular nodes can be posted by clicking 

.
8. Both of these selections bring up this window (**Figure 16**) in which a variable can be selected for posting. Variables can be posted in the color of the node or by clicking on "Fix Color," which allows the user to specify a posting color. Variables can also be rounded by selecting from the drop down menu. Posting can also be filtered by a formula. A typical formula for filtering is **n<=_zones,** which posts the node numbers for zone centroids only.

Figure 16: Node Posting Specifications

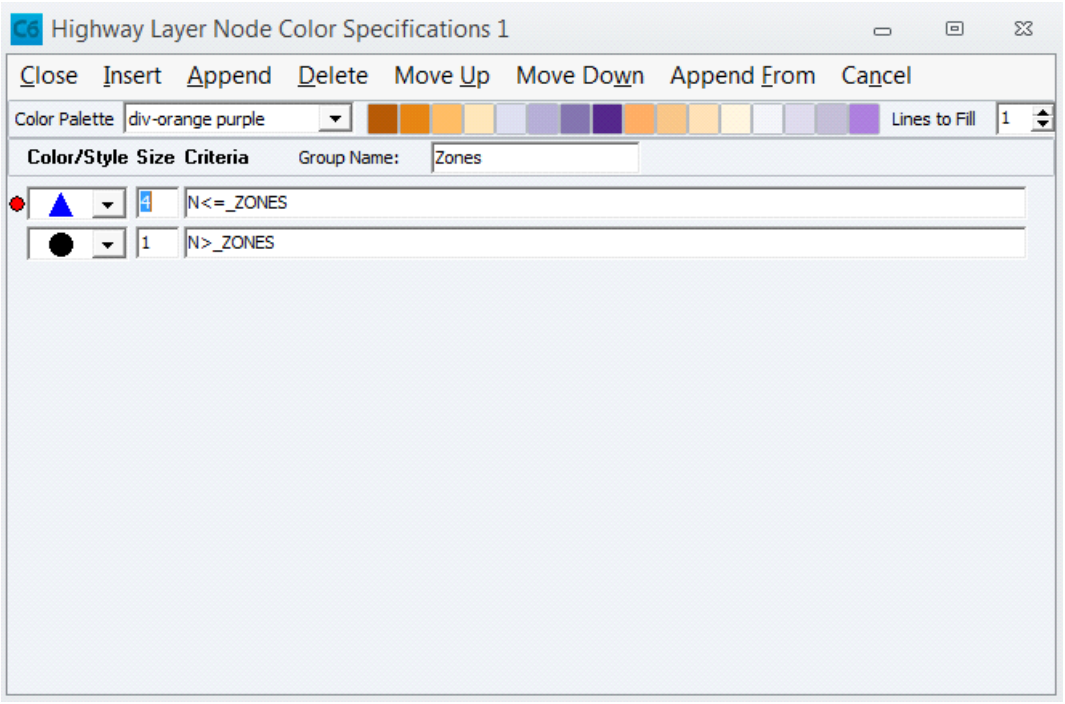


9. Node color settings can be changed by clicking 

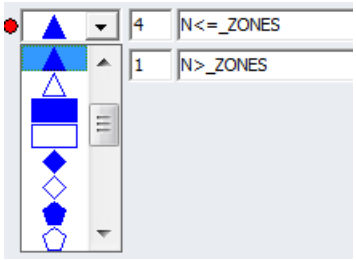
.

   a. Clicking  will bring up a window (**Figure 17**) for changing the current color settings.

Figure 17: Highway Layer Node Color Specification

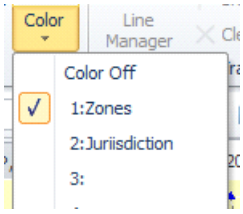


In this window, the color and marker shape can be changed by clicking on the colored shapes. Additional node styles can be inserted or appended, and definitions (including legend text) can be set for nodes with different characteristics – such as jurisdiction.



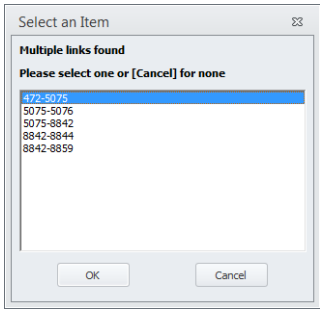
   b. Clicking 

will bring up a list of available color settings that have been saved in the .VPR file. Any additional color settings added will show up in this list.



Editing Existing Links

1. Existing links can be edited by first clicking to activate select mode. Clicking on a link will open the Highway Links table as shown in **Figure 19**. If the view is zoomed out and CUBE cannot determine which link to edit, the **Select an Item** window will open up, prompting the user to select the desired link.



2. Once the desired link is selected, values in the Highway Links table can be edited to change facility type, number of lanes, speed, etc.
3. The **save** button at the top of the table must be clicked to save the changes, while the button can be used to discard changes.
4. Links can be realigned in two ways:
    a. Without clicking on the link first, clicking on the node at either end of the link will allow the user to move the node and any links attached to it.
    b. After first selecting the link, clicking on the node at either end of the link and dragging it to a different node will change the link so its end is at the new node instead of the old one. If the new location does not correspond to an existing node, CUBE will ask if the user wants to add a new A or B node.
5. Realigning links automatically updates the DISTANCE field of the link.

Add, Copy, Paste, and Split Links

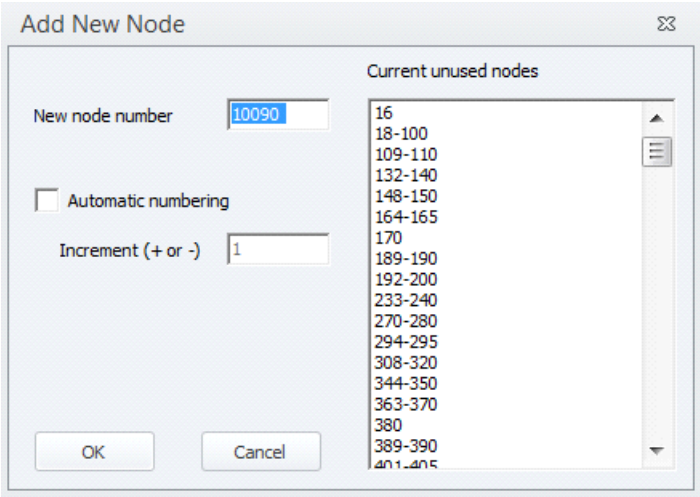
Add Links

1. New roadways can easily be added by clicking 

for two-way links or 

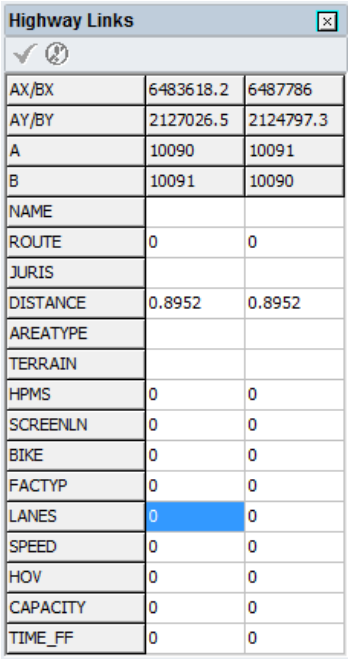
for one-way links.
2. Next, click either on an existing node or in open map space for the A node, and then click on another existing node or open map space for the B node. If open space is selected, a window will open for assigning new node or nodes. This window shows all nodes that are not currently used in the network. The default is for the highest existing node +1. ***Make sure that any added roadway nodes have a node number higher than 1600. Node numbers 1600 and below are reserved for zone and gateway centroids.***

Figure 18: Add New Node Window



3. Once a new link is added, clicking on it reveals a data table (Highway Links window) for the link and any link attributes that can be edited.

Figure 19: Highway Links Table

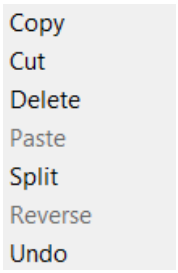


AX/BX	6483618.2	6487786
AY/BY	2127026.5	2124797.3
A	10090	10091
B	10091	10090
NAME		
ROUTE	0	0
JURIS		
DISTANCE	0.8952	0.8952
AREATYPE		
TERRAIN		
HPMS	0	0
SCREENLN	0	0
BIKE	0	0
FACTYP	0	0
LANES	0	0
SPEED	0	0
HOV	0	0
CAPACITY	0	0
TIME_FF	0	0

4. The **save** button ✓ at the top of the table must be clicked to save the changes, while the ⊘ button can be used to discard changes.

Copy and Paste Links

1. To copy an existing link and its attributes to a new link, first left-click on the source link you want to copy to make it start blinking, then right-click on the source link.



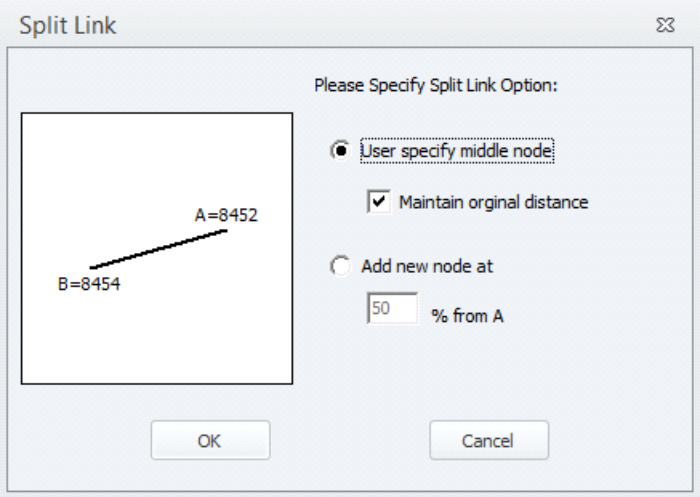
2. Next select **copy** from the resulting box, then right-click again anywhere in the blank space of the map, and select **paste** from the resulting box. Finally, select the desired A node and B node for the new link. If either end of the new link is not at an existing node, the program will prompt the user to create a new node and ask for the new node number, as described in step 2 above.

Splitting links

Splitting links is another useful tool, especially when adding new links or changing link attributes part way through an existing link. The process is similar to copying links.

1. First left-click, then right-click on the desired link. Click **split** in the resulting box. Next the tool offers the choice to use an existing node as the split point or split the link at some percentage of the distance between the "A" node and "B" node.

Figure 20: Split Link Window



2. The resulting links will share the same attributes as the existing link and distances will automatically be calculated for the two new shorter links.

Deleting Links

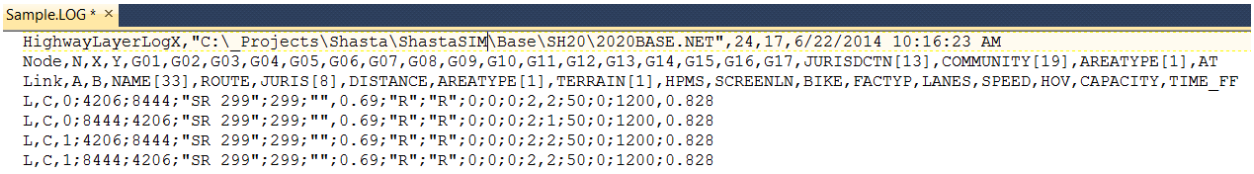
Links can easily be deleted by:

1. Clicking on the link and hitting the delete key on the keyboard, or;
2. Right-clicking on the link and clicking delete.

Saving Edit Logs

If desired, an edit log (text file) can be saved in order to document changes made to the network or to save changes for applying to another network. To save a log file, click Save Edit Log. To play a log file, click Play Edit Log. Logs include all added, split, modified, and deleted links and nodes. It should be noted that edit logs contain all changes since the network was last opened. If the user desires to save incremental changes in multiple log files, the network needs to be closed and reopened. Below is a sample log file (**Figure 20**) for changing the Facility Type (FACTYP) on one two-way link.

Figure 21: Edit Log Format



6. VIEW AND EDIT TRANSIT NETWORK

Transit line networks are actually ASCII text files (**base.lin**) and can be viewed and edited either in CUBE or by using a standard text editor. Due to a requirement of the software, loop routes *(routes where a bus goes in both directions on a road)* are coded as two separate routes – with one route for the outbound direction and one for the inbound direction. They are notated by a "N/S" or "E/W" designation at the end (example: RAB01N and RAB01S).

Each transit line consists of a header line(s) plus a list of all network nodes used by the transit line.

The first row or two for each line consists of the following, separated by commas:

- LINE NAME= (text, name of route)
- TIMEFAC= (numeric, bus transit time penalty compared to other vehicles)
- ONEWAY= (text, T=true)
- MODE= (numeric, Bus=2)
- COLOR= (numeric, color used to display line in CUBE)
- FREQ[1]= (numeric, peak frequency in minutes)
- FREQ[2]= (numeric, off-peak frequency in minutes)
- FREQ[3]= (numeric, not used in ShastaSIM)

Following the header lines and a final comma, all line nodes are listed in order, separated by commas. Nodes where buses do not stop are negative (,-xxxx,) while nodes where buses do stop are positive (,xxxx,). It should be noted that for bus transit (mode=2) all node pairs must represent links in the highway network. If two consecutive nodes in the transit line file do not correspond with a roadway network link, the model run will crash. ***Users should review the transit network after making edits to the transportation network to ensure that the model does not crash. Typically this is very important when eliminating or moving network links.***

An example from a ShastaSIM transit line file is shown in **Figure 22**. This shows RABA Route 1 north and south.

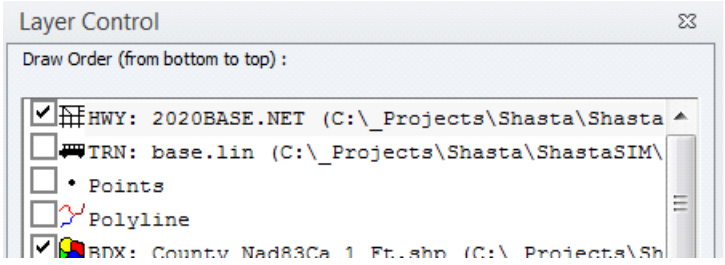
Figure 22: Transit Line File in TextPad Text Editor

base.lin ×

```
;;<<Trnbuild>>;;
LINE NAME="RAB01N", TIMEFAC=1.9, ONEWAY=T, MODE=2, COLOR=13,
     FREQ[1]=60, FREQ[2]=60, FREQ[3]=0, N=8915, -8913, -8912, -8910,
     8898, -8900, 8308, -8890, -8888, 8866, -8864, 8862, -5074,
     8838, -8836, -8834, 8832, -5642, -5643, -5644, -8594, -5226,
     -8596, 8604, -8606, 8608, -5233, 8612, -5234, 8622, -5235,
     8628, -5121, -5120, 8362, 8366, 5119, 8204, 8202, 5246, 5245,
     8201, 5248, 5247, 4860, 5249, 8200, 5250, 5251, 8198, 4859,
     8194, 5256, 8195, 5257, 8140, -5273, -5272, -8132, -5271, 8131,
     8130, -8126, -5280, -5279, -5278, 5277, 8120, -5276, 8032,
     5282, -5283, -7511, -8034, -8036, -8038, -5281, -4847, 8040,
     -5312, 8042, -5313, 8044, -5314, -8046, 5316, -5317, -8048,
     7512, 7513
LINE NAME="RAB01S", TIMEFAC=1.9, ONEWAY=T, MODE=2, COLOR=13,
     FREQ[1]=60, FREQ[2]=60, FREQ[3]=0, N=7513, 8072, 7515, -7514,
     8074, 8076, 8078, 8080, 8082, 8084, 8086, 8098, 8100, -5812,
     8116, 8148, -8150, -5624, 8152, -5626, -5625, 8180, 7504,
     -8184, 5629, 5628, 8185, 5627, -8192, 8394, 8392, -5131, 8386,
     8382, -5129, -5130, 8380, 8378, 8376, 8374, 8538, -8536, 8534,
     -5149, 5150, -8532, 8530, -5157, -5156, -5155, 8550, 5158,
     -8564, -8566, -5159, -5160, -8568, 8570, 8572, 8573, -7371,
     -8524, 5148, -5147, 8522, -8520, -5145, -5146, 8518, -5635,
     8580, 8578, -8582, 5161, -5640, -8584, -5641, 8586, -8588,
     -8590, -8592, -8594, -5644, -5643, -5642, 8832, -8834, -8836,
     8838, -5074, 8862, -8864, -8866, -8888, 8890, -8902, 8908,
     -8918, 8906, -8912, -2034, 2032, -2033, 8915
```

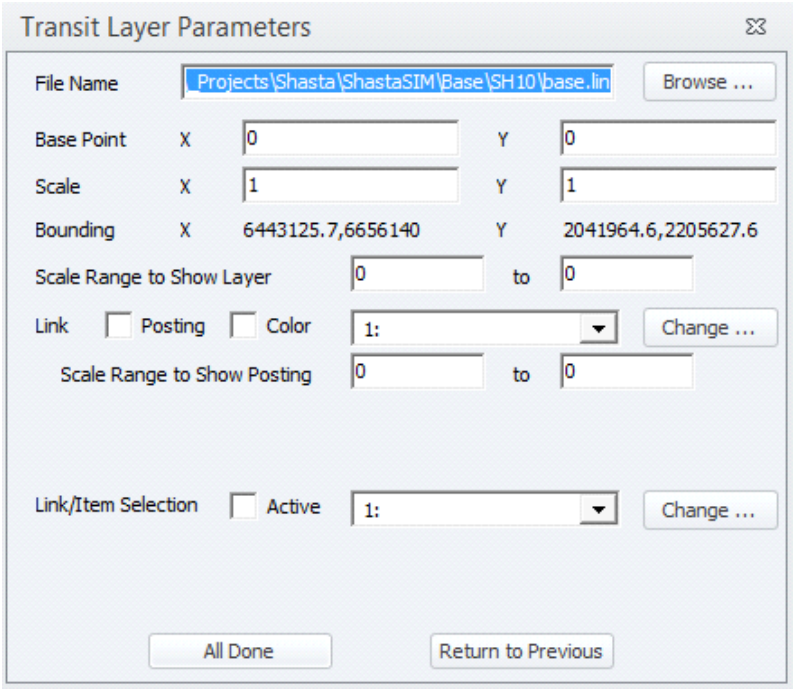
To load a transit file with the scenario network in CUBE (if the transit line file is not already loaded with the **DEFAULT.VPR** file), do the following:

1. Click to open Layer Control. The Layer Control box opens.



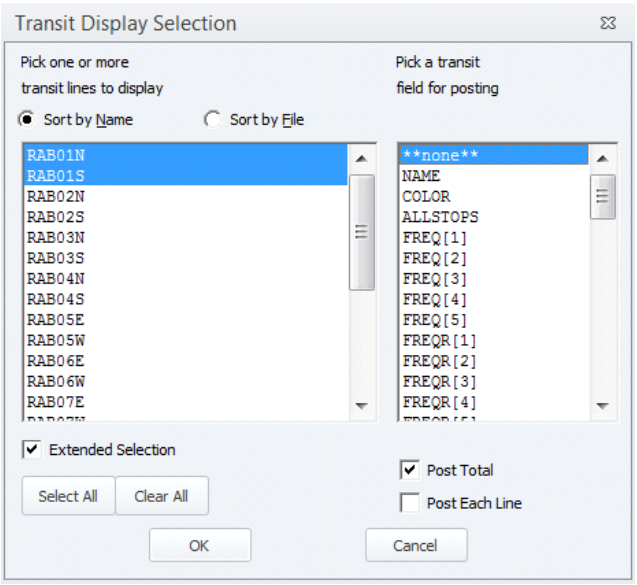
2. Next double-click Transit. The Transit Layer Parameters box opens.

Figure 23: Transit Layer Parameters Window

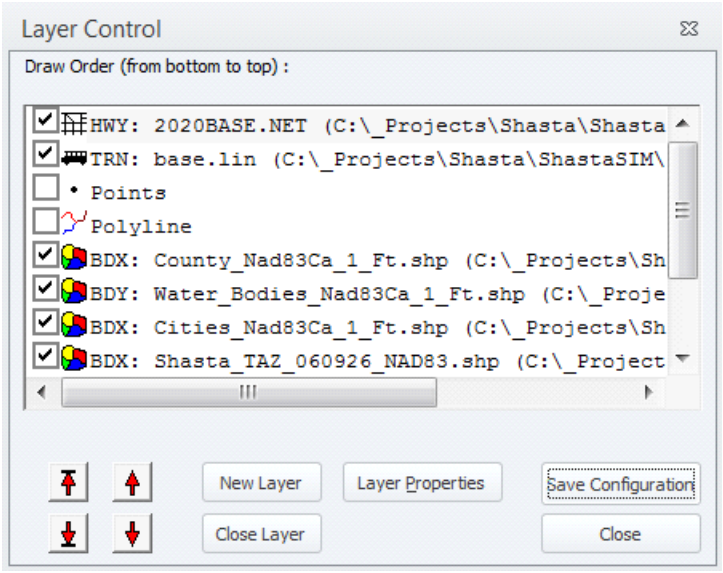


3. Select the appropriate base.lin file in the appropriate directory and click All Done.
4. The transit lines should all show up on the map, as shown in **Figure 26** (page 37). With the transit line file open, any links split while editing the transportation network will result in the transit line file being updated as well.
5. Click Display Line(s) to choose which lines to display. This brings up the **Transit Display Selection** window (See **Figure 24**). In this window, individual lines or groups of lines can be selected for display. Only the lines highlighted in blue will be shown.

Figure 24: Transit Display Selection Window



6. In order to edit an individual transit line in CUBE after the transit line file has been added to the map, first click to open Layer Control.



7. Next select TRN: base.lin and click to move the transit network to the "top" of the map. This will allow editing of transit lines. Click Close to return to the map.

8. Once the transit network is the active layer and the desired transit line is displayed, click anywhere on the line to enter edit mode. The line will turn yellow and a **Transit Route** table will appear on the map (**Figure 25**).
9. This table includes the same information seen in the text file.
    a. Attributes such as TIMEFAC, ONEWAY, MODE, COLOR, and FREQ[1,2,3] can be changed by editing the values on the right.
    b. Nodes, when selected, are highlighted on the map with a flashing circle. Nodes can be:
        i. Converted to or from a stop by adding or deleting the "-" from the node number.
        ii. Appended to the end of the file by clicking .
        iii. Added to a particular location in the file by clicking .
        iv. Removed from the file by clicking .
        v. Moved up in the file by clicking and down by clicking .
    c. The **save** button at the top of the table must be clicked to save the changes, while the button can be used to discard changes.
    d. Clicking the button allows the user to edit the transit line graphically. ***At this time it is not recommended to use this method as this method can be quite confusing to new users of CUBE. Detailed instructions can be found in the CUBE help.***

Figure 25: Editing a Transit Line in CUBE

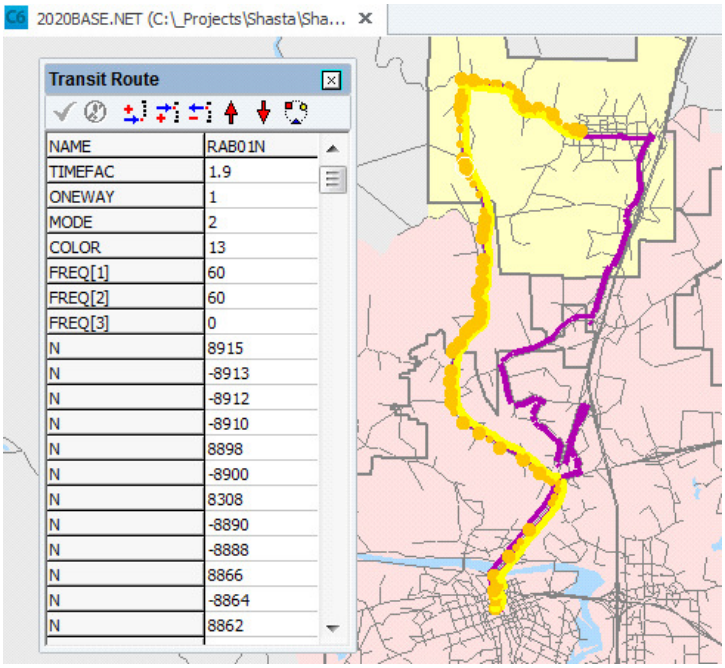
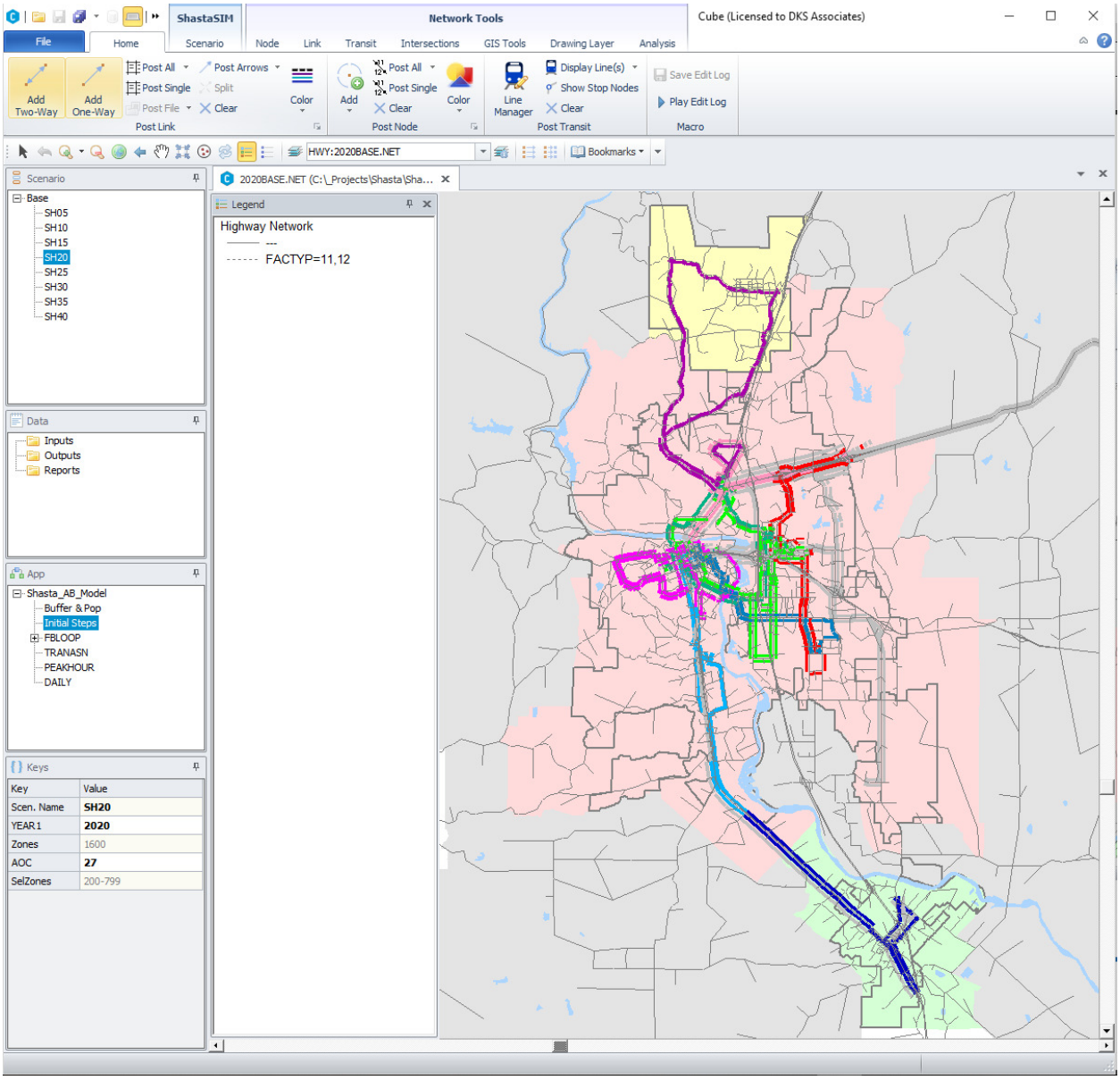


Figure 26: Transit Network Viewing in CUBE



7. Land Use Inputs

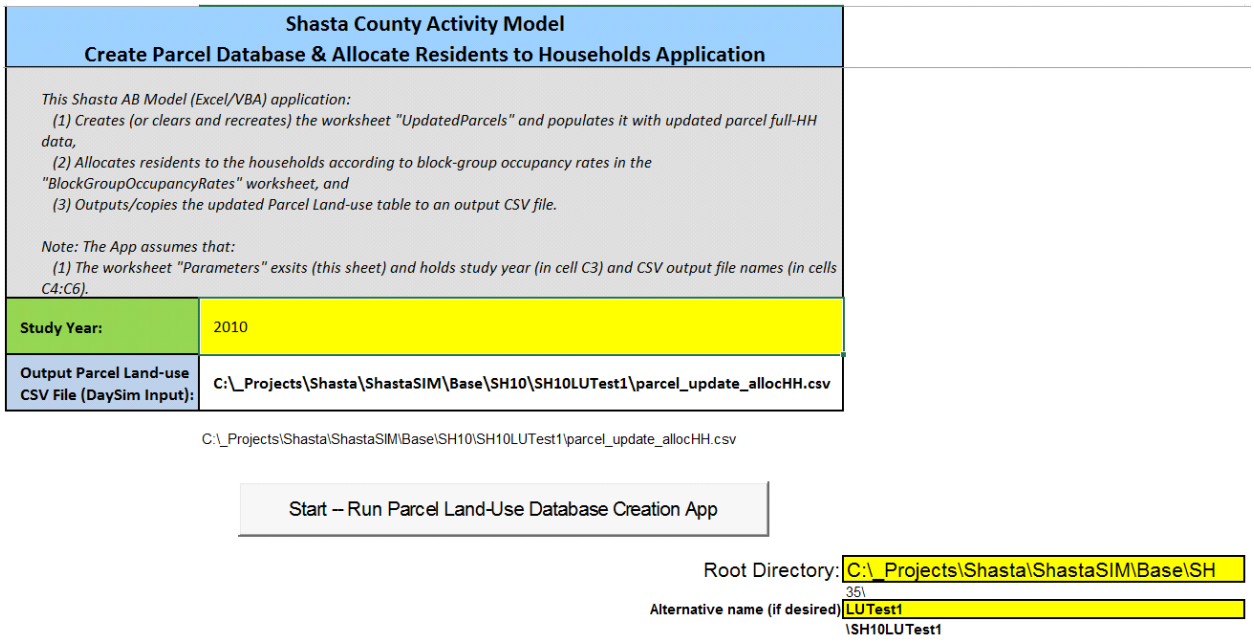
As stated in the ShastaSIM Model Development Report, the primary land use input to the model is a comma delimited text file called **PARCEL_UPDATE_ALLOCHH.CSV.** This file is created by a macro-enabled spreadsheet called **CREATE_SHASTASIM_PARCELS.XLSM**. The macro-enabled spreadsheet takes the base 2010 land use data (as derived from Shasta County parcel data), adds land use growth between 2010 and the forecast year, and finally allocates occupied (and vacant) housing units based on US Census data. The spreadsheet has been modified to estimate Strategic Growth Area (SGA) land use shifts in the cities and unincorporated shasta county. The growth shifts to the SGAs is restricted within the confines of each city or county boundary and don't erroneously pull growth from outside the jurisdictional boundary (i.e. land use growth redirected to the city of Shasta Lake SGA is pulled from growth within the city of Shasta Lakes city boundary file and doesn't pull growth from anywhere else in the county). This is a new feature starting with the 2015 Regional Transportation Plan and Sustainable Communities Strategy. Currently the shifts are assumed as follows:

	% Shift to SGA(s)				
Jurisdiction	2020	2025	2030	2035	2040
City of Anderson	4%	6%	8%	10%	10%
City of Redding	3%	4%	5%	6%	6%
City of Shasta Lake	4%	6%	8%	10%	10%
Shasta County (unincorporated)	4%	6%	8%	10%	10%

While these shifts can be modified in the spreadsheet, they should not be modified without direct input and approval by SRTA. Modifications to these assumptions for a project would render the results inconsistent with the adopted Regional Transportation Plan and Sustainable Community Strategy for the region.

The parameters sheet of the macro-enabled spreadsheet, where the forecast year is selected, is shown in **Figure 27**. Once the year is selected and the start button enacted, the macro creates the .csv file in the appropriate year's base scenario directory. Users can modify and update the root directory of the model by editing the cell beginning with "Root Directory." ***When making land use changes for a project, users will need to run the spreadsheet for each scenario year that needs to be evaluated. Users should also ensure the resulting output file is going to the correct directory location.***

Figure 27: Create_ShastaSIM_Parcels.xlsm Parameters Sheet



On page 48, **Figure 30** shows the land use data fields included in the **PARCEL_UPDATE_ALLOCHH.CSV** land use input file used for ShastaSIM model runs. Key land use input variables (such as occupied households, employment, and students) are highlighted in bold.

Editing Land Use

Individual parcels or groups of parcels can be modified to represent new projects. Changing the number of employees or households on a set of existing parcels is the easiest method of changing land use. The **CREATE_SHASTASIM_PARCELS.XLSM** or the **PARCEL_UPDATE_ALLOCHH.CSV** files may be edited to modify land use for a scenario. However, careful consideration should be made before editing either land use file.

Parcel_Update_AllocHH.csv

For individual project analysis purposes, where the user wants to measure the full impact of the project at the assumed build-out year or years (e.g. 2020, 2030), ***it is recommended that users edit a copy of the* PARCEL_UPDATE_ALLOCHH.CSV *file from the "parent" scenario.*** This ensures all of the assumed land use changes for the project are fully accounted for in the analysis. The regional forecast assumptions that are built into the macro (see below discussion) are already factored into this file for each "parent" scenario (i.e. SH15, SH25). Users can open and run the **SHASTASIM_COMPARE_INPUTS.CAT** to ensure that the model runs accounted only for the specific changes associated with the project. ***Typically this process would be done by developers who***

propose a project to a lead agency or by a lead agency in evaluating a proposed project that was submitted.

Steps to edit PARCEL_UPDATE_ALLOCHH.CSV:

1. Copy **PARCEL_UPDATE_ALLOCHH.CSV** from the "parent" scenario to the newly created "child" scenario (e.g. copy file from SH25 into a new SH25.Alt1 folder)
2. Open up the file in Microsoft Excel
3. Identify the parcel(s) that should be edited based on the Shasta County Assessor's Parcel Numbers (APN) for the project parcels. ***Note: Users should be aware that the APN is identified as "ASMT" within the travel model files.***
4. Identify the necessary travel model parcel information by using the travel model GIS map:
    a. In ArcGIS open **SRTA_BASEMAP.MXD** in the SHASTASIM\GIS\ directory. Assuming all GIS files are present, the ArcGIS window should look like **Figure 28**. This ArcGIS project has many layers that can be toggled on and off, including GIS Roadways, CUBE Master Network Roadways, and GIS based Bus Routes. These can all be turned on or off by clicking the check box in the table of contents to the left of the map.
    b. Zoom into the location of the project parcel(s). **When the window is zoomed in to 1:4000 scale or closer**, the APN for the parcel is displayed in black and the PARCELID of the corresponding record in the model land use input is displayed in grey next to a grey dot representing the XY coordinates of the land use record. A number of saved views can also be invoked by clicking Bookmarks. An example of a large vacant parcel in Anderson is shown in Figure 28 and described as follows:
        i. ASMT: 201940009000
        ii. APN: 201-940-009-000
        iii. PARCELID: 78584

Figure 28: SRTA_BASEMAP.MXD in ArcGIS

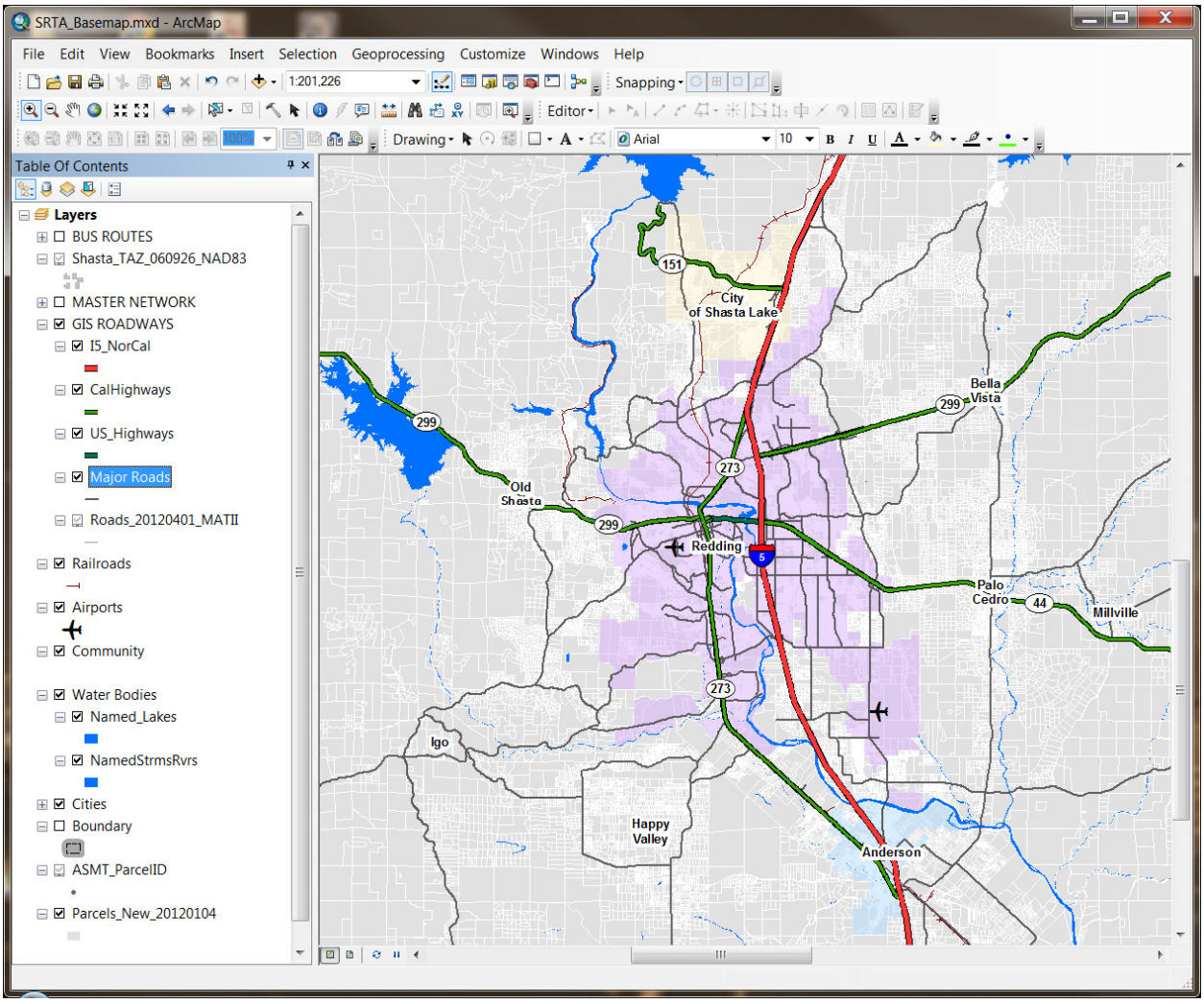
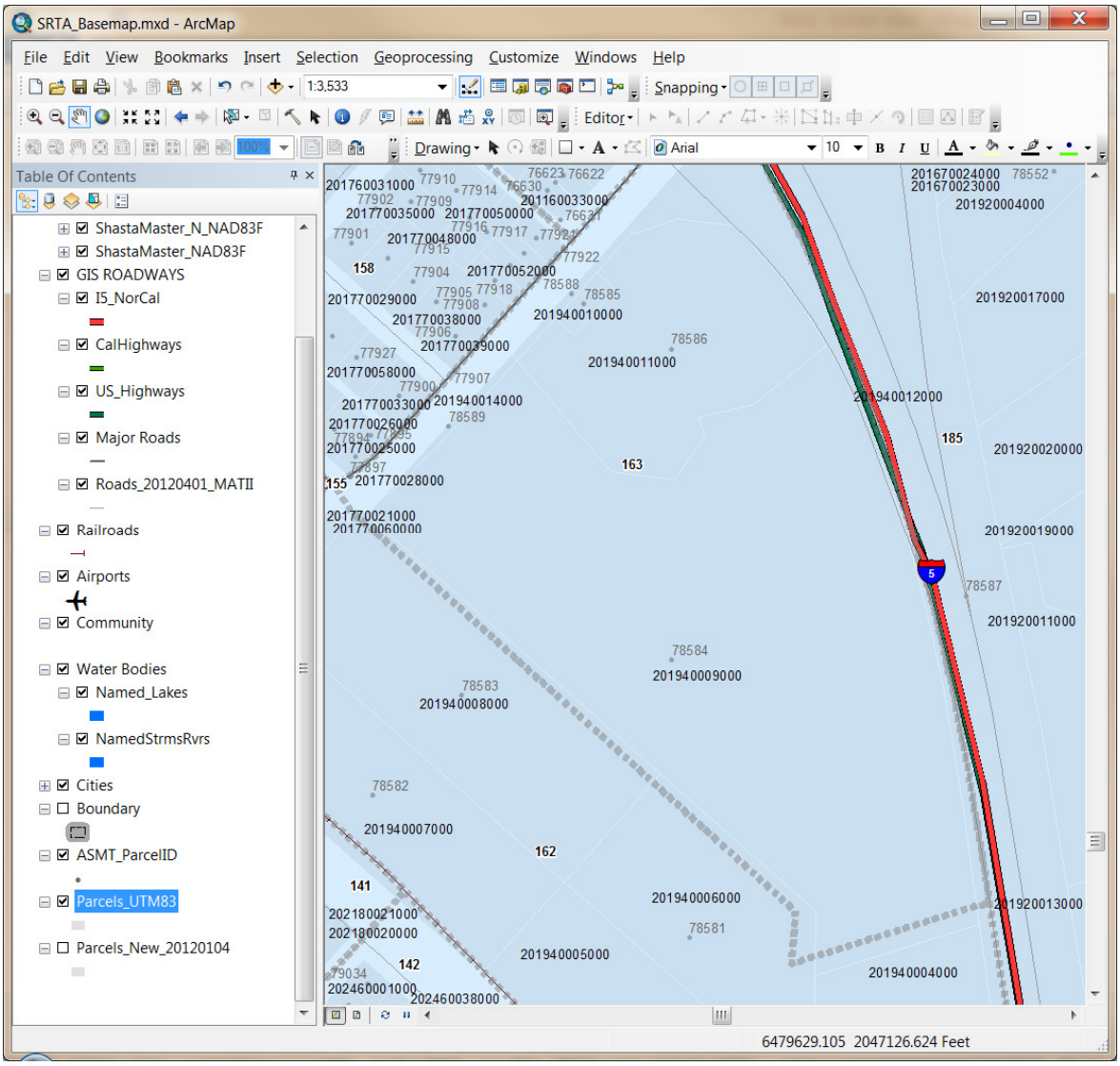


Figure 29: GIS Detailed View of Parcels



5. Open up the **PARCEL_UPDATE_ALLOCHH.CSV** file in the project folder
6. Highlight the 'parcelid' column (this should be column A in the file)
7. Search for the appropriate 'parcelid' that was identified in step 5b (use ctrl+F for a fast search)
8. Make the appropriate residential or employment land use edits
    a. For residential edits
        i. Identify the type and number of dwelling units (households) you want to add. The following residential types are available (for more information see Chapter 2 of the *ShastaSIM Model Development Report*):

1. SFDU (column G)
2. MF2_4DU (column H)
3. MF5+DU (column I)
4. MHDU (column J)

ii. Add the appropriate amount of dwelling units by type (columns G-K).

iii. Add the total number of dwelling units under TOT_DU (column K). Make sure this column totals the number of dwellings units desired. The .csv file does not contain any formulas and can only retain cell values.

iv. Identify the total number of dwelling units that should be occupied (columns L-P) by residential type:

1. SFHH (column L)
2. MF2_4HH (column M)
3. MF5+HH (column N)
4. MHHH (column O)

v. Add the total number of occupied dwelling units under TOT_HH (column P)

NOTE: Generally columns G-K should match columns L-P. This ensures that the model understands that a specific number of dwelling units should exist on the associated parcel and that 100% of those units should be occupied.

b. For employment edits

i. Identify the type and number of employment jobs to add in columns T through AC. The following employment types exist:

1. Empedu_p - education
2. Empfoo_p - food
3. Empgov_p - government
4. Empind_p - industrial
5. Empmed_p - medical
6. Empofc_p - office
7. Empret_p - retail
8. Empsvc_p - service
9. Empoth_p - other

ii. Ensure that emptot_p (column AC) matches the sum of columns T-AB

9. Save the file and run the model

Users should be aware that the steps above apply only to one scenario year. For projects where multiple model year runs are necessary, steps 6-10 above must be repeated for each scenario.

Create_ShastaSIM_Parcels.xlsm

Users may elect to edit land use in the **CREATE_SHASTASIM_PARCELS.XLSM** file, which would create a new **PARCEL_UPDATE_ALLOCHH.CSV** file for the given scenario. **However, because the macro accounts for specific forecast assumptions through year 2030, users are cautioned in using the macro**. The specific forecast assumptions accounted for in the macro are:

1. The region's typical occupancy rates (i.e. a percentage of all available retail space is considered vacant) for employment related land uses assumes that they do not return to "normal" occupancy rates until year 2030. This is due to an assumption that the region does not fully recover from the 2008 recession until year 2030.
2. Occupied households for residential land uses are controlled by the typical residential occupancy rate as identified by the US Census Bureau.

Generally this process would be used for scenario planning purposes by a lead agency.

Steps to edit CREATE_SHASTASIM_PARCELS.XLSM:

1. Identify the parcel(s) that should be edited based on the Shasta County Assessor's Parcel Numbers (APN) for the project parcels, using **SRTA_BASEMAP.MXD** as described above.
    a. ***Note: Users should be aware that the APN is identified as "ASMT" within the travel model files.***
2. Open up **CREATE_SHASTASIM_PARCELS.XLSM**
3. Click 'save as' and create a new excel table using the following naming convention: **CREATE_SHASTASIM_PARCELS_[INSERT SCENARIO NAME].XLSM**
4. Click the 'LU_Growth' worksheet tab
5. Search for the APN(s) in the "ASMT" column
6. Click the "LU_Growth" worksheet tab
7. Search (via 'parcelid') to see if additional land use growth assumptions exist for the parcel. Steps 7a and 7b describe what to do if forecast information exists or not.
    a. **Scenario 1 - If forecast assumptions already exist for the parcel:**
        i. Review existing forecast assumptions and edit columns K through AD as appropriate.
            1. Columns K – S, U – Y, and AA are optional items and only help to provide more data.
            2. Columns **T**, **Z**, and **AB** are required, and are dependent on the type of project.
        ii. See **Figure 31** for a description of the columns in the LU_Growth tab of the worksheet. Users can refer to Table 1 of the *ShastaSIM Model Development Report* for the Parcel2010_fullHH tab of the worksheet.

b. **Scenario 2 - If forecast assumptions don't exist for the parcel:**
    i. Go to the end of the table and use one of the sample rows already included at the bottom of the worksheet (see **Figure 32** for an example).
        1. Filling in the ParcelID in Column A will automatically fill in **Columns B – J** in the row.
        2. **Column T** (model land use) can be filled in by selecting the cell and using the drop down menu (click on arrow to the right) of pre-selected model land use categories.
        3. **Column Z** (quantity of dwelling units or employees) can be filled in by entering the desired number of dwelling units or employees.
        4. **Column AB** (year of implementation) can be filled in by entering the desired year of implementation for the project (as stated previously, if portions of a project develop over time, use separate rows with different years for phases of the project).
        5. **Column AD** (comments) can be filled in with notes describing the project.
        6. **Column AC** (percentage of project to include) will automatically update based on the year selected for the row.
        7. **Columns AE – AS** (land use to be added) will automatically be updated.
    ii. If more rows are necessary than the rows provided, copy and add more rows at the bottom of the sheet as needed. ***NOTE: Users should be aware that there should be one row per year for each residential forecast or employment forecast for the project.*** For example, if a project assumes 25 single-family units for year 2020, 30 single-family units for year 2025, 25 multi-family units for year 2025 and 25,000 square feet of retail space for year 2025, then there should be one row for each assumption.

8. Save your edits and run the macro to create the new **PARCEL_UPDATE_ALLOCHH.CSV** file. ***(Make sure the new file is located in the correct directory)***

9. Open up ShastaSIM.cat and run the model

Figure 30: Parcel data Input (PARCEL_UPDATE_ALLOCHH.CSV) File Format

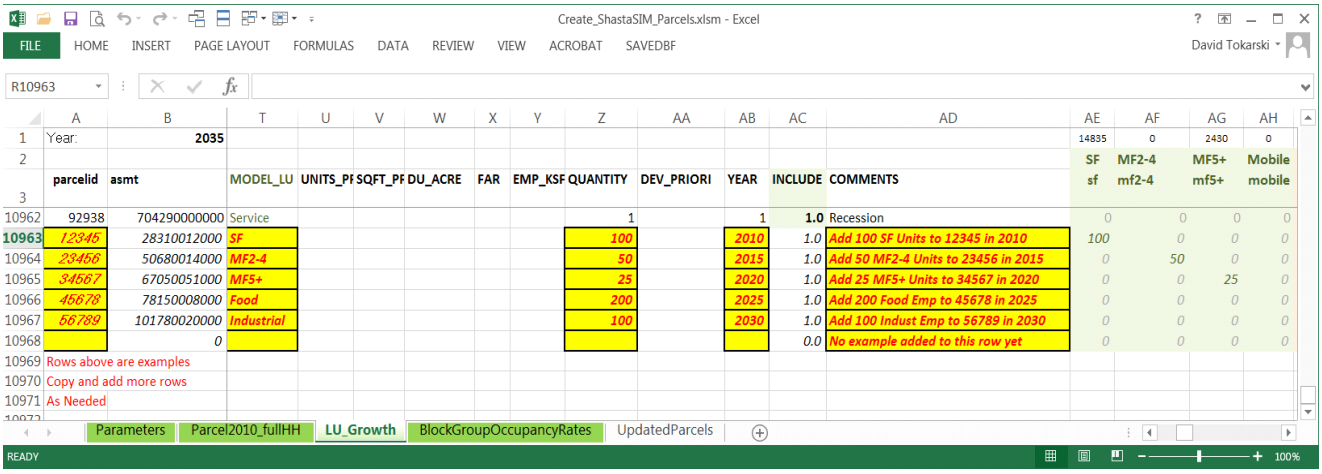
FIELD	DESCRIPTION
Parcelid	parcel ID number
xcoord_p	X coordinate – state plane feet
ycoord_p	Y coordinate – state plane feet
sqft_p	Area – square feet
taz_p	TAZ number
block_p	census block
SFDU	single family dwelling units on parcel
MF2_4DU	multi-family (2-4 units) dwelling units on parcel
MF5+DU	multi-family (5+ units) dwelling units on parcel
MHDU	mobile home dwelling units on parcel
TOT_DU	total dwelling units on parcel
SFHH	**single family occupied households on parcel**
MF2_4HH	**multi-family (2-4 units) occupied households on parcel**
MF5+HH	**multi-family (5+ units) occupied households on parcel**
MHHH	**mobile home occupied households on parcel**
TOT_HH	total occupied households on parcel
stugrd_p	**grade school enrollment on parcel**
stuhgh_p	**high school enrollment on parcel**
stuuni_p	**university enrollment on parcel**
empedu_p	**educational employment on parcel**
empfoo_p	**food employment on parcel**
empgov_p	**government employment on parcel**
empind_p	**industrial employment on parcel**
empmed_p	**medical employment on parcel**
empofc_p	**office employment on parcel**
empret_p	**retail employment on parcel**
empsvc_p	**service employment on parcel**
empoth_p	**other employment on parcel**
emptot_p	**total employment on parcel**
parkdy_p	off-street daily parking on parcel
parkhr_p	off-street hourly parking on parcel
ppricdyp	off-street daily parking price
pprichrp	off-street hourly parking price
track	census tract
group	census block group

Figure 31: LU_Growth Tab File Format for CREATE_SHASTASIM_PARCELS.XLSM

Column	FIELD	DESCRIPTION
A	Parcelid	parcel ID number
B	asmt	Shasta County Assessor Parcel Number (APN)
C	xcoord_p	X coordinate – state plane feet
D	ycoord_p	Y coordinate – state plane feet
E	sqft_p	Parcel Area – square feet
F	taz_p	TAZ number
G	TRACT10	Census Tract
H	GROUP10	Census Block Group
I	BLOCK10	Census Block
J	GEOID10	2010 US Census Geo ID
K	NAME	Name of potential project
L	SOURCE	Source of information (could be lead agency, developer or specific data file (map or GIS) provided)
M	OWNER	Legal owner of the parcel
N	PIN	Same as ASMT (in some cases, in others, blank)
O	ADDRESS	Street address number
P	STNAME	Street name
Q	ACRES	Number of acres for parcel
R	AREA	Area of parcel (in square feet)
S	MODEL_LU (Black text)	Type of land use – previous 4-step model land use category (Optional item to include)
T	MODEL_LU (Green text)	Type of land use – new ShastaSIM category: Education, Food, Government, Industrial, Medical, MF5+, Mobile,
U	UNITS_PROP	Number of residential units proposed
V	SQFT_PROP	Amount of employment square footage proposed
W	DU_ACRE	Number of residential dwelling units per acre
X	FAR	Floor Area Ratio
Y	EMP_KSF	Square footage (1,000 sf) per employee
Z	QUANTITY	Number of units to be built OR amount of jobs assumed
AA	DEV_PRIORI	Development Priority [1-5 with 1 being highest]
AB	YEAR	Year that residential units should be assumed to be built OR number of employees that should be created (by
AC	INCLUDE	Determines how much of growth to include (depends on forecast year selected, always between 0.0 and 1.0)
AD	COMMENTS	Additional user comments
AE	sf	single family dwelling units on parcel

Column	FIELD	DESCRIPTION
AF	mf2-4	multi-family (2-4 units) dwelling units on parcel
AG	mf5+	multi-family (5+ units) dwelling units on parcel
AH	mobile	mobile home dwelling units on parcel
AI	studk12p	grade/high school enrollment on parcel
AJ	studunip	university enrollment on parcel
AK	empedu_p	educational employment on parcel
AL	empfoo_p	food employment on parcel
AM	empgov_p	government employment on parcel
AN	empind_p	industrial employment on parcel
AO	empmed_p	medical employment on parcel
AP	empofc_p	office employment on parcel
AQ	empoth_p	other employment on parcel
AR	empret_p	retail employment on parcel
AS	empsvc_p	service employment on parcel

Figure 32: LU_Growth Tab Added Rows in CREATE_SHASTASIM_PARCELS.XLSM



8. Running Comparison Applications and MOE Calculations

Once a model scenario is run, a series of additional CUBE applications are available to compare and contrast scenario inputs and outputs, as well as to calculate various measures of effectiveness (MOE). Some of the MOEs are the same as those previously calculated with the four step model and some are new with the activity based model. Three CUBE catalogs have been created for comparing inputs, outputs, and doing MOE calculations:

- **ShastaSIM_COMPARE_INPUTS.CAT**
- **ShastaSIM _COMPARE_OUTPUTS.CAT**
- **ShastaSIM _COMPARE_TRANSIT.CAT**

In Cube Application Manager, scenarios can be selected for evaluation by clicking on the appropriate scenario in the Scenarios Pane on the top-left side of Cube. Individual applications can be opened visually by double clicking on the application name in the Applications Pane on the left side of Cube. Applications can also be run by right-clicking the application and then adding the desired scenarios for evaluation.

Compare Inputs Application

The **ShastaSIM_COMPARE_INPUTS.CAT** can be opened in CUBE using the same methods described on **page 15**. Opening the catalog provides a list of available applications to choose from in the Application Pane. Any of these applications can be run by right-clicking on them to bring up the Run Catalog window.

The Model Inputs application includes the following nine modules:

LU Parcels CSV to DBF: This module takes the land use input (**PARCEL_UPDATE_ALLOCHH.CSV**) and converts it into a .DBF file for use in other modules. The input .CSV file is located in the scenario directory. The resultant .DBF file is located in the COMPARE\PARCEL directory and is called **{SCENARIO_CODE}PARCEL_UPDATE.DBF**. It includes households, students, and categorized employees per parcel. All parcel records are maintained.

Figure 33: Run Model from Scenario Pane

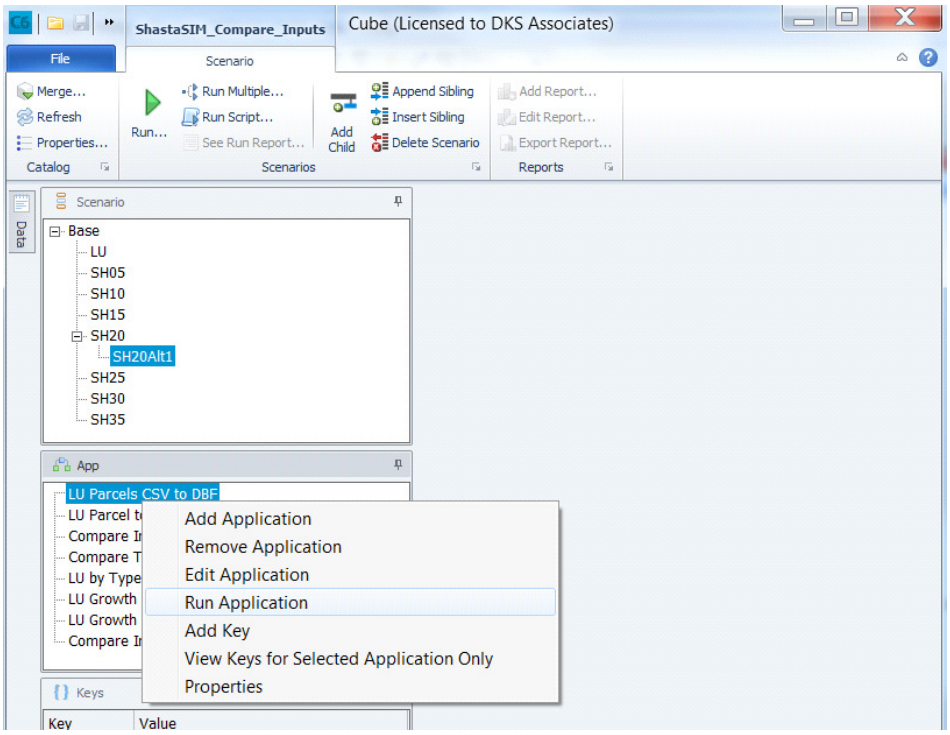
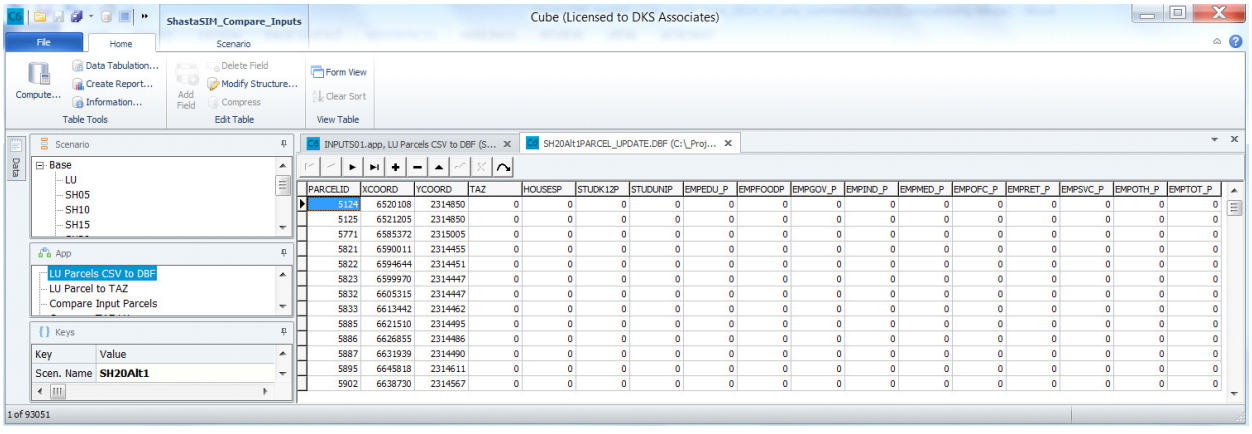
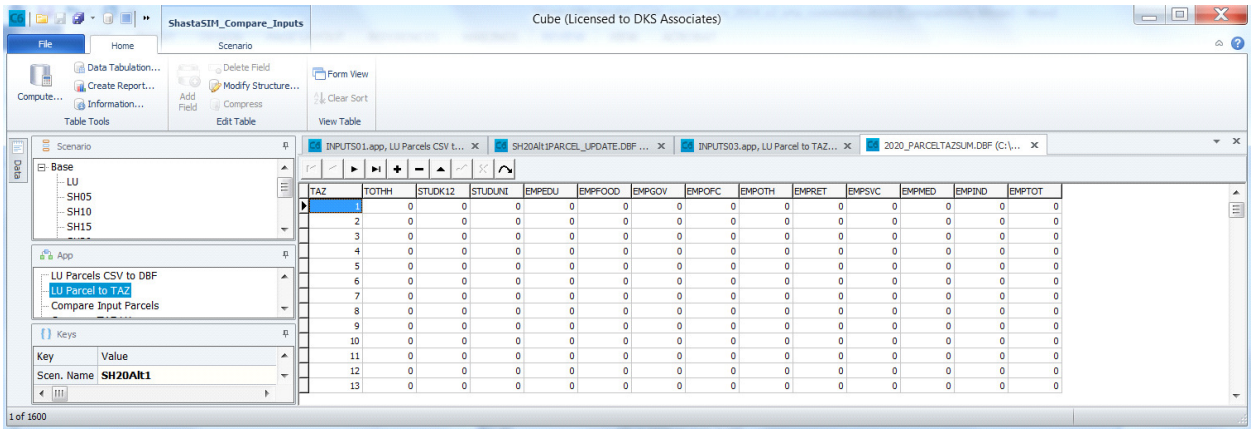


Figure 34: Parcel_Update File Fields



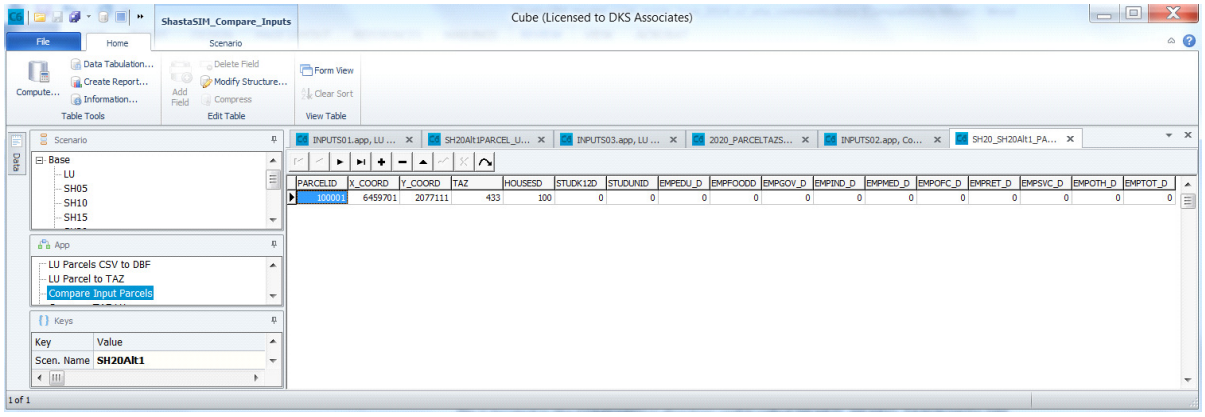
LU Parcel to TAZ: This module takes the .DBF file from the previous module and aggregates the households, students, and employment to traffic analysis zones (TAZs). The resultant .DBF file is located in the COMPARE\LU directory and is called **{SCENARIO_CODE}_PARCELTAZSUM.DBF**.

Figure 35: TAZSUM File Fields



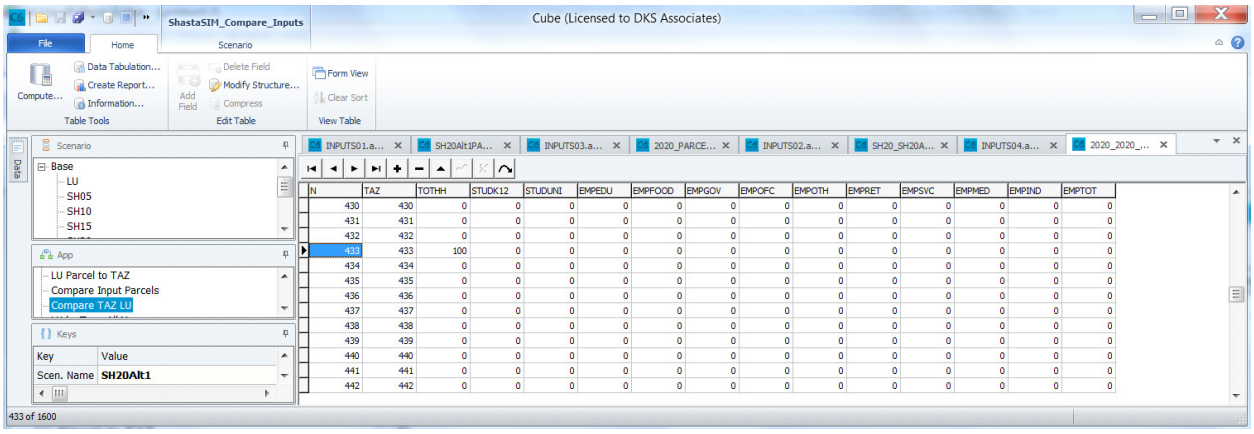
Compare Input Parcels: This module compares the land use inputs for two scenarios. YEAR1 is the later year or ""plus project"" scenario, while YEAR2 is the earlier year or ""no project"" scenario. Currently the scenarios are set up so that each YEAR1 is compared to the base 2010 scenario (YEAR2), but YEAR2 can be changed (using Keys). For instance instead of comparing 2025 to 2010, the user can set it to compare 2025 to 2020. Only changed (or added) parcels are included in the resultant .DBF file ({**YEAR2}_{YEAR1}_TAZGROWTH.DBF**) in the COMPARE\LU directory.

Figure 36: Compare Parcels File Fields



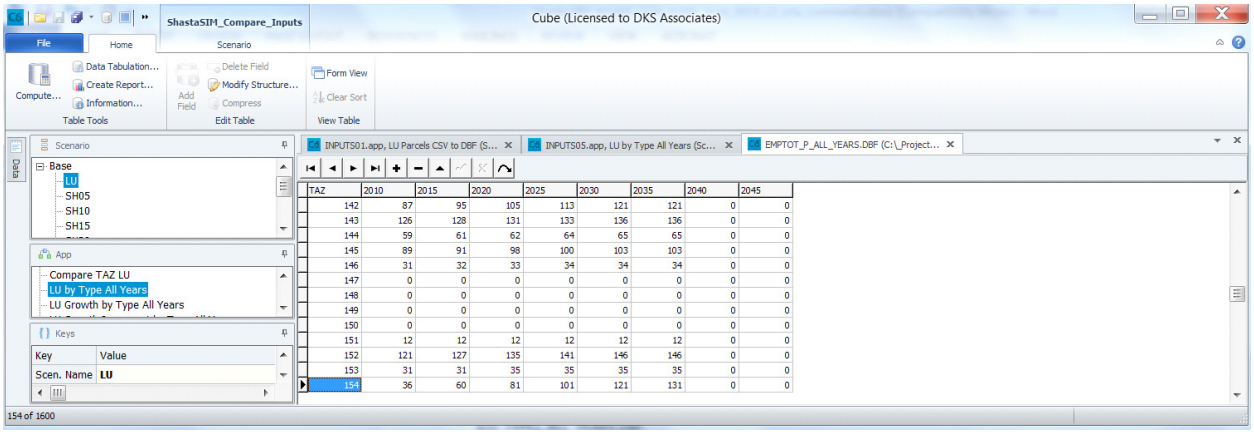
Compare TAZ LU: This module compares the land use totals by TAZ for two scenarios. Similar to the previous module, this one can be set up to compare future scenarios to the 2010 scenario or to other scenarios. It can also be set up to compare a "plus project" to a "no project" scenario. The resultant .DBF file is located in the COMPARE\LU directory and is called **{YEAR2}_{YEAR1}_TAZGROWTH.DBF**.

Figure 37: Compare TAZ File Fields



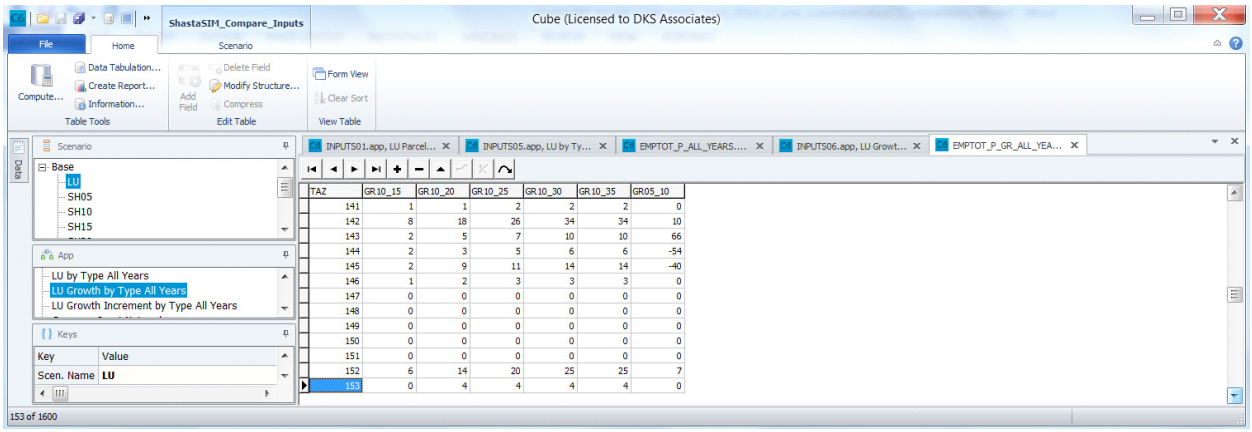
LU Growth by Type All Years: This module creates a .DBF file showing land use for all 5 year increments (2010-2035) for a selected land use category (households, students, each employment category). This module is only run for the "LU" scenario and the desired land use category is a Key that can be selected by drop down menu. The resultant .DBF file is located in the COMPARE\LU directory and is called **{LU_TYPE}_ALL_YEARS.DBF**.

Figure 38: All Years by Type File Fields



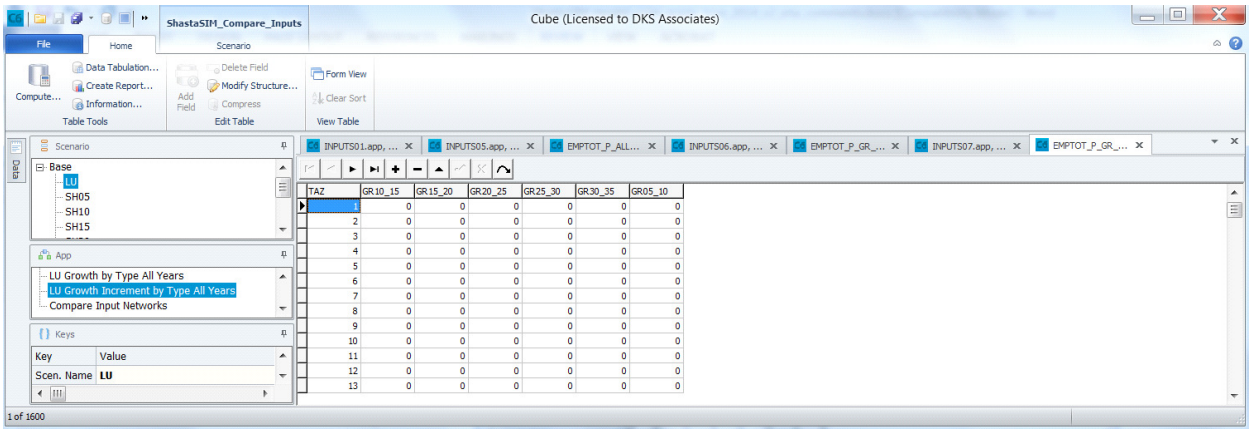
LU Growth by Type All Years: This module is similar to the previous one but the resultant .DBF file includes growth between 2010 and each other year. The resultant .DBF file is located in the COMPARE\LU directory and is called **{LU_TYPE}_GR_ALL_YEARS.DBF**.

Figure 39: All Years Growth by Type File Fields



LU Growth Increment by Type All Years: This module is similar to the previous one but the resultant .DBF file includes incremental 5 year growth between each future year. The resultant .DBF file is located in the COMPARE\LU directory and is called **{LU_TYPE}_GR_INCR_ALL_YEARS.DBF**.

Figure 40: Growth Increment by Type File Fields



Compare Input Networks: This module compares the input roadway networks for two scenarios. Input base networks are located in each scenario directory. The resultant comparison network is located in the COMPARE\NETWORKS directory and is called **{YEAR1}_{YEAR2}COMP.NET**. From the application manager, the comparison network can be opened by double clicking on the output network box. A .VPR file exists in the COMPARE\NETWORKS directory that allows users to easily display and print network comparisons for each resultant network. Color schemes included in the .VPR file include change in lanes, change in speed, and change in facility class. They also show new added links and removed links.

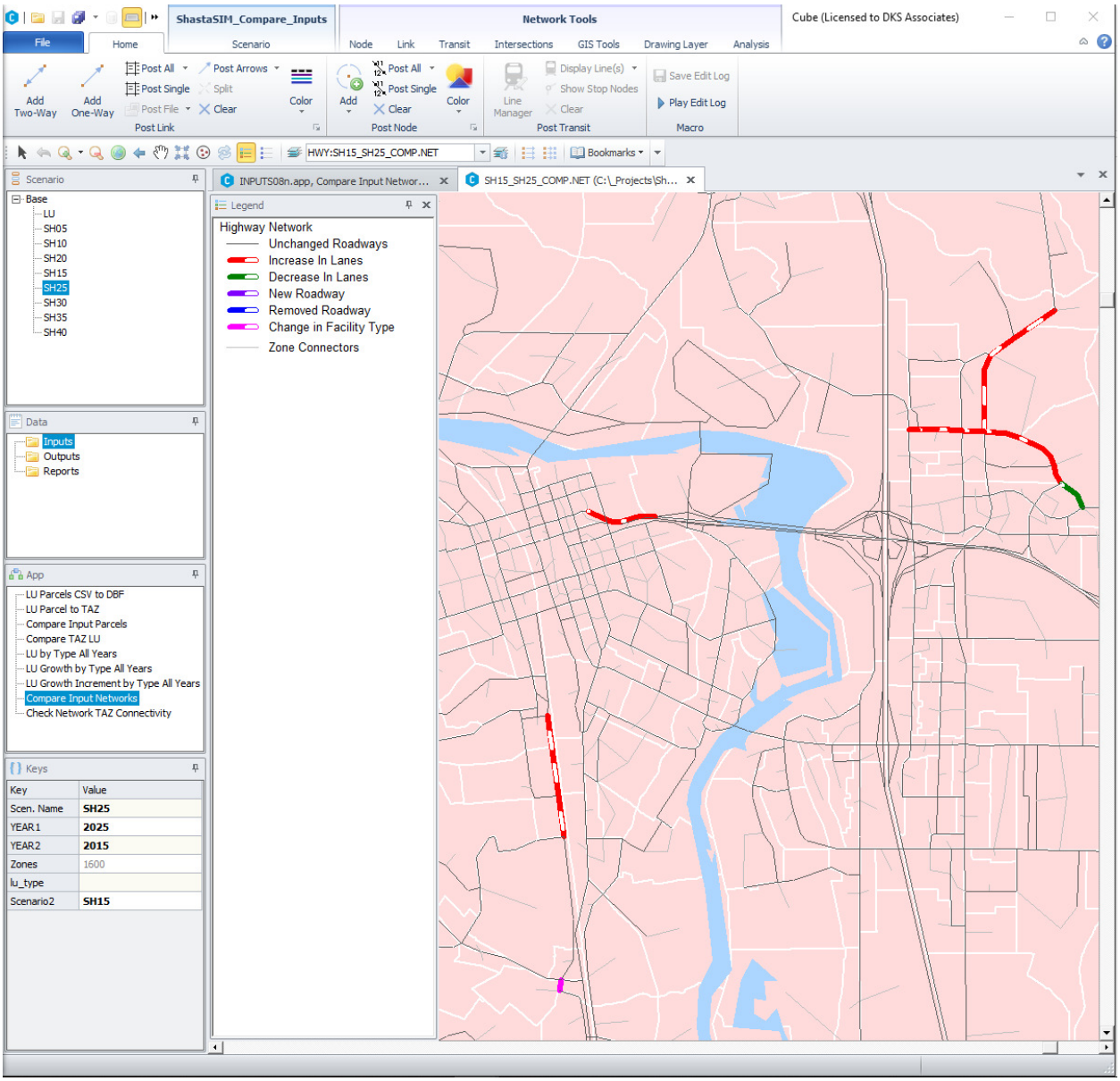
The following Keys are used in the Model Inputs application:

- {YEAR1} – The "future" scenario of interest. For example, if comparing a 2030 to a 2010, {YEAR1} would be 2030.
- {YEAR2} – The "base" scenario. For example, if all future scenarios are compared back to 2010, then {YEAR2} would be 2010.
- {Zones} – The number of zones in the model network. Default is set to 1600.
- {lu_type} – For the three modules that compare all years, choose the land use category of interest using {lu_type}. ***Users should be aware that to see the results of all land uses for the three "land use by type" modules, multiple runs would have to take place, one for each land use.***
- {Scenario2} – Folder name of "base" scenario. Typically "SH10"

Check Network TAZ Connectivity: Since the model will not automatically crash if TAZs with land use are not properly connected to the highway network (with centroid connectors) and model results could be incorrect, this module checks to see if any TAZs are disconnected. Once run, a file called **ZONESNOACCESS.TXT** is created. If the text file contains no TAZ numbers, then all TAZs are properly connected to the network. If any TAZ numbers are listed, then the base network should be edited to add centroid connectors for the listed TAZ nodes.

The zone connectivity module should be run before the model is run. This ensures the TAZs and network is connected and eliminates having to rerun the model.

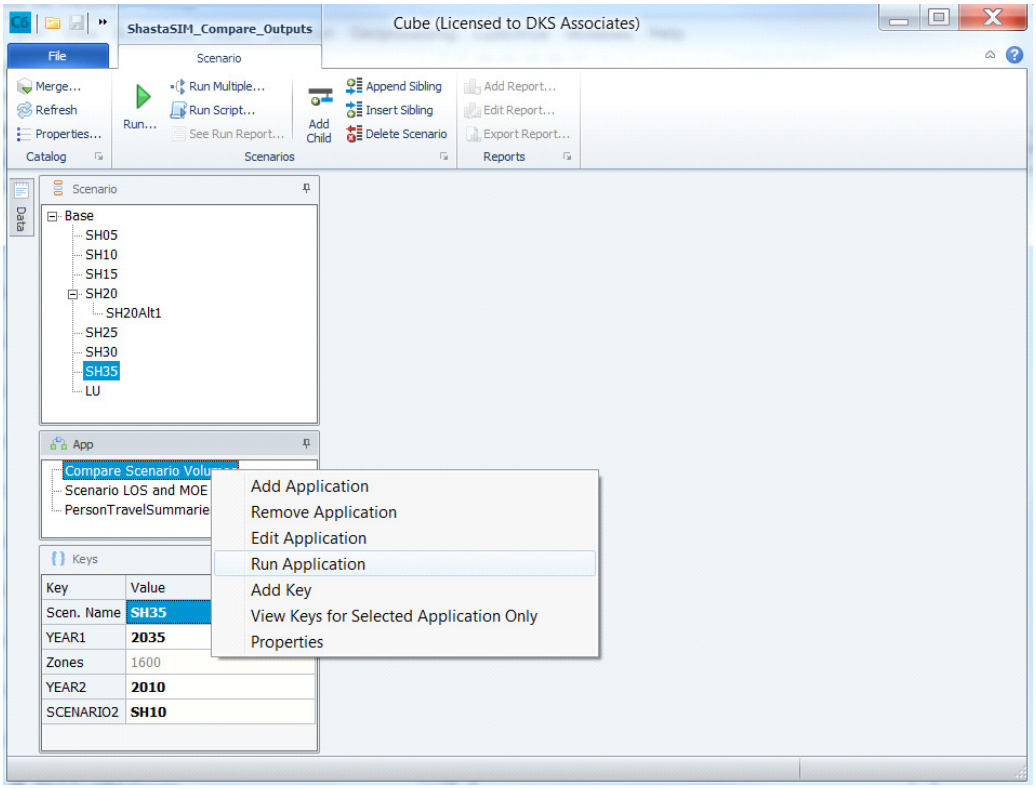
Figure 41: Compare Input Networks (Lanes)



Compare Outputs Catalog

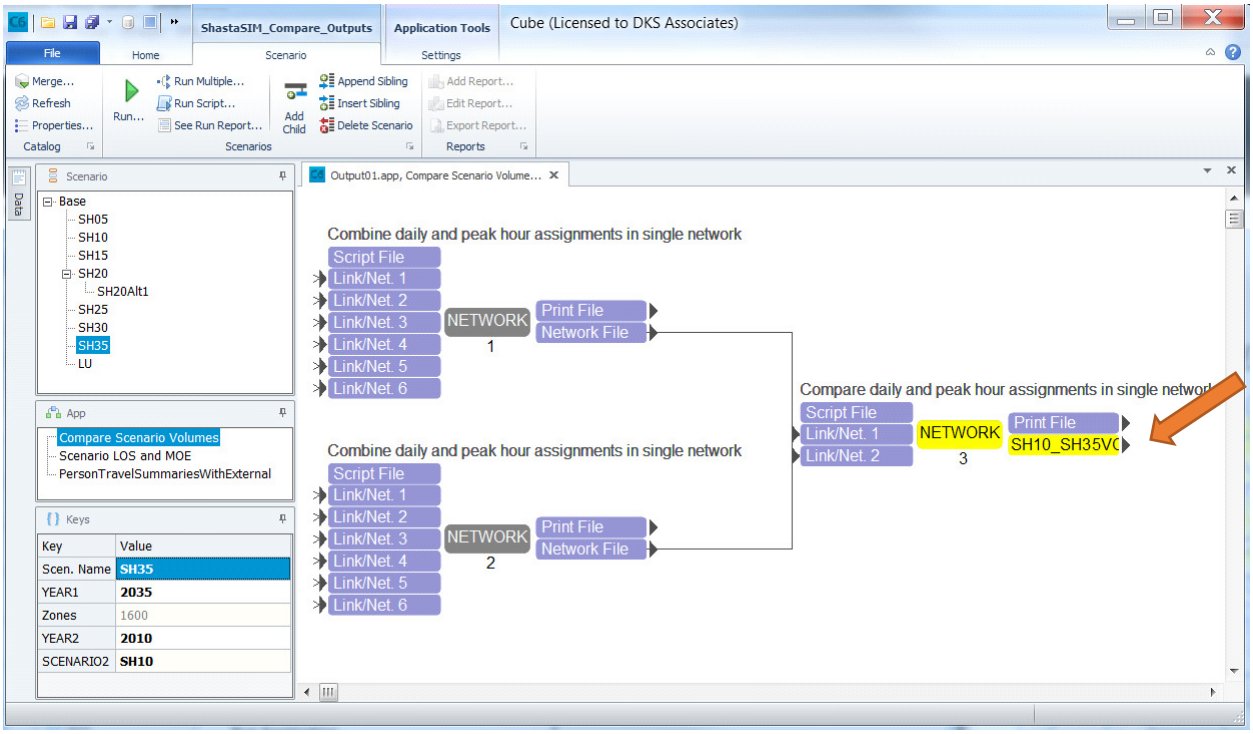
The **SHASTASIM_COMPARE_OUTPUTS.CAT** can be opened in CUBE using the same methods described on **page 15**. Opening the catalog provides a list of available applications to choose from in the Application Pane. Any of these applications can be run by right-clicking on them to bring up the Run Catalog window.

Figure 42: Compare Outputs Catalog



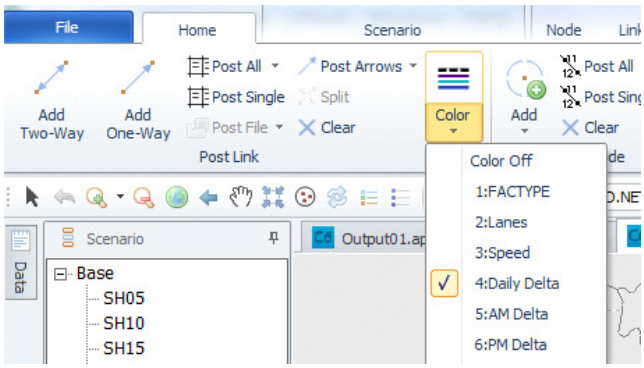
Compare Scenario Volumes: This module compares the loaded peak hour and daily networks for two scenarios. Input base networks are located in each scenario directory. The resultant comparison network is located in the COMPARE\DELTA directory and is called **{YEAR1}_{YEAR2}VOLD.NET**. From the application manager, the comparison network can be opened by double clicking on the output network box.

Figure 43: Compare Scenario Volumes Application



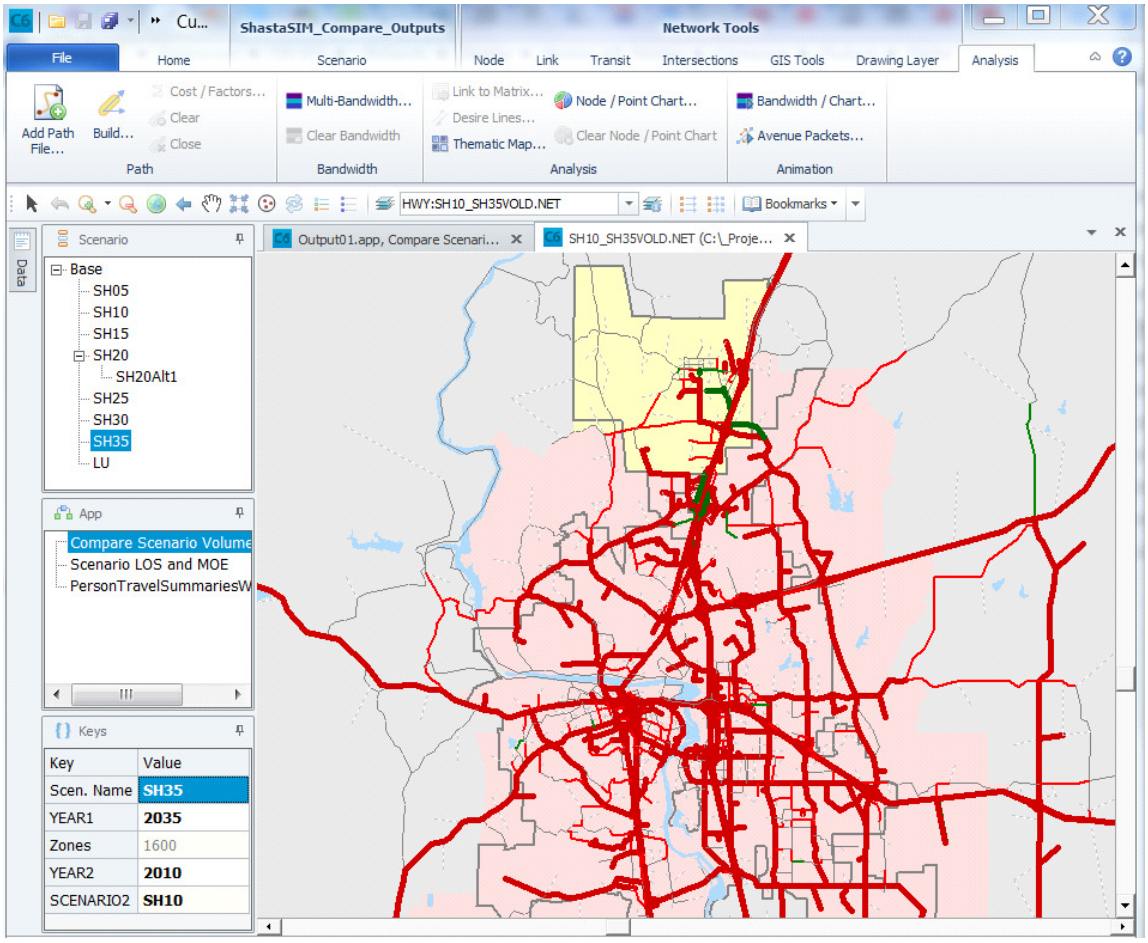
A .VPR file exists in the COMPARE\OUTPUT\DELTA directory that allows users to easily display and print network comparisons for each resultant network. Volume changes are colored red for volume increases, green for volume decreases, and blue for new links. Bandwidths are also included to visually display the magnitude of volume changes between scenarios. Opening the **20xxVOLD.NET** shows a network that is color coded by daily two-way model deltas. Color coding can be changed between daily, AM and PM peak by clicking Color under the HOME tab, as shown in **Figure 44**.

Figure 44: CUBE Color Setting Choice



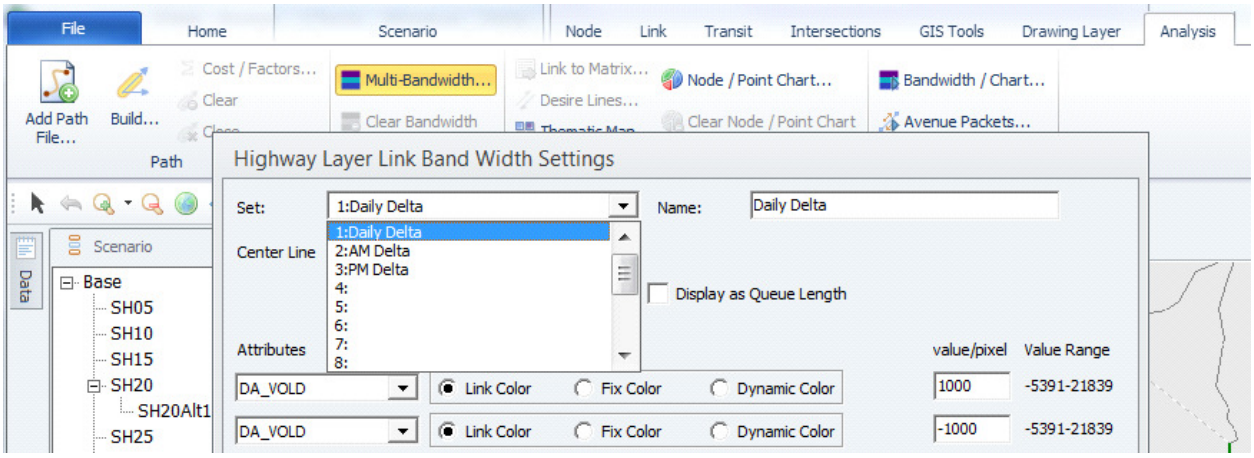
The network will be color coded by the daily volume "delta." Volume increases are red, volume decreases are green, and links with minimal volume change (less than 100 daily or 10 peak hour trips) are grey.

Figure 45: Compare Scenario Volumes Network View



To create a bandwidth map showing the magnitude of change for all links, click on the ANALYSIS tab and on the MULTI BANDWIDTH button. Then the Bandwidth settings window (**Figure 46**) opens.

Figure 46: Bandwidth Settings



This window (see above) offers the choice of daily, AM peak, or PM peak bandwidth. It is important to make sure that the same bandwidth (daily, AM, or PM) is selected as the color setting.

Scenario LOS and MOE

Scenario LOS: This module **(Figure 47)** calculates estimated peak hour level of service (LOS) for model roadway segments. The calculations are the same formulas used by SRTA in previous models. The resultant LOS network is located in the COMPARE\OUTPUT\LOS directory and is called **20xx_LOS.NET**. From the application manager, the LOS network can be opened by double clicking on the output network box. **Figure 47** shows a final screenshot of daily volume change from 2010 to 2035.

Figure 47: Compare Scenario Volumes Bandwidth View

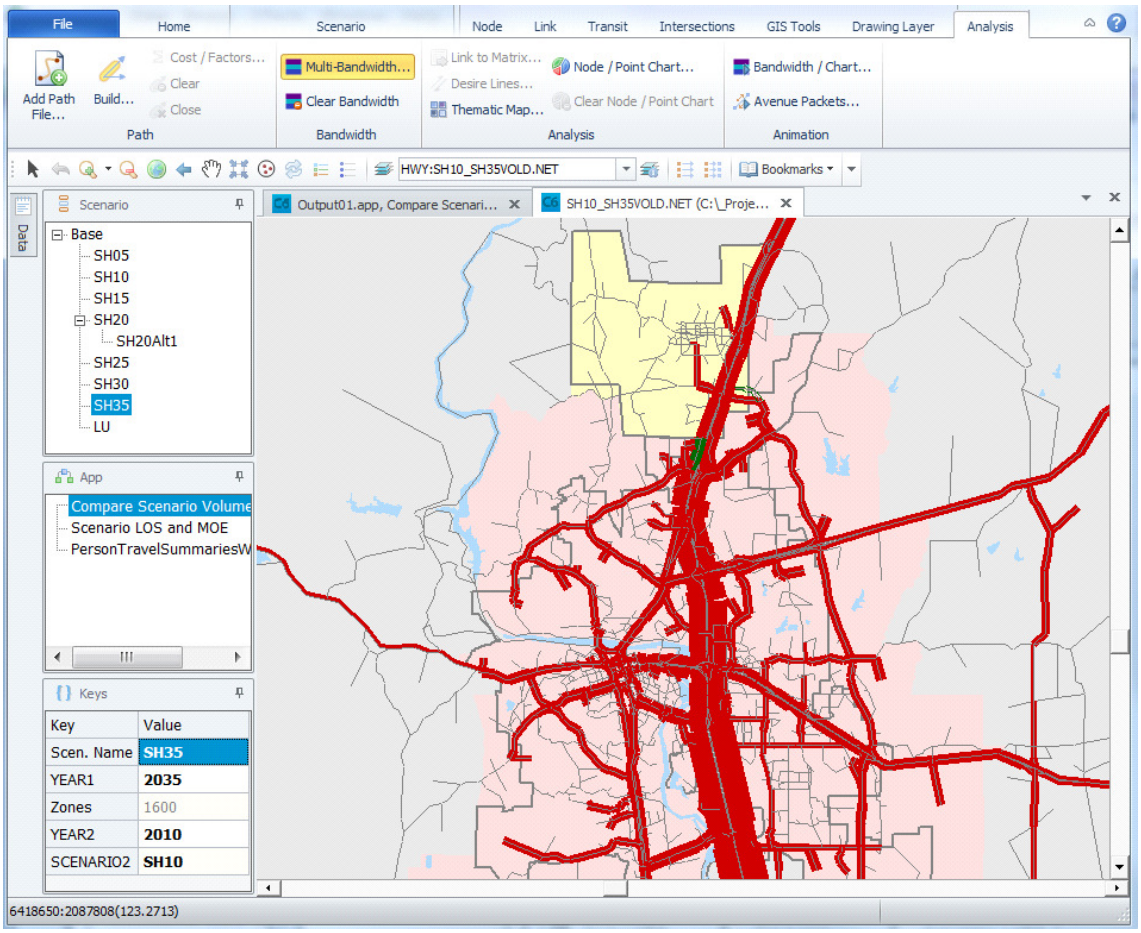
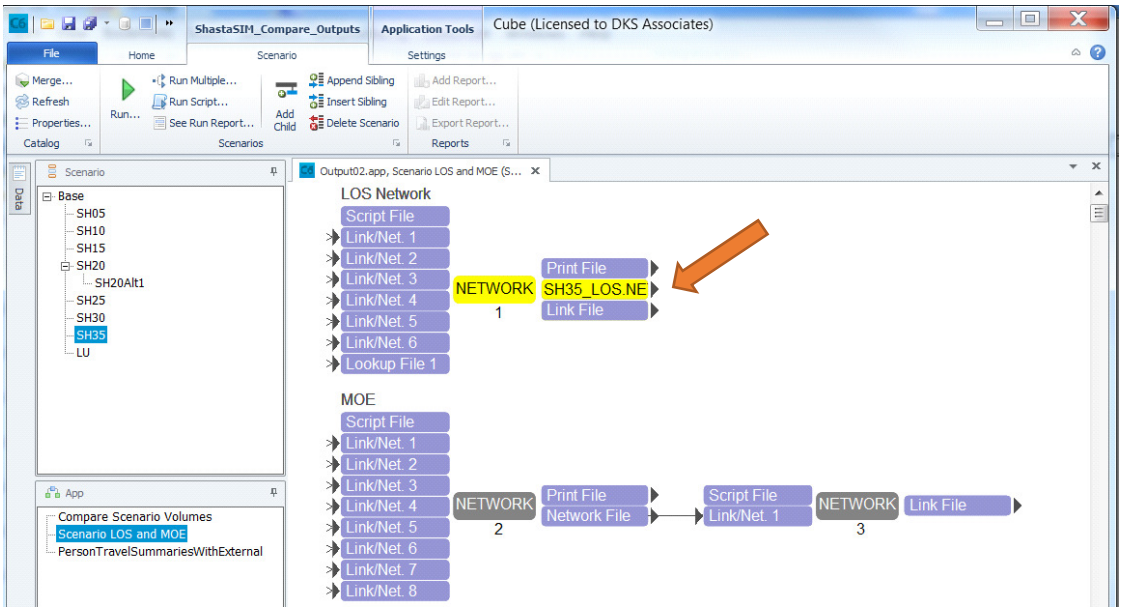
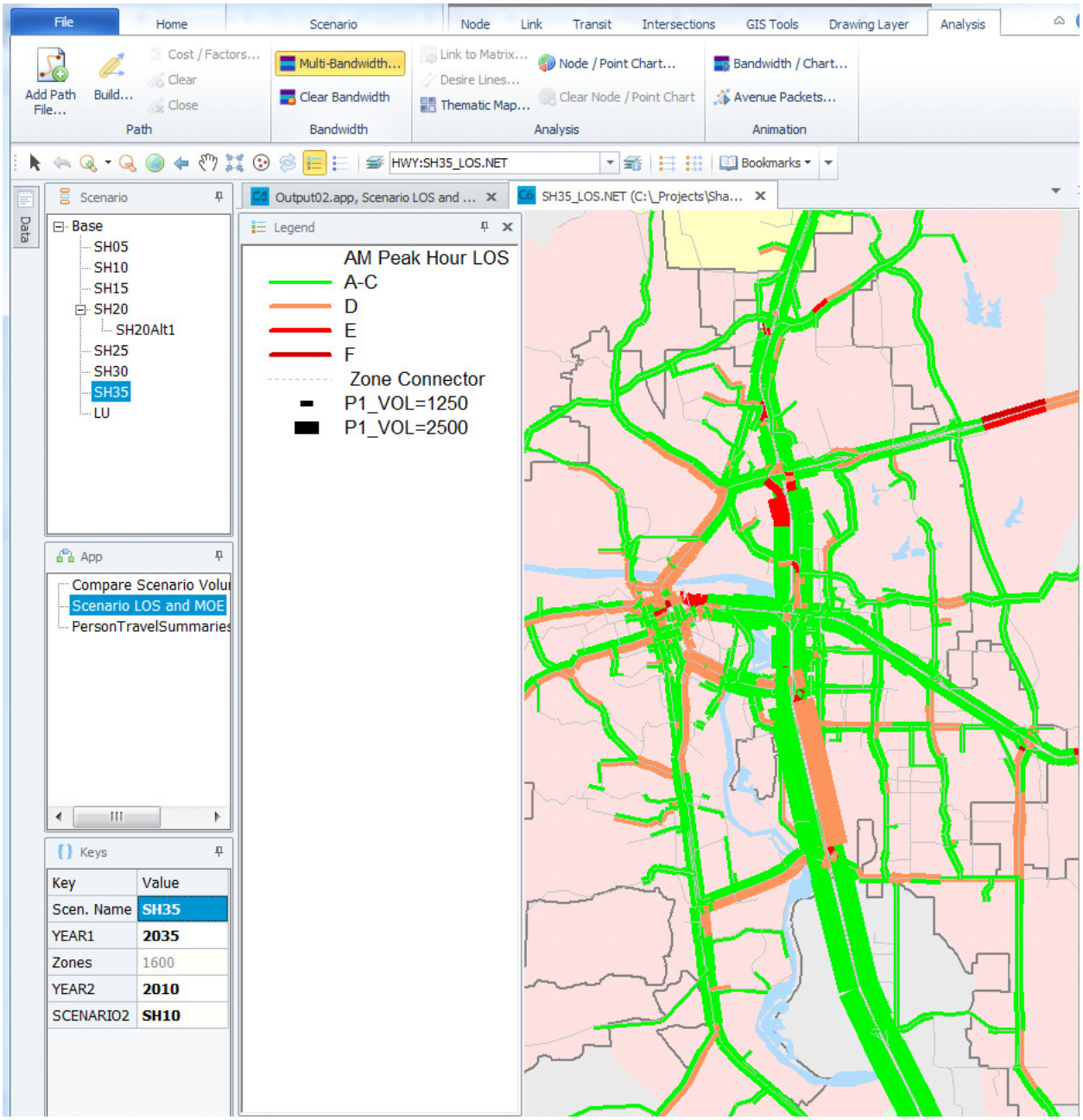


Figure 48: Scenario LOS and MOE Application



A .VPR file exists in the COMPARE\OUTPUT\LOS directory that allows users to easily display and print LOS for each resultant network. Bandwidth settings are also included to visually display the magnitude of volume for each scenario. The method for displaying the correct color coding and bandwidth are the same as discussed above for the volume comparisons. The legend shown in **Figure 49** (page 64) can be opened by clicking . Once the legend is visible on the map, click to keep it from disappearing.

Figure 49: Scenario LOS Network View



Measures of Effectiveness (MOEs): A number of basic MOE's are also created with this application. These MOE's are unique to the activity based model and were not possible with the four step model. MOE's calculated with this application include household vehicle travel distance and time, and household VMT. Files created in the scenario directory include the following.

- Vehicle travel distance and time per trip (by household). Fields in these three files include SAMPN (household number), MODE (travel modes used: 1=drive-transit-walk, 2=walk-transit-drive, 3=Walk-transit-walk, 4=School bus, 5=Shared ride 3+, 6=Shared ride 2, 7=Drive alone, 8=Bike, 9=walk), DIST (distance in miles per trip), TIME (time in minutes per trip), and EXPFAC (conversion factor between person trips and vehicle trips).
    - **A1.VEH.DBF**
    - **P1.VEH.DBF**
    - **DAY.VEH.DBF**
- Daily vehicle VMT (TAZ as origin and destination). Fields in this file include TAZ, VT_O (vehicle trips with TAZ as origin), VT_D (vehicle trips with TAZ as destination), VMT_O (VMT with TAZ as origin), VMT_D (VMT with TAZ as destination).
    - **VEH_VMT.CSV**

Person Travel Summaries With External: This module first aggregates all trip records to each person in the region. This allows all trips by people in a household to be attributed to the correct household, even if the trip did not originate or terminate at the household (such as lunch trips during the work day). Next, the application aggregates the household data to the appropriate TAZ, which in turn allows easy aggregation to each jurisdiction boundary in the model. These processes apply to trips where both trip-ends take place within Shasta County or any of its jurisdictions. Therefore internal-external (IX) trips and external-internal (XI) trips (which are not calculated with the same level of detail as internal trips) need to be counted as well. The IX and XI trips are combined with the TAZ level data to form a more complete dataset. Files created in the scenario directory include the following.

- Data per TAZ
    - **HH_POP.CSV** (households, persons, employment, workers in households)
    - **20xx_TAZ_SUM.DBF** (households, persons, person trips, vehicle trips, VMT, VHT, VMT per person, VMT per household, IX/XI person trips, IX/XI vehicle trips, IX/XI VMT, IX/XI VHT,)
- Data per person
    - **PERSONTRIPSUMS.DBF** (# of trips, # of vehicle trips, personal VMT, personal VHT)

- Data per jurisdiction
    - **PERS_JURIS_SUM.TXT** (# of households, # of persons, # of person trips, # of vehicle trips, total VMT, total VHT)

The following Keys are used in the Model Outputs application:

- {YEAR1} – The "future" scenario of interest. For example, if comparing a 2030 to a 2010, {YEAR1} would be 2030.
- {YEAR2} – The "base" scenario. For example, if all future scenarios are compared back to 2010, then {YEAR2} would be 2010.
- {Zones} – The number of zones in the model network. Default is set to 1600.
- {Scenario2} – Folder name of "base" scenario. Typically "SH10" if comparing back to 2010, however if the user is doing a ""plus project"" scenario, {Senario2} will likely be the parent folder under which the child scenario is located (though not always).

Scenario Intrazonal VMT and VMT By Speed Bin: This module calculates and summarizes VMT by speed bin as required by California Senate Bill 375 (SB 375). Two files are created within the COMPARE\OUTPUT\VMT\ directory. **SHXX_IZ_VMT.CSV** summarizes intrazonal VMT (VMT that remains within each TAZ) by speed bin. **SHXXVMT_SPEEDBIN.CSV** summarizes other VMT (internal VMT between different TAZs, internal-external, and external-internal) by speed bin, categorized as urban streets and freeways.

VMT Per Capita SACOG: This module has been added to ShastaSIM 1.1 and uses SACOG's methodology to calculate VMT per capita. Key outputs of this module include:

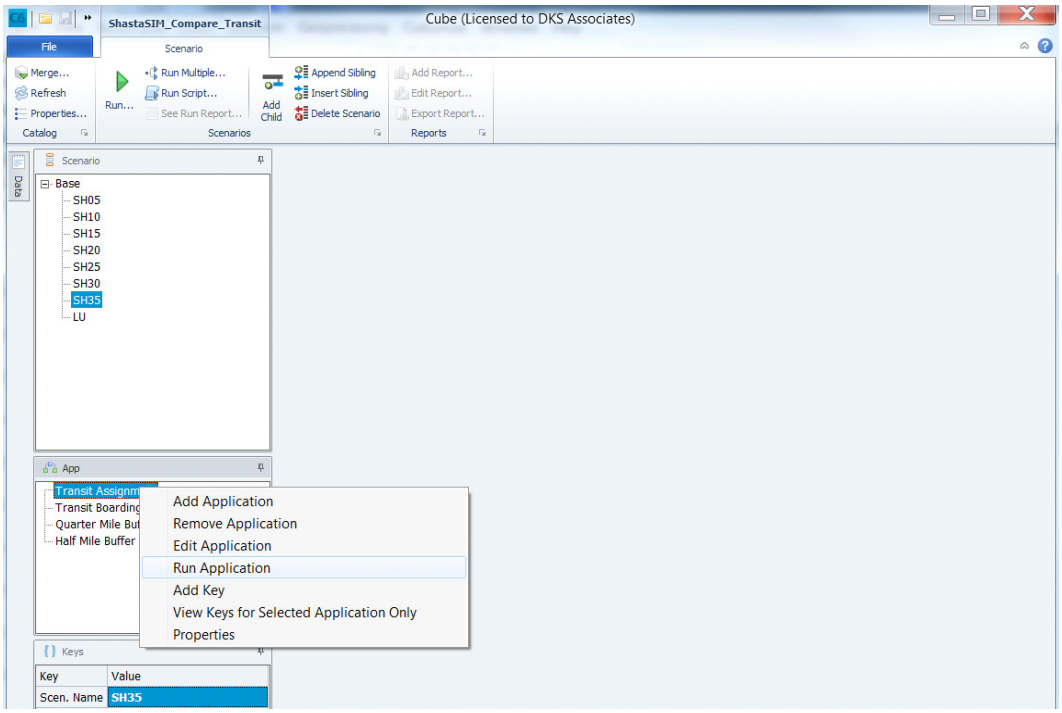
- **PERSTRIPSUMS.DBF**: includes household location, person trips, vehicle trips, and VMT and VHT per person residing in the county.
- **II_TAZ.DBF**: includes households and population totals, as well as all internal (trips begin and end in Shasta County) person trips, vehicle trips, VMT and VHT summarized by TAZ.
- **IXXI_TAZ.DBF**: includes internal-external (IX) and external-internal (XI) trips, summarized by TAZ.
- **CV_SGA.CSV**: includes commercial vehicle VMT, summarized by origin and destination for each jurisdiction and Strategic Growth Area (SGA).
- **EXT_SGA.CSV**: includes internal-external (IX) and external-internal (XI) VMT, summarized by origin and destination for each jurisdiction and SGA.
- **CV_SGA_TRIPS.CSV**: includes commercial vehicle trips, summarized by origin and destination for each jurisdiction and SGA, and excludes VMT on gateway connectors outside Shasta County.

- **EXT_SGA_TRIPS.CSV**: includes internal-external (IX) and external-internal (XI) trips, summarized by origin and destination for each jurisdiction and SGA, and excludes VMT on gateway connectors outside Shasta County.

Compare Transit Application

The **SHASTASIM_COMPARE_TRANSIT.CAT** can be opened in CUBE using the same methods described on **page 15**. Opening the catalog provides a list of available applications to choose from in the Application Pane. Any of these applications can be run by right-clicking on them to bring up the Run Catalog window.

Figure 50: Compare Transit Application



Transit Assignment: This module runs the transit assignment for the current scenario and prepares all files needed for the modules that follow it, including **line boardings**, which are located in the scenario directory. This module does not create any files in the COMPARE directory; however it creates four new .CSV files and two new .DBF files in the Scenario directory. In the following outputs, walk access refers to a trip where the transit user walks from their origin to the bus stop. Drive access refers to a trip where a person takes a vehicle (either drives or is dropped off) to the bus stop.

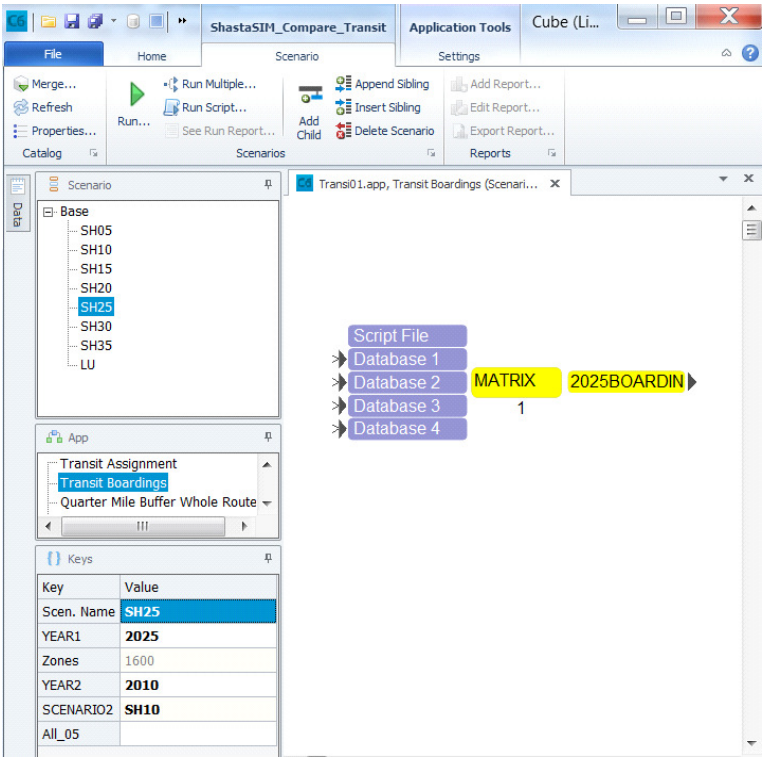
- Generalized Transit Loading Data by Route (one row per route direction)
  - **20xxLVPW.CSV** (walk-access transit loadings, peak period)

- **20xxLVPD.CSV** (drive-access transit loadings, peak period)
- **20xxLVOW.CSV** (walk-access transit loadings, off peak)
- **20xxLVOD.CSV** (drive-access transit loadings, off peak)

- Detailed Transit Boarding Data by Route (many rows per route per direction)
  - **20xxTRPKWK.DBF** (walk-access transit boardings, peak period)
  - **20xxTRPKDR.DBF** (drive-access transit boardings, peak period)
  - **20xxTROPWK.DBF** (walk-access transit boardings, off peak)
  - **20xxTROPDR.DBF** (drive-access transit boardings, off peak)

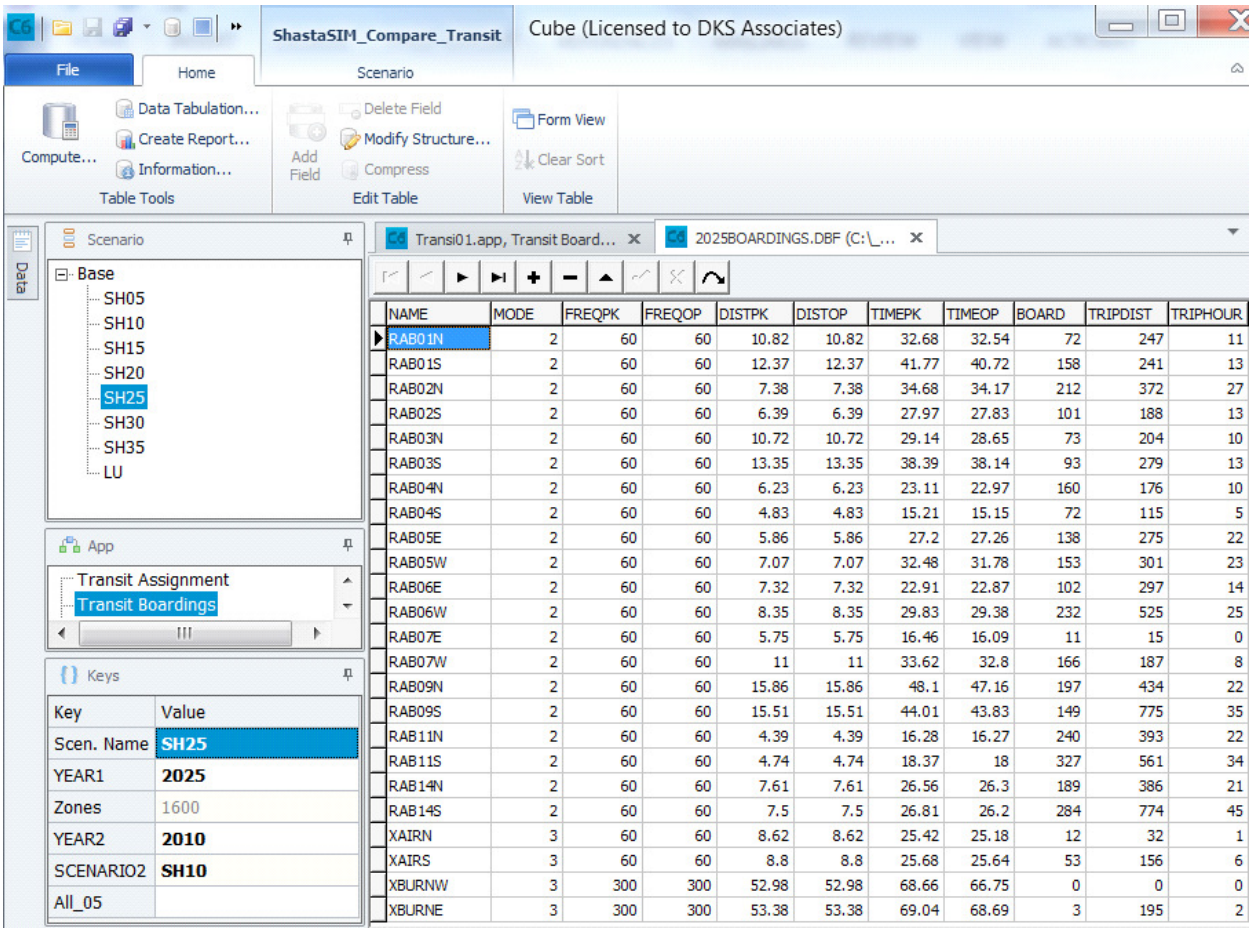
Transit Boardings: This module compiles all boardings for each transit route for a single scenario, including "peak hour" walk and drive boardings and "off-peak" walk and drive boardings. The resultant .DBF file is located in the COMPARE\TRANSIT directory and is called **20xx_BOARDINGS.DBF**. For a comparison of boardings between scenarios, individual .DBF files can be copied into sheets in an Excel spreadsheet for review. The boardings file can be opened by double clicking on the appropriate box in the **Transit Boardings** application (See **Figure 51**).

Figure 51: Compare Transit Boardings Application



The resultant boardings file has the following fields: MODE (mode 2 = bus), FREQPK (peak frequency in minutes), FREQOP (off peak frequency in minutes), DISTPK and DISTOP (route distance in miles), TIMEPK and TIMEOP (route travel time in minutes), BOARD (total route daily boardings), TRIPDIST (total distance traveled by riders), and TRIPHOUR (total hours traveled by riders).

Figure 52: Compare Transit Boardings Output

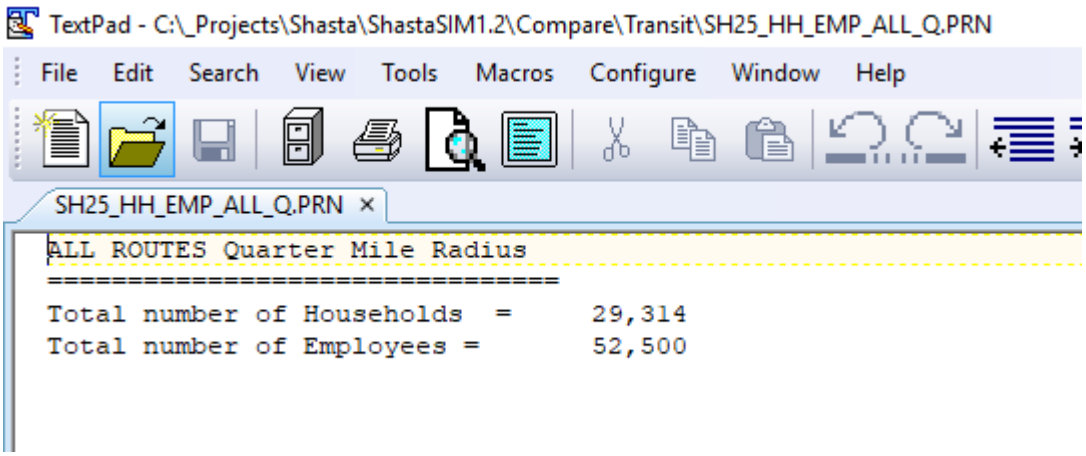


NAME	MODE	FREQPK	FREQOP	DISTPK	DISTOP	TIMEPK	TIMEOP	BOARD	TRIPDIST	TRIPHOUR
RAB01N	2	60	60	10.82	10.82	32.68	32.54	72	247	11
RAB01S	2	60	60	12.37	12.37	41.77	40.72	158	241	13
RAB02N	2	60	60	7.38	7.38	34.68	34.17	212	372	27
RAB02S	2	60	60	6.39	6.39	27.97	27.83	101	188	13
RAB03N	2	60	60	10.72	10.72	29.14	28.65	73	204	10
RAB03S	2	60	60	13.35	13.35	38.39	38.14	93	279	13
RAB04N	2	60	60	6.23	6.23	23.11	22.97	160	176	10
RAB04S	2	60	60	4.83	4.83	15.21	15.15	72	115	5
RAB05E	2	60	60	5.86	5.86	27.2	27.26	138	275	22
RAB05W	2	60	60	7.07	7.07	32.48	31.78	153	301	23
RAB06E	2	60	60	7.32	7.32	22.91	22.87	102	297	14
RAB06W	2	60	60	8.35	8.35	29.83	29.38	232	525	25
RAB07E	2	60	60	5.75	5.75	16.46	16.09	11	15	0
RAB07W	2	60	60	11	11	33.62	32.8	166	187	8
RAB09N	2	60	60	15.86	15.86	48.1	47.16	197	434	22
RAB09S	2	60	60	15.51	15.51	44.01	43.83	149	775	35
RAB11N	2	60	60	4.39	4.39	16.28	16.27	240	393	22
RAB11S	2	60	60	4.74	4.74	18.37	18	327	561	34
RAB14N	2	60	60	7.61	7.61	26.56	26.3	189	386	21
RAB14S	2	60	60	7.5	7.5	26.81	26.2	284	774	45
XAIRN	3	60	60	8.62	8.62	25.42	25.18	12	32	1
XAIRS	3	60	60	8.8	8.8	25.68	25.64	53	156	6
XBURNW	3	300	300	52.98	52.98	68.66	66.75	0	0	0
XBURNE	3	300	300	53.38	53.38	69.04	68.69	3	195	2

Transit Stops: This module creates transit stop and transit link DBF files in unique scenario directories below the COMPARE\TRANSIT\ directory. These files are created in order to support the following two buffering modules.

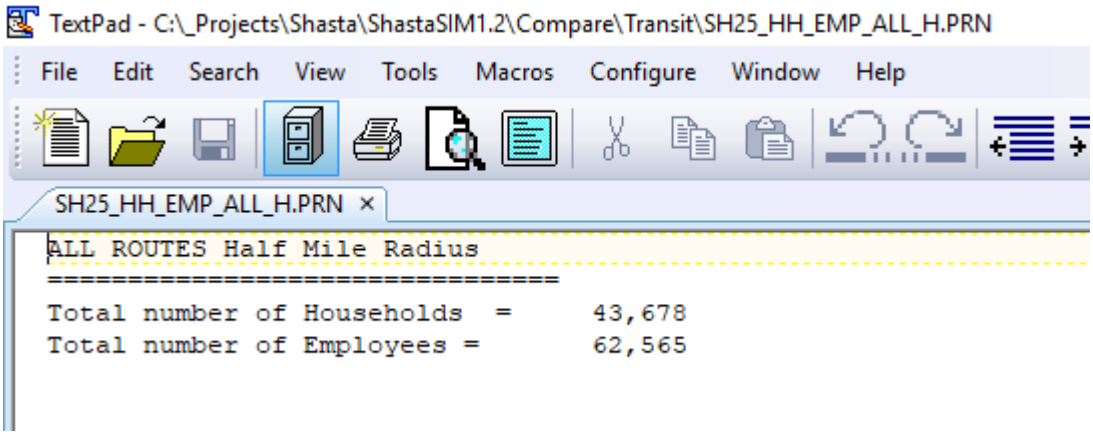
Buffer Transit Quarter Mile: *This module calculates the number of households and employees within a 1/4 mile radius of the stops of all transit routes. Households and employment within 1/4 mile of more than one stop are not double counted. A resultant text .PRN called **SHXX_HH_EMP_ALL_Q.PRN** is created and is located in the COMPARE\TRANSIT directory. A sample of the SH25 file is shown below.*

Figure 53: Households & Employment Within ¼ Mile of Transit Stop Output



Buffer Transit Half Mile: *This module calculates the number of households and employees within a 1/2 mile radius of the stops of all transit routes. Households and employment within 1/2 mile of more than one stop are not double counted. A resultant text .PRN called **SHXX_HH_EMP_ALL_H.PRN** is created and is located in the COMPARE\TRANSIT directory. A sample of the SH25 file is shown below.*

Figure 54: Households & Employment Within ½ Mile of Transit Stop Output



The following Keys are used in the Compare Transit application:

- {YEAR1} – The "future" scenario of interest. For example, if comparing a 2030 to a 2010, {YEAR1} would be 2030.
- {YEAR2} – The "base" scenario. For example, if all future scenarios are compared back to 2010, then {YEAR2} would be 2010.
- {Zones} – The number of zones in the model network. Default is set to 1600.
- {Scenario2} – Folder name of "base" scenario. Typically "SH10" if comparing back to 2010.

9. SUMMARIZATION OF MOE RESULTS

A large spreadsheet (**MOE_BASE.XLS** in the MOE directory) has been created to consolidate and summarize all of the MOE data described above. The spreadsheet has a data sheet for each base scenario (SH05, SH10, SH15, SH20, SH25, SH30, and SH35) where the following data must be pasted into the correct cells for the data to be summarized:

- **20xx_VOL.DBF**: CELL D2
- **20xxBOARDINGS.DBF**: CELL CA2
- **HH_POP.CSV**: CELL CM2
- **VEH_VMT.CSV**: CELL CU2
- **20xxPERS_TAZ_SUM.DBF**: CELL DC2
- **20xxHMILE_BUFFER_H.PRN**: CELL CA30
- **20xxQMILE_BUFFER_Q.PRN**: CELL CD30

The resultant summary data includes all of the data in Chapter 9 of the *ShastaSIM Model Development Report* (DKS Associates, 2014), as well as additional detailed data. The **MOE_BASE.XLS** spreadsheet includes three summary sheets (Pop HH VMT Summary, Roadway Summary, and Transit Summary), screenshots of which are shown in **Figure 55** to **Figure 60**. Each year also has a roadway system MOE sheet called MEAS_SHXX, a screenshot of which is shown in .

A second MOE table centered on VMT has been created with the model update. This spreadsheet (**VMT_SUMMARIES_COMPARISON.XLSX)** includes detailed VMT summaries based on SACOG's methodology of calculating VMT per capita. The methodology calculates not only total VMT per capita, but also VMT per capita consistent with SB 375, which excludes through trips (XX) that do not begin or end within the County. The methodology also separates VMT attributed to households within the County from VMT not attributed to households within the County. This table is shown in **Figure 62**; which spans multiple pages.

A third MOE table summarizes VMT by speed bin for use in the EMFAC greenhouse gas software package. This spreadsheet (**EMFAC_SPEED_BINS_SRTA_SB375.XLSX**) summarizes network based VMT by 5 mile-per-hour congested speed increments. This table is shown in **Figure 63**.

Figure 55: MOE_BASE.XLS Population and Households Summary

Shasta County Activity Based Model: Population, Households, and VMT Summary

Population	2005	2010	2015	2020	2025	2030	2035	2040
Shasta County Total	174,495	176,465	182,261	191,905	199,977	207,448	214,856	223,042
Redding	89,936	91,182	95,570	102,978	105,970	108,226	112,618	117,570
Anderson	9,767	9,877	10,523	11,319	12,972	12,953	13,462	13,031
Shasta Lake	10,040	10,125	9,936	10,360	10,711	11,229	11,457	12,025
Unincorporated County	64,752	65,281	66,232	67,248	70,324	75,040	77,319	80,416

Households	2005	2010	2015	2020	2025	2030	2035	2040
Shasta County Total	70,343	71,151	73,471	77,283	80,588	83,636	86,532	89,837
Redding	36,170	36,789	38,613	41,440	42,871	43,834	45,494	47,459
Anderson	3,926	3,987	4,204	4,535	5,274	5,265	5,327	5,318
Shasta Lake	3,993	4,008	4,034	4,073	4,292	4,534	4,584	4,760
Unincorporated County	26,254	26,367	26,620	27,235	28,151	30,003	31,127	32,300
Population Growth	**2005**	**2005-2010**	**2010-2015**	**2015-2020**	**2020-2025**	**2025-2030**	**2030-2035**	**2035-2040**
Shasta County Total		1,970	5,796	9,644	8,072	7,471	7,408	8,186
Redding		1,246	4,388	7,408	2,992	2,256	4,392	4,952
Anderson		110	646	796	1,653	-19	509	-431
Shasta Lake		85	-189	424	351	518	228	568
Unincorporated County		529	951	1,016	3,076	4,716	2,279	3,097

Households Growth	2005	2005-2010	2010-2015	2015-2020	2020-2025	2025-2030	2030-2035	2035-2040
Shasta County Total		808	2,320	3,812	3,305	3,048	2,896	3,305
Redding		619	1,824	2,827	1,431	963	1,660	1,965
Anderson		61	217	331	739	-9	62	-9
Shasta Lake		15	26	39	219	242	50	176
Unincorporated County		113	253	615	916	1,852	1,124	1,173
Average Population Per Household	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Shasta County Total	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48
Redding	2.49	2.48	2.48	2.48	2.47	2.47	2.48	2.48
Anderson	2.49	2.48	2.50	2.50	2.46	2.46	2.53	2.45
Shasta Lake	2.51	2.53	2.46	2.54	2.50	2.48	2.50	2.53
Unincorporated County	2.47	2.48	2.49	2.47	2.50	2.50	2.48	2.49

Figure 56: MOE_BASE.XLS VMT Summary

VMT Attributed to Households	2005	2010	2015	2020	2025	2030	2035	2040
To/From Within Shasta County (I-I)								
Shasta County Total	3,011,156	2,820,726	2,938,208	2,838,772	2,969,750	3,049,086	3,167,542	3,295,718
Redding	984,295	985,397	1,060,114	1,103,707	1,148,352	1,152,675	1,211,487	1,279,210
Anderson	136,081	135,460	144,635	145,107	172,505	170,913	176,943	171,027
Shasta Lake	149,909	149,326	150,697	141,636	149,495	155,747	159,270	166,981
Unincorporated County	1,740,870	1,550,542	1,582,762	1,448,321	1,499,399	1,569,751	1,619,842	1,678,501
To/From Outside Shasta County (I-X and X-I)								
Shasta County Total	496,680	530,342	596,470	678,140	754,605	829,066	912,638	994,437
Redding	293,927	259,795	301,065	348,869	386,092	418,037	461,416	504,184
Anderson	22,707	29,120	33,512	39,345	48,459	51,719	55,885	58,107
Shasta Lake	33,389	28,603	30,926	34,363	38,844	43,679	47,091	51,366
Unincorporated County	146,657	212,824	230,967	255,563	281,210	315,631	348,246	380,780
All VMT								
Shasta County Total	3,507,836	3,351,067	3,534,679	3,516,912	3,724,355	3,878,152	4,080,180	4,290,155
Redding	1,278,222	1,245,193	1,361,180	1,452,576	1,534,443	1,570,713	1,672,903	1,783,393
Anderson	158,788	164,580	178,147	184,452	220,964	222,632	232,828	229,134
Shasta Lake	183,299	177,928	181,623	175,999	188,338	199,425	206,362	218,347
Unincorporated County	1,887,527	1,763,366	1,813,729	1,703,884	1,780,610	1,885,382	1,968,088	2,059,281

VMT Per Capita	2005	2010	2015	2020	2025	2030	2035	2040
To/From Within Shasta County (I-I)								
Shasta County Total	17.26	15.98	16.12	14.79	14.85	14.70	14.74	14.78
Redding	10.94	10.81	11.09	10.72	10.84	10.65	10.76	10.88
Anderson	13.93	13.71	13.74	12.82	13.30	13.19	13.14	13.12
Shasta Lake	14.93	14.75	15.17	13.67	13.96	13.87	13.90	13.89
Unincorporated County	26.89	23.75	23.90	21.54	21.32	20.92	20.95	20.87
To/From Outside Shasta County (I-X and X-I)								
Shasta County Total	2.85	3.01	3.27	3.53	3.77	4.00	4.25	4.46
Redding	3.27	2.85	3.15	3.39	3.64	3.86	4.10	4.29
Anderson	2.32	2.95	3.18	3.48	3.74	3.99	4.15	4.46
Shasta Lake	3.33	2.82	3.11	3.32	3.63	3.89	4.11	4.27
Unincorporated County	2.26	3.26	3.49	3.80	4.00	4.21	4.50	4.74
All VMT Per Capita								
Shasta County Total	20.10	18.99	19.39	18.33	18.62	18.69	18.99	19.23
Redding	14.21	13.66	14.24	14.11	14.48	14.51	14.85	15.17
Anderson	16.26	16.66	16.93	16.30	17.03	17.19	17.30	17.58
Shasta Lake	18.26	17.57	18.28	16.99	17.58	17.76	18.01	18.16
Unincorporated County	29.15	27.01	27.38	25.34	25.32	25.13	25.45	25.61

VMT Per Household	2005	2010	2015	2020	2025	2030	2035	2040
To/From Within Shasta County (I-I)								
Shasta County Total	42.81	39.64	39.99	36.73	36.85	36.46	36.61	36.69
Redding	27.21	26.79	27.45	26.63	26.79	26.30	26.63	26.95
Anderson	34.66	33.98	34.40	32.00	32.71	32.46	33.22	32.16
Shasta Lake	37.54	37.26	37.36	34.77	34.83	34.35	34.74	35.08
Unincorporated County	66.31	58.81	59.46	53.18	53.26	52.32	52.04	51.97
To/From Outside Shasta County (I-X and X-I)								
Shasta County Total	7.06	7.45	8.12	8.77	9.36	9.91	10.55	11.07
Redding	8.13	7.06	7.80	8.42	9.01	9.54	10.14	10.62
Anderson	5.78	7.30	7.97	8.68	9.19	9.82	10.49	10.93
Shasta Lake	8.36	7.14	7.67	8.44	9.05	9.63	10.27	10.79
Unincorporated County	5.59	8.07	8.68	9.38	9.99	10.52	11.19	11.79
All VMT Per Household								
Shasta County Total	49.87	47.10	48.11	45.51	46.21	46.37	47.15	47.75
Redding	35.34	33.85	35.25	35.05	35.79	35.83	36.77	37.58
Anderson	40.45	41.28	42.38	40.67	41.90	42.29	43.71	43.09
Shasta Lake	45.91	44.39	45.02	43.21	43.88	43.98	45.02	45.87
Unincorporated County	71.89	66.88	68.13	62.56	63.25	62.84	63.23	63.75

Figure 57: MOE_BASE.XLS VMT and Trips Summary

Vehicle Trips	2005	2010	2015	2020	2025	2030	2035	2040
To/From Within Shasta County (I-I)								
Shasta County Total	432,870	436,149	451,665	465,060	486,162	501,070	521,064	540,782
Redding	226,454	229,704	240,212	254,774	263,691	266,090	278,134	290,255
Anderson	23,984	24,258	25,411	26,617	30,873	30,955	32,418	31,095
Shasta Lake	23,702	23,871	24,251	23,878	25,070	26,299	26,896	28,022
Unincorporated County	158,729	158,316	161,790	159,792	166,529	177,727	183,616	191,410
To/From Outside Shasta County (I-X and X-I)								
Shasta County Total	15,740	19,113	21,420	24,387	27,411	30,436	33,490	36,659
Redding	7,703	7,597	8,772	10,247	11,342	12,207	13,491	14,792
Anderson	969	1,894	2,143	2,571	3,207	3,414	3,721	3,757
Shasta Lake	781	736	790	883	1,000	1,113	1,207	1,320
Unincorporated County	6,287	8,886	9,715	10,686	11,862	13,702	15,071	16,790
All Vehicle Trips								
Shasta County Total	448,610	455,262	473,085	489,447	513,573	531,506	554,554	577,441
Redding	234,157	237,301	248,984	265,021	275,033	278,297	291,625	305,047
Anderson	24,953	26,152	27,554	29,188	34,080	34,369	36,139	34,852
Shasta Lake	24,483	24,607	25,041	24,761	26,070	27,412	28,103	29,342
Unincorporated County	165,016	167,202	171,505	170,478	178,391	191,429	198,687	208,200

Average Trip Length	2005	2010	2015	2020	2025	2030	2035	2040
To/From Within Shasta County (I-I)								
Shasta County Total	6.96	6.47	6.51	6.10	6.11	6.09	6.08	6.09
Redding	4.35	4.29	4.41	4.33	4.35	4.33	4.36	4.41
Anderson	5.67	5.58	5.69	5.45	5.59	5.52	5.46	5.50
Shasta Lake	6.32	6.26	6.21	5.93	5.96	5.92	5.92	5.96
Unincorporated County	10.97	9.79	9.78	9.06	9.00	8.83	8.82	8.77
To/From Outside Shasta County (I-X and X-I)								
Shasta County Total	31.56	27.75	27.85	27.81	27.53	27.24	27.25	27.13
Redding	38.16	34.20	34.32	34.05	34.04	34.25	34.20	34.08
Anderson	23.43	15.37	15.64	15.30	15.11	15.15	15.02	15.47
Shasta Lake	42.75	38.86	39.15	38.92	38.84	39.24	39.02	38.91
Unincorporated County	23.33	23.95	23.77	23.92	23.71	23.04	23.11	22.68
Total Average Trip Length								
Shasta County Total	7.82	7.36	7.47	7.19	7.25	7.30	7.36	7.43
Redding	5.46	5.25	5.47	5.48	5.58	5.64	5.74	5.85
Anderson	6.36	6.29	6.47	6.32	6.48	6.48	6.44	6.57
Shasta Lake	7.49	7.23	7.25	7.11	7.22	7.28	7.34	7.44
Unincorporated County	11.44	10.55	10.58	9.99	9.98	9.85	9.91	9.89

Average Daily Trips per Household	2005	2010	2015	2020	2025	2030	2035	2040
Shasta County Total	6.38	6.40	6.44	6.33	6.37	6.35	6.41	6.43
Redding	6.47	6.45	6.45	6.40	6.42	6.35	6.41	6.43
Anderson	6.36	6.56	6.55	6.44	6.46	6.53	6.78	6.55
Shasta Lake	6.13	6.14	6.21	6.08	6.07	6.05	6.13	6.16
Unincorporated County	6.29	6.34	6.44	6.26	6.34	6.38	6.38	6.45

Figure 58: MOE_BASE.XLS Roadway Summary

Roadway Statistics	VMT, VHD, Miles							
	2005	2010	2015	2020	2025	2030	2035	2040
Total Lane Miles of Roads in Analysis Area	**3,826.7**	**3,840.4**	**3,859.0**	**3,885.0**	**3,899.8**	**3,912.4**	**3,930.7**	**3,942.2**
5 year increment		13.7		25.9	14.8	12.6	18.3	11.4
Increase vs 2015				25.9	40.7	53.4	71.7	83.1
Daily Vehicle Miles of Travel on Roadways	**4,976,252**	**5,501,460**	**5,920,517**	**6,127,422**	**6,551,512**	**6,926,559**	**7,347,223**	**7,747,014**
Freeway	1,959,604	2,258,253	2,473,072	2,632,364	2,844,870	3,041,434	3,256,302	3,527,267
Highway	1,020,877	1,176,582	1,257,809	1,253,731	1,341,287	1,412,052	1,502,933	1,534,056
Expressway	209,845	222,473	234,738	235,688	250,259	263,222	275,897	288,712
Arterial	990,062	1,013,642	1,070,424	1,101,941	1,161,803	1,210,050	1,261,668	1,307,198
Collector	314,934	328,506	360,037	369,865	393,638	419,816	446,107	458,087
Local	86,305	91,618	92,425	97,110	100,479	105,276	109,960	115,142
Ramp	104,520	107,651	114,933	118,570	125,627	126,555	133,003	139,243
Zone Connector	290,106	302,734	317,080	318,152	333,549	348,155	361,355	377,309
Daily Vehicle Miles of Travel: Outside Shasta Co.	**378,178**	**913,519**	**986,710**	**1,059,907**	**1,132,888**	**1,205,864**	**1,279,324**	**1,352,555**
Daily Vehicle Miles of Travel: Redding Trips	**3,370,456**	**3,316,706**	**3,532,689**	**3,626,451**	**3,847,036**	**4,027,284**	**4,263,592**	**4,464,365**
Daily Vehicle Hours of Delay	**1,564**	**1,391**	**2,145**	**2,045**	**2,415**	**2,749**	**3,054**	**3,397**
Freeway	18.6	64.7	63.4	49.6	118.8	232.2	112.6	113.5
Highway	106.4	110.0	113.0	82.3	100.7	133.5	149.6	154.8
Expressway	445.7	215.0	260.5	234.9	290.8	321.3	380.9	462.9
Arterial	553.1	510.8	1,097.1	1,042.4	1,151.2	1,230.4	1,418.3	1,605.4
Collector	215.3	224.3	331.7	349.4	439.3	488.4	580.6	600.4
Local	133.7	149.8	145.4	150.5	149.7	157.9	170.9	175.0
Ramp	91.2	116.2	128.3	136.1	164.5	185.6	240.8	275.6
Zone Connector	0.0	0.4	5.6	0.2	0.0	0.0	0.0	9.1
Miles of Roads at LOS E/F	**12.2**	**8.9**	**10.7**	**7.5**	**9.8**	**13.9**	**12.1**	**16.6**
Freeway	0.9	1.7	2.8	0.9	3.7	6.4	2.0	5.7
Highway	2.5	2.5	2.5	2.5	2.5	3.1	2.5	0.5
Expressway	3.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3
Arterial	3.5	2.5	3.4	1.6	1.4	1.6	4.0	6.5
Collector	0.4	0.3	0.3	0.5	0.5	1.0	1.1	1.1
Local	0.2	0.2	0.0	0.4	0.0	0.0	0.4	0.4
Ramp	1.7	1.7	1.7	1.7	1.7	1.7	2.1	2.1
Zone Connector	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Figure 59: MOE_BASE.XLS Transit Boardings Summary

Countywide Transit Statistics	2005	2010	2015	2020	2025	2030	2035	2040
Total System Daily Transit Boardings	**2,482**	**2,925**	**3,000**	**3,500**	**3,597**	**6,201**	**6,164**	**6,564**
Route 1 North	38	79	70	113	114	135	190	164
Route 1 South	35	175	160	42	28	38	45	42
Route 2 North	185	223	237					
Route 2 South	100	99	111					
Route 2 East				122	143	332	336	402
Route 2 West Clockwise				253	266	410	356	385
Route 2 West Counter-Clockwise				276	279	431	370	413
Route 3 North	60	64	79	64	82	200	191	224
Route 3 South	66	95	102	167	189	284	247	280
Route 4 North	110	131	146	97	101	73	71	69
Route 4 South	94	43	53	114	97	146	160	157
Route 5 East			94	208	200	446	481	476
Route 5 West			135	156	140	516	551	555
Route 6 North	104	100	89	44	43	173	173	185
Route 6 South	247	230	200	154	150	371	385	381
Route 7 North	106	19	16					
Route 7 South	128	144	178					
Route 7 East				3	2	25	26	17
Route 7 West				150	166	391	410	413
Route 8 North	26							
Route 8 South	22							
Route 9 North	169	158	181	8	5	7	6	10
Route 9 South	104	112	118	15	15	12	11	14
Route 11 North	197	180	223					
Route 11 South	47	311	315					
Route 11				636	683	899	845	979
Route 14 North	54	163	160					
Route 14 South	248	287	279					
Route 14				715	712	1031	1039	1118
Anderson Commuter				21	26	36	21	32
Airport Express North	0	16	7	11	13	14	7	7
Airport Express South	0	37	44	22	29	37	37	31
Burney Express West	0	2	2	5	4	5	3	4
Burney Express East	1	1	1	27	14	58	54	49
School Express AM				6	4	8	3	6
School Express PM				2	3	5	2	2
Cross-Town Express West				10	27	34	32	36
Cross-Town Express East				59	62	84	91	89
Cottonwood Express South	0	0					8	12
Cottonwood Express North	0	0					13	12

Figure 60: MOE_BASE.XLS Transit Buffering Summary

Countywide Transit Statistics	2005	2010	2015	2020	2025	2030	2035	2040
Total Households Within 1/2 Mile of Transit Stops	43,329	44,265	42,053	42,534	43,678	44,582	46,802	48,207
Total Employment Within 1/2 Mile of Transit Stops	49,097	53,184	57,711	60,175	62,565	64,649	67,674	69,143
Total Households Within 1/4 Mile of Transit Stops	31,679	32,214	30,290	28,828	29,314	29,828	31,275	31,610
Total Employment Within 1/4 Mile of Transit Stops	44,847	47,023	50,499	50,701	52,500	53,968	56,051	57,103

Figure 61: MOE_BASE.XLS Meas_SHxx Sheet (Year 2020 example)

ROAD SYSTEM MEASURES OF EFFECTIVENESS				SH20			
Shasta County 2020							
	Daily Vehicle Miles of Travel	6,127,422		County			
	Daily VMT: Through Trips	1,059,907					
	Daily VMT: To/From Redding	3,626,451					
	Daily Vehicle Hours of Delay	2,045		1			
	Miles of Roads at LOS E/F	7.5					
	Total Lane Miles of Roads	3,885					

	AM Peak Period	PM Peak Period	Off Peak Period	Daily	Daily XX	Daily Redding
VEHICLE MILES OF TRAVEL						
Freeway						
Freeway	133,465	141,125	2,357,774	2,632,364	820,926	1,340,383
Highway						
Multi-Lane Rural Highway	4,871	4,812	62,129	71,812	5,200	38,439
2-Lane Rural Highway	72,187	53,693	1,056,040	1,181,920	220,612	611,865
Total	**77,058**	**58,505**	**1,118,169**	**1,253,731**	**225,813**	**650,304**
Expressway						
Urban Expressway	18,092	20,742	196,854	235,688	4,125	198,680
Arterial						
Multi-Lane Rural Arterial	1,685	1,967	17,628	21,280	0	13,348
2-Lane Rural Arterial	27,603	28,444	303,871	359,918	60	192,731
Urban Arterial	53,370	69,255	598,118	720,743	3,582	642,509
Total	**82,658**	**99,666**	**919,618**	**1,101,941**	**3,642**	**848,589**
Collector						
Rural Collector	13,247	14,241	204,897	232,385	4,232	115,736
Urban Collector	10,355	13,204	113,922	137,481	0	117,808
Total	**23,602**	**27,445**	**318,819**	**369,865**	**4,232**	**233,544**
Local						
Rural Local	1,083	1,233	39,357	41,673	330	13,078
Urban Local	4,079	5,514	45,844	55,437	0	51,617
Total	**5,162**	**6,747**	**85,201**	**97,110**	**330**	**64,695**
Ramp						
Ramp	8,972	10,258	99,340	118,570	839	100,210
Connector						
Zone Connector	24,122	28,552	265,478	318,152	0	190,047
TOTAL	**373,129**	**393,040**	**5,361,253**	**6,127,422**	**1,059,907**	**3,626,451**

VEHICLE HOURS OF TRAVEL, FREE-FLOW SPEEDS					
Freeway					
	Freeway	2,133	2,253	37,354	41,740
Highway					
	Multi-Lane Rural Highway	103	100	1,328	1,532
	2-Lane Rural Highway	1,456	1,086	22,116	24,658
	Total	**1,559**	**1,186**	**23,444**	**26,190**
Expressway					
	Urban Expressway	417	479	4,535	5,432
Arterial					
	Multi-Lane Rural Arterial	38	44	398	481
	2-Lane Rural Arterial	603	624	6,668	7,895
	Urban Arterial	1,458	1,896	16,354	19,708
	Total	**2,099**	**2,565**	**23,421**	**28,084**
Collector					
	Rural Collector	332	359	5,543	6,233
	Urban Collector	348	448	3,842	4,639
	Total	**680**	**807**	**9,385**	**10,872**
Local					
	Rural Local	32	37	1,140	1,208
	Urban Local	156	212	1,756	2,124
	Total	**189**	**249**	**2,895**	**3,333**
Ramp					
	Ramp	200	229	2,213	2,642
Connector					
	Zone Connector	1,167	1,416	12,923	15,505
TOTAL		**8,443**	**9,184**	**116,170**	**133,797**
AVERAGE SPEEDS, FREE-FLOW SPEEDS					
Freeway					
	Freeway	62.6	62.6	63.1	63.1
Highway					
	Multi-Lane Rural Highway	47.1	47.9	46.8	46.9
	2-Lane Rural Highway	49.6	49.4	47.7	47.9
	Total	**49.4**	**49.3**	**47.7**	**47.9**
Expressway					
	Urban Expressway	43.4	43.3	43.4	43.4
Arterial					
	Multi-Lane Rural Arterial	44.4	44.4	44.3	44.3
	2-Lane Rural Arterial	45.8	45.6	45.6	45.6
	Urban Arterial	36.6	36.5	36.6	36.6
	Total	**39.4**	**38.9**	**39.3**	**39.2**
Collector					
	Rural Collector	40.0	39.7	37.0	37.3
	Urban Collector	29.7	29.4	29.6	29.6
	Total	**34.7**	**34.0**	**34.0**	**34.0**
Local					
	Rural Local	33.6	33.6	34.5	34.5
	Urban Local	26.1	26.0	26.1	26.1
	Total	**27.4**	**27.1**	**29.4**	**29.1**
Ramp					
	Ramp	44.9	44.8	44.9	44.9
Connector					
	Zone Connector	20.7	20.2	20.5	20.5
TOTAL		**44.2**	**42.8**	**46.2**	**45.8**

VEHICLE HOURS OF TRAVEL, CONGESTED SPEEDS				
Freeway				
Freeway	2,137	2,255	37,398	41,789
Highway				
Multi-Lane Rural Highway	103	100	1,328	1,532
2-Lane Rural Highway	1,468	1,088	22,184	24,740
Total	**1,571**	**1,189**	**23,512**	**26,272**
Expressway				
Urban Expressway	443	513	4,710	5,666
Arterial				
Multi-Lane Rural Arterial	41	48	428	517
2-Lane Rural Arterial	626	648	6,904	8,178
Urban Arterial	1,522	2,008	16,900	20,431
Total	**2,190**	**2,704**	**24,232**	**29,126**
Collector				
Rural Collector	336	364	5,597	6,298
Urban Collector	377	487	4,060	4,924
Total	**713**	**851**	**9,658**	**11,222**
Local				
Rural Local	32	37	1,144	1,213
Urban Local	173	233	1,865	2,270
Total	**205**	**269**	**3,008**	**3,483**
Ramp				
Ramp	216	249	2,314	2,778
Connector				
Zone Connector	1,167	1,416	12,923	15,505
TOTAL	**8,641**	**9,445**	**117,755**	**135,842**

AVERAGE SPEEDS, CONGESTED SPEEDS				
Freeway				
Freeway	62.5	62.6	63.0	63.0
Highway				
Multi-Lane Rural Highway	47.1	47.9	46.8	46.9
2-Lane Rural Highway	49.2	49.3	47.6	47.8
Total	**49.0**	**49.2**	**47.6**	**47.7**
Expressway				
Urban Expressway	40.9	40.4	41.8	41.6
Arterial				
Multi-Lane Rural Arterial	40.7	41.4	41.2	41.1
2-Lane Rural Arterial	44.1	43.9	44.0	44.0
Urban Arterial	35.1	34.5	35.4	35.3
Total	**37.7**	**36.9**	**38.0**	**37.8**
Collector				
Rural Collector	39.4	39.1	36.6	36.9
Urban Collector	27.5	27.1	28.1	27.9
Total	**33.1**	**32.3**	**33.0**	**33.0**
Local				
Rural Local	33.5	33.6	34.4	34.4
Urban Local	23.6	23.7	24.6	24.4
Total	**25.1**	**25.0**	**28.3**	**27.9**
Ramp				
Ramp	41.6	41.3	42.9	42.7
Connector				
Zone Connector	20.7	20.2	20.5	20.5
TOTAL	**43.2**	**41.6**	**45.5**	**45.1**

VEHICLE HOURS OF DELAY, CONGESTED SPEEDS				
Freeway				
Freeway	4	2	44	50
Highway				
Multi-Lane Rural Highway	0	0	0	0
2-Lane Rural Highway	12	2	68	82
Total	**12**	**2**	**68**	**82**
Expressway				
Urban Expressway	26	34	175	235
Arterial				
Multi-Lane Rural Arterial	3	3	30	37
2-Lane Rural Arterial	23	24	235	283
Urban Arterial	64	112	546	723
Total	**91**	**139**	**812**	**1,042**
Collector				
Rural Collector	5	5	55	64
Urban Collector	29	38	218	285
Total	**33**	**44**	**273**	**349**
Local				
Rural Local	0	0	4	4
Urban Local	17	21	109	146
Total	**17**	**21**	**113**	**151**
Ramp				
Ramp	16	20	101	136
Connector				
Zone Connector	0	0	0	0
TOTAL	**198**	**262**	**1,585**	**2,045**

MILES OF CONGESTED ROAD	LOS D	LOS E	LOS F	TOTAL
Freeway				
Freeway	8.1	0.0	0.9	9.0
Highway				
Multi-Lane Rural Highway	0.0	0.0	0.0	0.0
2-Lane Rural Highway	18.5	2.5	0.0	21.0
Total	**18.5**	**2.5**	**0.0**	**21.0**
Expressway				
Urban Expressway	3.3	0.0	0.0	3.3
Arterial				
Multi-Lane Rural Arterial	0.0	0.0	0.0	0.0
2-Lane Rural Arterial	0.4	0.0	0.0	0.4
Urban Arterial	72.7	1.5	0.0	74.3
Total	**73.1**	**1.5**	**0.0**	**74.7**
Collector				
Rural Collector	0.0	0.0	0.0	0.0
Urban Collector	5.8	0.4	0.1	6.3
Total	**5.8**	**0.4**	**0.1**	**6.3**
Local				
Rural Local	0.0	0.0	0.0	0.0
Urban Local	4.1	0.4	0.0	4.5
Total	**4.1**	**0.4**	**0.0**	**4.5**
Ramp				
Ramp	1.5	1.7	0.0	3.3
Connector				
Zone Connector	0.0	0.0	0.0	0.0
TOTAL	**114.4**	**6.5**	**1.0**	**122.0**

TOTAL LANE-MILES OF ROAD				
Freeway				
Freeway				329.2
Highway				
Multi-Lane Rural Highway				35.9
2-Lane Rural Highway				477.8
Total				**514**
Expressway				
Urban Expressway				52.7
Arterial				
Multi-Lane Rural Arterial				17.4
2-Lane Rural Arterial				323.8
Urban Arterial				259.8
Total				**601**
Collector				
Rural Collector				779.4
Urban Collector				185.3
Total				**965**
Local				
Rural Local				273.0
Urban Local				93.9
Total				**367**
Ramp				
Ramp				36.7
Connector				
Zone Connector				1,020.1
TOTAL				**3,885**

Figure 62: VMT_Summaries_Comparison.XLS

Shasta County VMT Per Capita by SGA (using SACOG VMT Methodology)

Alternative	Jurisdiction/SGA	House-holds	Popul-ation	Employ ment	Household Based VMT				Non-HH IXXI VMT	Total IXXI VMT	Commercial Vehicles			Intra-zonal VMT	Total SB375 VMT	Thru (XX) Trips VMT	TOTAL VMT
					II	IXXI	Total	per Capita			II VMT	IX VMT	XI VMT				
SH05	Anderson	3,942	9,816	3,376	134,638	25,093	159,731	16.3	32,455	57,548	26,377	3,625	4,365				
	Redding	37,120	92,351	43,885	1,001,998	247,147	1,249,144	13.5	474,004	721,150	197,051	47,278	55,744				
	Shasta Lake	3,257	8,126	1,629	117,533	21,987	139,521	17.2	25,143	47,130	16,983	2,720	3,285				
	Unincorporated	26,024	64,202	13,323	1,535,617	210,876	1,746,493	27.2	207,882	418,758	172,406	37,340	37,582				
SH05 Total		**70,343**	**174,495**	**62,213**	**2,789,786**	**505,104**	**3,294,889**	**18.88**	**739,483**	**1,244,587**	**412,817**	**90,962**	**100,976**	**38,351**	**4,677,479**	**968,411**	**5,607,539**
	% of Total VMT				50%	9%	59%		13%	22%	7%	2%	2%	1%	83%	17%	
SH10	Anderson	4,004	9,925	3,675	137,505	24,890	162,395	16.4	32,413	57,303	28,285	3,665	4,373				
	Redding	37,754	93,564	45,025	1,020,208	237,938	1,258,145	13.4	459,490	697,427	200,615	45,932	53,568				
	Shasta Lake	3,265	8,289	1,698	122,936	20,784	143,720	17.3	24,150	44,934	17,394	2,670	3,200				
	Unincorporated	26,128	64,687	13,266	1,541,731	198,836	1,740,567	26.9	197,300	396,136	172,988	36,013	35,870				
SH10 Total		**71,151**	**176,465**	**63,664**	**2,822,380**	**482,447**	**3,304,827**	**18.73**	**713,353**	**1,195,801**	**419,282**	**88,280**	**97,010**	**35,103**	**4,657,856**	**913,519**	**5,536,272**
	% of Total VMT				51%	9%	60%		13%	22%	8%	2%	2%	1%	84%	17%	
SH15	Anderson	4,221	10,564	3,877	145,294	27,395	172,689	16.3	36,708	64,103	29,549	4,195	4,984				
	Redding	39,581	97,921	48,485	1,096,613	265,811	1,362,424	13.9	528,607	794,418	215,014	51,633	60,011				
	Shasta Lake	3,289	8,132	1,822	122,472	22,814	145,287	17.9	27,064	49,879	17,793	3,005	3,561				
	Unincorporated	26,380	65,644	15,340	1,573,829	219,453	1,793,282	27.3	245,419	464,872	182,382	41,675	41,233				
SH15 Total		**73,471**	**182,261**	**69,524**	**2,938,208**	**535,473**	**3,473,681**	**19.06**	**837,798**	**1,373,271**	**444,737**	**100,508**	**109,788**	**35,103**	**5,001,615**	**913,519**	**5,880,031**
	% of Total VMT				50%	9%	59%		14%	23%	8%	2%	2%	1%	85%	16%	
SH20	Anderson	4,552	11,355	4,101	145,463	31,728	177,192	15.6	41,920	73,648	31,293	4,752	5,644				
	Redding	42,582	105,813	51,117	1,142,736	308,584	1,451,321	13.7	593,815	902,399	227,983	57,777	67,233				
	Shasta Lake	3,301	8,463	2,000	115,585	24,984	140,569	16.6	30,608	55,592	18,488	3,507	4,131				
	Unincorporated	26,848	66,274	16,367	1,434,987	239,331	1,674,318	25.3	267,757	507,089	188,250	46,240	45,683				
SH20 Total		**77,283**	**191,905**	**73,585**	**2,838,772**	**604,628**	**3,443,400**	**17.94**	**934,100**	**1,538,728**	**466,013**	**112,277**	**122,690**	**35,103**	**5,113,584**	**913,519**	**5,992,000**
	% of Total VMT				47%	10%	57%		16%	26%	8%	2%	2%	1%	85%	15%	

Shasta County VMT Per Capita by SGA (using SACOG VMT Methodology)

Alternative	Jurisdiction/SGA	House-holds	Popul-ation	Employ ment	Household Based VMT				Non-HH IXXI VMT	Total IXXI VMT	Commercial Vehicles			Intra-zonal VMT	Total SB375 VMT	Thru (XX) Trips VMT	TOTAL VMT
					II	IXXI	Total	per Capita			II VMT	IX VMT	XI VMT				
SH25	Anderson	5,290	13,009	4,286	172,966	38,715	211,681	16.3	49,222	87,937	33,548	5,376	6,387				
	Redding	44,038	108,845	53,156	1,189,737	342,981	1,532,718	14.1	680,542	1,023,523	236,506	63,693	74,250				
	Shasta Lake	3,486	8,776	2,180	121,542	27,748	149,291	17.0	35,736	63,485	19,636	4,163	4,888				
	Unincorporated	27,774	69,347	17,063	1,485,506	263,674	1,749,179	25.2	307,000	570,674	193,040	50,477	49,836				
SH25 Total		**80,588**	**199,977**	**76,685**	**2,969,751**	**673,118**	**3,642,869**	**18.22**	**1,072,501**	**1,745,618**	**482,730**	**123,709**	**135,361**	**35,103**	**5,492,272**	**913,519**	**6,370,689**
	% of Total VMT				47%	11%	57%		17%	27%	8%	2%	2%	1%	86%	14%	
SH30	Anderson	5,282	12,989	4,414	171,479	40,790	212,269	16.3	52,897	93,687	33,667	5,756	6,840				
	Redding	45,113	111,545	55,137	1,198,715	374,871	1,573,586	14.1	736,263	1,111,134	244,611	69,818	81,556				
	Shasta Lake	3,624	8,861	2,302	123,053	30,596	153,648	17.3	39,601	70,197	20,433	4,673	5,494				
	Unincorporated	29,617	74,053	17,676	1,555,841	295,549	1,851,390	25.0	325,791	621,340	199,987	54,753	54,130				
SH30 Total		**83,636**	**207,448**	**79,529**	**3,049,087**	**741,807**	**3,790,894**	**18.27**	**1,154,552**	**1,896,358**	**498,699**	**134,999**	**148,021**	**35,103**	**5,762,267**	**913,519**	**6,640,683**
	% of Total VMT				46%	11%	57%		17%	29%	8%	2%	2%	1%	87%	14%	
SH35	Anderson	5,344	13,513	4,749	177,685	44,379	222,064	16.4	60,883	105,262	34,491	6,442	7,226				
	Redding	46,779	115,775	56,944	1,257,531	413,687	1,671,218	14.4	807,883	1,221,570	254,250	79,977	88,086				
	Shasta Lake	3,664	9,161	2,392	125,580	32,711	158,291	17.3	41,610	74,322	20,880	5,373	5,949				
	Unincorporated	30,745	76,407	18,167	1,606,746	323,552	1,930,298	25.3	353,582	677,135	200,110	60,123	58,750				
SH35 Total		**86,532**	**214,856**	**82,252**	**3,167,542**	**814,330**	**3,981,871**	**18.53**	**1,263,959**	**2,078,289**	**509,731**	**151,916**	**160,011**	**35,103**	**6,102,591**	**913,519**	**6,981,008**
	% of Total VMT				45%	12%	57%		18%	30%	7%	2%	2%	1%	87%	13%	
SH40	Anderson	5,335	13,067	5,273	171,698	46,489	218,187	16.7	65,107	111,596	35,620	7,128	7,989				
	Redding	48,754	120,823	57,925	1,325,527	453,005	1,778,531	14.7	820,157	1,273,162	259,192	85,406	94,364				
	Shasta Lake	3,831	9,686	2,412	134,022	36,004	170,026	17.6	42,156	78,160	21,153	5,703	6,322				
	Unincorporated	31,917	79,466	18,796	1,664,471	353,614	2,018,085	25.4	347,812	701,427	202,406	63,961	62,989				
SH40 Total		**89,837**	**223,042**	**84,406**	**3,295,717**	**889,112**	**4,184,829**	**18.76**	**1,275,232**	**2,164,344**	**518,371**	**162,198**	**171,664**	**35,103**	**6,347,398**	**913,519**	**7,225,814**
	% of Total VMT				46%	12%	58%		18%	30%	7%	2%	2%	0%	88%	13%	

Figure 63: EMFAC_SPEED_BINS_SRTA_SB375.XLSX

Speed Bin	Daily VMT (excluding through trips that do not originate or terminate in Shasta County)							
	2005	2010	**2015**	**2020**	**2025**	**2030**	**2030**	**2040**
5	2	2	2	2	3	3	3	3
10	404	423	427	309	435	1,037	1,209	950
15	79,127	77,910	80,869	84,957	91,454	94,252	99,658	103,615
20	98,220	97,138	101,363	107,992	114,680	123,566	130,846	143,015
25	343,233	335,714	349,338	349,699	371,535	386,895	408,278	428,597
30	176,990	169,277	176,234	187,976	203,224	213,270	223,584	245,745
35	426,544	411,176	427,172	446,520	475,482	494,334	524,532	553,390
40	353,238	370,860	388,356	396,951	420,744	448,775	467,296	491,085
45	592,819	612,682	610,907	620,305	653,521	680,648	714,093	733,122
50	904,016	903,241	974,890	947,815	999,013	1,042,598	1,102,218	1,127,099
55	121,000	132,547	170,036	176,414	187,009	248,369	208,826	180,303
60	646,206	633,986	737,520	738,406	824,778	828,733	851,344	940,992
65	896,912	879,415	951,950	1,047,892	1,115,550	1,197,381	1,375,626	1,505,651
70	0	0	0	0	0	0	0	0
Total	**4,638,709**	**4,624,372**	**4,969,064**	**5,105,238**	**5,457,428**	**5,759,862**	**6,107,514**	**6,453,567**
Intrazonal	37,351	35,103	35,204	37,772	38,804	39,188	39,579	40,688
XX	967,411	913,519	986,711	1,059,907	1,132,886	1,205,868	1,279,324	1,352,568
Total Inc XX	**5,606,121**	**5,537,891**	**5,955,776**	**6,165,145**	**6,590,314**	**6,965,730**	**7,386,838**	**7,806,135**