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OVERVIEW

This document is a general user guide for all San Joaquin Valley Model Improvement Program Phase 2 (VMIP 2) models due to their similar structure. The content of the guide covers installation, use, and output review. Model development and validation reports were developed separately for each individual model and are available from the relevant MPO.

When XX is used throughout this document, it refers to the 2 or 3-digit character abbreviation for each model and YY refers to the calibration/validation year of the model. Model name, counties covered, and prefix are as follow:

- FresnoCOG, Fresno (FC)
- KernCOG, Kern (KE)
- KCAG, Kings (KN)
- MCTC, Madera (MD)
- Three-County Model for SJCOG, StanCOG, MCAG, (TCM)
- TCAG, Tulare (TU)

SUMMARY OF INFORMATION TO UPDATE

The table below summarizes the types of data used by the model, suggested update or review, the source of the data, and a reference to the appropriate section of the user guide.

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<thead>
<tr>
<th>Description</th>
<th>Reference</th>
<th>Variables</th>
<th>Source and Scale of current implementation</th>
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<tr>
<td>Description</td>
<td>Reference</td>
<td>Variables</td>
<td>Source and Scale of current implementation</td>
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INSTALL, SETUP, AND RUN THE VMIP MODELS

This section describes preparing a computer that does not currently have Cube or the model installed, and includes an overview of the software installation, setting up the model as received, running the scenarios that correspond to the validation year and RTP scenario as entire model or specific sub-group applications, and running the post-processors. The following chapters include instructions on creating new scenarios and preparing new scenario input data and viewing the model data in GIS maps.

INSTALLING THE SOFTWARE

The model was developed and tested using Cube 6.1.1 and ArcGIS 10.2. Newer versions of both software have been made available since the beginning of the model development, and at this time it is not recommended to upgrade to versions other than Cube 6.1.1 and ArcGIS 10.2. It is recommended to test compatibility of functionality and licensing method in the future.

SOFTWARE LICENSING

- Enterprise licensing for SJV MPOs
- Cube Base, Cube Voyager, Cube Cluster, Cube Land

SOFTWARE SETUP

Installation Procedure

- Locate the Cube setup file included with the deliverables. This will be Version 6.0.1, with ArcGIS Support. Double click the .exe file to initiate the install.

- The Windows installer will extract the necessary files. This may take a few minutes.

- The Cube 6 Installer welcome screen will open. Review the End User Software License Agreement and click Accept.
Review the software eligible to be installed with your licensing. Cube Base, Cube Voyager, Cube Cluster (Recommended) or Cube Land (Optional) may be listed depending on the installed license. Click **Install**.

Once the installation is complete, click **Exit** to close the application. To automatically open Cube or the *What’s New* documentation, leave each box checked. Otherwise uncheck both boxes.
Review Software Version

- Open Cube6 via the Start menu or by double-clicking the icon on your desktop
- Verify the version of your software
  - Click on the question mark at the top right corner of the program window.
  - Click About... in the drop down menu.
  - Review and note the Version, License No., and Processors of Cube 6
MODEL FILE SETUP

Install Model

- Unzip the contents to a directory where you would like to store the model run data.
  - This can be on a different drive or partition than the Citilabs software
  - It is recommended that the directory be local rather than on the network and have at least 10GB of storage for each scenario than you plan to run

File Descriptions

- The directory structure for the model will look similar to the image below, along with a general description of each directory and its contents.

  - 0_Documents – Documentation and support documents not directly related to the model run itself. Contents and description of this directory:
    - Validation – Directory containing validation spreadsheets for the base year. Summaries for non-validation year scenarios are included in the 01_Inputs\Support directory. See Review Model Outputs for more information on the scenario summary spreadsheets used for validation.
    - XX Model Development Report_2016September.docx – General development report for VMIP 2 models customized for with values specific to each model. Detailed model validation for each model is also included.
1. Inputs – The inputs listed by type for SB 375 scenario years and the validation year

- _Support – This directory has scenario summary spreadsheets and scenario preparation files used to generate the inputs in the other input directories. Within the "1_Inputs\_Support” directory there are Excel spreadsheets for preparing a majority of the scenario data. The model as delivered contains the data for the SB 375 scenario years and the validation year.

- Tools – Recommended directory for post-processor related files
  - FratarTrips.dbf – Exampled file used to match trip generation using the Fratar process during the select link assignment post-processor.
  - RailStationTrips.dbf – Exampled file used to designate boarding values and external travel for the interregional transit post-processor.
  - SJV MIP Quick Response Tool Template Final.xlsx – The quick-response tool allows the user to quickly determine impacts of smart growth, travel demand management (TDM), and transportation system management (TSM) in an off-model tool.
  - !!XX_Scenario_Summary.xlsx – Summary of scenario inputs and change from default parameters. This file is used to document and summarize each scenario, the data files to export from the scenario prep workbook, and the key values to modify in the Cube Application. The file begins with !! to have it always at the top of the directory listing.
  - VMIP2_XX_LandUsePrep.xlsx – Prepare and summarize land use by zone and planning area.
  - VMIP2_XX_ScenarioPrep.xlsx – Review local and interregional assumptions relating to land use, socio-economic, and TAZ then export information for scenario model run and evaluation. Auto operating cost calculation for all SJV MPO models based on the fuel and non-fuel costs method developed by the Big 4 MPOs with Big 4 MPOs included.
  - VMIP2_XX_Parameters.xlsx – Parameters used in model development such as vehicle availability, mode choice, friction factors, and trip generation rates. This file is primary for documentation or future model calibration and the values are not directly used by the model.

- 1_TAZ through 10_Reporting – Recommended directory structure and default output location from the Scenario Prep workbooks to organize input data. Nearly all input files are exported from the input workbook in CSV format. The exceptions to this are:
  - 3_Highway – Master network in geodatabase (and associated turn penalty .pen file) or Voyager binary .NET format. The SelectLink assignment and summary text files are also recommended to be stored in this directory.
4_Transit – Drive access block file, walk access block file, and transit line file in plain text format. For models using a geodatabase, the transit lines are in the geodatabase referred to in the highway directory

5_Trucks – Files from the interregional goods movement model: Auto and Truck interregional matrix files in Voyager binary .MAT format, Regional and sub-area network in Voyager .Net format

6_Static – transit fare (FAR), public transport system (PTS), and transit factors (FAC) files in plain text format

- App – The scripts and applications for the model. This directory should not be modified except to review or delete PRN files for model runs, and all changes to the scripts should be made from the Cube Catalog.

- GIS – master geodatabase with base GIS layers, blank personal geodatabase and default map documents used to create scenario specific geodatabases, Model map document containing links to all SB 375 scenario input summary data.

RUNNING THE MODEL

UPDATE MODEL DIRECTORY STRUCTURE

- Open Cube and click **Open Catalog**
- Navigate to the catalog file and click **Open**

- When the model catalog open's, double-click on **Input Processing** in the Application Manager (App) window pane.
The first time you open the application, you will be asked to update the application directory. Click Yes. This will ensure that the model runs properly.

Double-click and update the paths for **SJV Model** in the App window pane.
NAVIGATING APPLICATION MANAGER

Window Panes

Once you open your model catalog, you will see four windows, or panes, to the left of the program window. They are as follows:

- **Scenario Pane**
  - Scenarios are hierarchical in nature.
  - Child or sibling scenarios can be added to create variations on the “base” scenario.
  - Child scenarios inherit key values from its parent.

- **Data Pane**
  - Provides a means of viewing/editing the input files for an application.
  - Lists output files and reports from an application run.

- **Application (App) Pane**
  - Organizes model applications.
  - Helps the user navigate through the model and quickly access sub-routines.

- **Keys Pane**
  - Lists catalog keys and associated values referenced in the model script.
  - Key list and values may change depending on the scenario.

You can modify the panes by resizing, moving, overlapping, or auto-hiding them to suit your needs. For more information, please refer to the Scenario Manager section in Cube 6 Help.

The entire model structure with sub-groups expanded is below.
Selecting a Scenario

- Locate the Scenario pane and click the [+]
  beside Scenarios

- Click the *scenario name* within the model year you would like to select
Checking input keys

- Double-click on the scenario you would like to review
- Review the Socio-economic and Highway Inputs.

- If your model utilizes Cube Cluster, verify that Distribute processing? is checked. Otherwise, uncheck it.

  ![Selecting Distribute processing?](image)

  - **Note:** If Distribute processing? is checked, set the number of ClusterNodes to be 1 less than the number of core processors your computer has. This will prevent the model from utilizing 100% of the computer’s CPU. If your computer has less than 2 core processors, do not use Cube Cluster.

- Click Next...
• Review the Post-Processing inputs and assumptions.

• Click Next...

• Review the Transit Inputs.
• If your model has transit, verify that **pt network available** is checked. Otherwise, uncheck it.

  ![Image of the transit availability checkbox](image.png)

  - Click **Next**...

• Review the Cube Land Inputs.

• If you would like to run Cube Land, verify that **RunLand** is checked. Otherwise, uncheck it.

  - Click **Next**...

• Review the model Calibration Factors.
• Click **Next...**
• Review the remaining model Calibration Factors.
• If you make any changes, click **Save** then **Close**. Otherwise, click **Close**.
• To navigate back to any windows you have passed, click **Back...**
• **Do not click Run** to run the model. It is difficult to know which application will be selected.
• Once you exit the inputs tab, be sure to save the catalog file if any changes were made. Click **File**, then **Save**, then select **Catalog**.
Importing Scenarios

When the catalog is used for many scenarios or multiple catalogs are used, merging or cleaning the catalog might be needed. To copy or merge scenarios it is very important to remember the parent/child structure of the scenarios and is often best to either delete scenarios (using caution with parent) or create a clean catalog and merge the scenarios as needed.

- Create a new Catalog under the File menu and save as a new name, or start with the original as delivered clean catalog to copy the information to.

- Click on and select the catalog that contains the scenarios to import.

- Select the Scenarios menu, and the scenario on the target and source. For new scenario most often the option will be Append as Child. The new scenario shows in red.

- When replacing the values in a scenario with the same name, select Merge and Use Source.
• Click OK and then save the catalog.

INPUT PROCESSING

Before running the SJV Model application, run the Input Processing application to prepare the input files and folder structure needed for the full model run.

• Select the scenario you will run in the Scenario Pane.

• Double-click on **Input Processing** in the App Pane. This will bring up the Input Processing application flow diagram in the Catalog window.
• Click on the Run... button located on the top Home ribbon. This will open the Run Application window.

![Run Application window](image)

• Select Run Application now from Task Monitor from the Run Settings list.

![Application Manager window](image)

• Click OK. This should activate the Application Manager window.

• Click OK. This should activate the Task Monitor window.
Checking Results of Input Processing

The Input Processing application creates directories, copies files, and processes input data. Reviewing key outputs of the Input Processing before running the full model is recommended to ensure that the model scenario being evaluated has the inputs as desired. In addition to checking that the files represent the scenario, the Input Processing also produces valuable information for scenario comparison.

- Once the run has completed successfully, the Task Run Result window will pop-up. Click OK. If you would like to view the report file, click **View Run Report File**.

- Close the Inputs window.
• Check to see that the input files and folders were created in the appropriate model folder.

![Folder structure]

FULL MODEL RUN

Before running a full model run, verify that you have the appropriate input files created from the Input Processing application.

• Select the scenario you will run in the Scenario Pane.

![Scenario Pane]

• Double-click on **SJV Model** in the App Pane. This will bring up the SJV Model application flow diagram in the Catalog window.
Click on the Run… button located on the top Home ribbon. This will open the Run Application window.

Select Run Application now from Task Monitor from the Run Settings list.
• Click **OK**. This should activate the Application Manager window.

• Click **OK**. This should activate the Task Monitor window.
• Once the run has completed successfully, the Task Run Result window will pop-up. Click **OK**. If you would like to view the report file, click **View Run Report File**.

• Close the Inputs window.

**REVIEW SCENARIO RUN**

A run report file for a previous model run can be viewed at any time by navigating to the file location in the file directory or accessing it directly in the catalog window.

• Select the scenario to review
• Click on the **Scenario** ribbon tab

![Image of Scenario ribbon tab]

• Click **See Run Report**.

![Image of See Run Report]

• The report .PRN file will open in the Catalog window for review.

![Image of Catalog window with report file]
REVIEW MODEL OUTPUTS

This process is very similar to that done during model development and uses the same Scenario Summary Metrics and Highway validations spreadsheets. The metrics require a full model run, and some of them are only produced with post-processors. See Post Processors for related.

Scenario Summary Metrics

The VMIP2_SCENARIOSummaryMetrics.XLSM spreadsheet contains multiple worksheets that summarize detailed model data into tabular form for comparison with CHTS or between scenarios. The validation year spreadsheet is included for each model developed and the spreadsheet is named MPO_YYValidationSummaryMetrics.XLSM (ex. KernCOG_15ValidationSummary.xlsm). This spreadsheet contains four main types of worksheets: Setup, Outputs, Inputs, and Calculations.

The metrics included and instructions for updating are described below.

VMIP2_SCENARIOSummaryMetrics.xlsx

Notes

- This worksheet describes the various metrics and where the output files are located

Model_Inputs

- This worksheet defines the scenario, path to model run files, and model outputs to be summarized for each scenario. For most mode runs, only the scenario description, path, and
scenario prefix for input files needs to be changed. It is recommended practice that all input worksheets start without data prior to importing new scenario data and the template delivered with the model is clear of scenario data.

- Open the VMIP2_SCENARIOSummaryMetrics.xlsm workbook and Saved As for the new scenario prior to importing scenario data.

- After updating the scenario name, path, and prefix or input file names, click to import the files.

- After the data are imported a message will appear.

- If the filenames or path contain an error will appear. If the path is correct, files without an error will be processed.

For Compare

- Summary of model scenario and CHTS for the model, San Joaquin Valley, and State.
  - Land use, trip generation, vehicle availability, mode split, travel time and distance, and VMT
  - Some metrics reported for all trip types (internal, exported, imported) and also internal only.
Worksheets 12-1.1 through 12-5.1 correspond to the numbering of the validation report and contain the same values as on the For Compare worksheet in more manageable pieces for the validation report.

- 12-1.1 Land Use
- 12-1.2 Trip Gen - P-A balance
- 12-1.3 Person Trips per HH
- 12-2.1 Vehicle Availability
- 12-2.2 Mode Split by Purpose
- 12-2.3 Purposes by Mode
- 12-3.8 Travel Time
- 12-3.6 VMT
- 12-4.1 Transit Assignment: note that the pivot table needs to be refreshed
- 12-5.1 Trip Distribution
• Worksheets in blue are used during the import of model data and should not be changed in name or color.

• Worksheets in purple are calculations of model inputs to match the CHTS comparisons and should not be changed in name or color.

Highway Summary Metrics

The highway volume summary metrics are used for two primary purposes: roadway volume validation and reporting of VMT by speed for SB 375 or air quality conformity. Since the format and type of summary is very different, a highway validation spreadsheet (SJV MIP – Highway Validation – MPO.xlsm) and VMT summary Transportation Data Template (TDT) have been created and included with the model.

Roadway Volumes

Open the SJV MIP – Highway Validation – MPO.xlsm.

CountData worksheet has the counts used for validation, the A and B node of the link in the model relating to the count location, and other associated descriptions such as road name and date of the count. A database of counts can be used to create the counts and this worksheet should only contain those used for validation.

Val 1-Way and Val 2-Way worksheets summarize the count data directionally or in total for each time period, functional class, and volume range pulling from the individual location calculations on the detailed time of day worksheets. These worksheets also have pivot tables and macros to refresh the data by clicking on the Refresh Pivot Tables button. This worksheet does not need to be updated other than refreshing the pivot tables.
worksheet summarizes data in the functional class format that FHWA is familiar seeing in the conformity documentation. This worksheet does not need to be updated.

worksheets summarize the individual count locations by time of day. Statistics at the bottom of the worksheet for each time of day are the same as the overall summary tables. These worksheets only need to be modified if additional count data are included beyond the current number of rows, or to aggregate locations into screenlines. Screenline values are XXYY where XX is the screenline and YYY is the count making up the screenline. For example, 10021 and 10022 are both part of screenline 10, where the northbound count is 021 and the southbound count is 022. Screenline summarizes are described later in this section.

worksheets format the data into the structure used to create the plots on the worksheets. These worksheets do not need to be updated.
worksheets summarize the information by screenline as defined on the individual time of day link worksheets. Refreshing the pivot tables will also update screenlines.

Functional Class worksheet summarizes the validation statistics based on the functional class definitions and is updated by refreshing the pivot tables.

Diet by Time Of Day worksheet summarizes the counts by time of day, specifically the passengers vehicles, medium trucks, and heavy trucks. This is used for calibrating the diurnal factors and also the relationship between truck trip generation and passenger vehicle trip generation.
worksheets contain the minimum and maximum allowed deviation for link level and screenline validation by time of day based on the Caltrans model development guidelines.

worksheet to the right of the worksheet contains the model assigned network output. This is the worksheet to paste the DBF file output from the traffic assignment step located at 09_ASSIGNMENT\SCENARIO_LOADEDNETWORK_DETAIL.DBF

Transportation Data Template (TDT)

XX_TDT_SB375_2014_RTP_EF14.xlsx

This workbook is used to summarize the VMT by speed output from the travel model and calculate the GHG and other air quality pollutants.

contains instructions on use of the workbook and also the percentage allocation of internal, exported, imported, and through trips. This workbook can also be used for conformity based on the current model output being 100% of all VMT within the boundary of the model. If the method for SB 375 or conformity changes in the future, the model and/or TDT must be updated. By having all values set at 100%, the spreadsheet can be used for conformity analysis.
SB 375 years summary of VMT by type of trip and facility type. For the validation year, this is also compared to the HPMS values and adjusted by facility type as appropriate. QA checks are built-in to ensure the VMT calculation method results are the same for speed bin, type of trip, and facility type.

**CombVMT_Summary** combines the roadway based VMT and the intrazonal VMT. This worksheet is a calculation and should not be modified.

**CombVMTData** worksheet is the location to copy and paste the SB 375, Conformity, and intrazonal VMT outputs from the travel model. Included in the TDT are the appropriate years for SB 375, so data should be copied into the appropriate section. TDTs are designed for each model output based on the number of air basins or counties. This worksheet should be updated with new scenario data as appropriate.
**Daily_Total_VMT** worksheet summarizes the individual year spreadsheets and compares the future scenarios including postmodel adjustments.

**EMFAC 2014 Speed** worksheet contains EMFAC 2014 emissions factors by year for each airbasin within the model. This worksheet should only be updated when new emissions factors (ex. new EMFAC version) are to be used.
RUNNING MULTIPLE SCENARIOS

To run multiple scenarios automatically, you can specify what scenarios to run before you run the model.

- Click on the **Run...** button located on the top **Home** ribbon. This will open the Run Application window.

- Click the **Select Scenarios...** button in the upper right corner.

- Select additional scenarios you would like to run in the **Scenarios:** window. Click **Add**.
• The additional scenario will be listed in the **Selected:** window.

• To remove a scenario listed in the **Selected:** window, click on the scenario and click **Remove**.

• Once you have the final list of scenarios to run, click **OK**. This will re-open the Run Application window. **Note:** the scenarios to be run will be listed in the Scenarios: window.
• Select **Run Application now from Task Monitor** from the Run Settings list.

• Click **OK** to proceed with the run. The scenarios will run in series (i.e. one after another).

• Once the run has completed successfully, a Task Monitor window will pop-up. If you would like to view the run results for each scenario, click **Yes**. Otherwise, click **No**.

• If you click **Yes** to view the run results, the Multiple Run Results window will open. Double-click the **Application** name for the scenario you would like to view. This will open the Task Run Result window for your scenario.
• Click on the **View Run Report File** button. Click **OK**.

• Click **OK** to close the Multiple Run Results window and close the Task Monitor Window.

• The run report .PRN file will open in the Catalog window for review.
RUNNING INDIVIDUAL SUB-GROUPS

If you would like to run only a portion of the model, you can specify and run application sub-group scripts within the model catalog.

- Click on the application sub-group you would like to run.
• Click on the **Run...** button located on the top **Home** ribbon. This will open the Run Application window.

![Run Application Window](image)

• Check the **Run Current Group Only** button. The Task Monitor Run File Name will switch from the parent application file to the sub-group application file.

![Run Application Window](image)

• Click **OK** and proceed with model run.
APPLICATION DIRECTORY MAINTENANCE

After multiple model runs, the application directory will contain temporary .PRN and miscellaneous files that may take up a sizeable portion of file space. Periodically, it is recommended that these files be removed by the model user.

The model contains a script in the Input Processing application to do the clean-up. However, the sub-group application does not run automatically as part of the Input Processing application. The user must run the sub-group application manually.

- Double-click on **Input Processing** in the App Pane. This will bring up the Input Processing application flow diagram in the Catalog window.

![Input Processing Application Flow Diagram](image)

- Locate the **Clean App Directory** sub-group application in the top right corner of the Catalog window.

![Clean App Directory](image)

- Double-click on the PILOT icon.
- The Task Monitor window will automatically open.

- Click **OK** after the run has completed successfully.
POST PROCESSORS

After the model is run there are a number of post-processors that can be run to prepare model data. The post-processors can be found in the App Pane in the SJV Model application group.

MODE SPLIT SUMMARY

Outputs detailed mode split summary information.

- Double click on **MODESUM** in the App Pane. This will bring up the **MODESUM** application group.
Click on the Run... button located on the top Home ribbon. This will open the Run Application window.

Check the Run Current Group Only button.
• Click **OK** and proceed with model run.

• The following five summaries are generated in `Scenario_Name\Reporting`
  
  o  **MODE_CHOICE_SUMMARY**
  
  o  **MODE_CHOICE_SUMMARY_II**
  
  o  **MODE_CHOICE_SUMMARY_IX**
  
  o  **MODE_CHOICE_SUMMARY_XI**
  
  o  **MODE_CHOICE_SUMMARY_XX**
DISTRIBUTION SUMMARY

Outputs detailed distribution by purpose summary information.

- Double click on **DISTSUM** in the App Pane. This will bring up the **DISTSUM** application group.
• Click on the **Run...** button located on the top **Home** ribbon. This will open the Run Application window.

• Check the **Run Current Group Only** button.
• Click OK and proceed with model run.

• The following five summaries are generated in Scenario_Name\Reporting
  
  o DISTRIBUTION_SUMMARY
  
  o DISTRIBUTION_SUMMARY_II
  
  o DISTRIBUTION_SUMMARY_IX
  
  o DISTRIBUTION_SUMMARY_XI
  
  o DISTRIBUTION_SUMMARY_XX
TRIP LENGTH FREQUENCY SUMMARY

Outputs trip length frequency summary information.

- Double click on **TLFSUM** in the App Pane. This will bring up the **TLFSUM** application group.
• Click on the **Run**... button located on the top **Home** ribbon. This will open the Run Application window.

• Check the **Run Current Group Only** button.
• Click OK and proceed with model run.

• The following summary is generated in Scenario_Name\10.Reporting

  o TripDurationSummary.DBF
NETWORK COMPARE

Compare user-defined network against model scenario network in personal geodatabase

- Define network to compare against model scenario network in Cube Application keys

- Select scenario in Scenario pane
- Click **Next** for second page of scenario keys
- Define network to compare

- Double click on **CompareNet** in the App Pane. This will bring up the **CompareNet** application group.
• Click on the **Run...** button located on the top **Home** ribbon. This will open the Run Application window.

• Check the **Run Current Group Only** button.
- Click OK and proceed with model run.
- To view results double click on the personal geodatabase in the Data pane
SOCIOECONOMIC DETAIL COMPARE

Compare user-defined socioeconomic detail against model scenario socioeconomic detail

- Define socioeconomic detail to compare against model scenario socioeconomic detail in Cube Application keys
- Select scenario in Scenario pane
- Click **Next** for second page of scenario keys

- Define socioeconomic detail to compare

- Double click on **CompareSEDetail** in the App Pane. This will bring up the **CompareSEDetail** application group.
- Click on the **Run...** button located on the top **Home** ribbon. This will open the Run Application window.

- Check the **Run Current Group Only** button.
Click **OK** and proceed with model run.

The following files are generated in **Scenario_Name\10_Reporting**

- CompareSEDetail.DBF
SELECT LINK ANALYSIS / FRATAR TO ITE CONTROL TOTALS

Creates select link or zone analysis for review in personal geodatabase file. If desired, select zone can be adjusted to match ITE control totals for easier review of select zone. The high level steps for this process are:

- Full model run with land use representing the project
- Prepare trip generation target and input file
- Define Scenario detail in Cube Application keys and running the post-process
- Review results
Full Model Run Preparing for Select Link/Fratar

The Select Link and Fratar post-process is based on a full model run for a given scenario and tracks the route/distribution of auto trips for a single zone or a group of zones. Before running the model, it is recommended to review the TAZ boundary to determine which zone(s) reflect the project, the land use in the zone(s), and if additional zones should be created.

- The MODELNAME.MXD in the GIS directory contains a layer for the TAZ boundary. (TAZ 1842 in the example below)

- Use the Parameters Workbook to review the land use in the zone and compare with the project land use. Typical projects fall into one of the following cases.
  - Case A: The land use is similar in type and magnitude and if the project represents the entire zone. No additional changes are needed.
  - Case B: The land use is not similar in type and magnitude, but represents the entire TAZ. Update the land use to reflect the project.
  - Case C: The land use is similar in type and magnitude, but does not represent the entire TAZ. Identify a vacant TAZ within the same zone range, modify the land use in the original zone and project zone to match the type and magnitude of land use, add a centroid and connector to the master network using the same attributes as the original zone.
Case D: The land use is not similar in type and magnitude and the project does not represent the entire original zone, or the entire project is in addition to the existing land use in the zone. Identify a vacant TAZ within the same zone range, leave the land use in the original zone and add the project land use to the vacant zone, add a centroid and connector to the master network using the same attributes as the original zone.

**Prepare trip generation target and input file**

- Determine the net new project vehicle trips for AM Peak 1hr, PM Peak 1hr, and Daily using empirical data, regionally validated trip generation rates, ITE, MXD+, or other methods.
- Copy and rename the 1_Inputs\Support\Tools\FratarTrips.DBF to a project specific name, and open in Cube.
- Edit the Zone number(s) and inbound/outbound trips by time of day to reflect the project. Save the file and close.

<table>
<thead>
<tr>
<th>ZONE</th>
<th>A1_IN</th>
<th>A1_OUT</th>
<th>P1_IN</th>
<th>P1_OUT</th>
<th>DAY_IN</th>
<th>DAY_OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1842</td>
<td>593</td>
<td>527</td>
<td>506</td>
<td>497</td>
<td>7943</td>
<td>7943</td>
</tr>
</tbody>
</table>

**Define Scenario detail in Cube Application keys and running the post-process**

- Select the scenario for evaluation
- Click **Next** for second page of scenario keys
- Define ITE Match and Select Link/Zone options to compare
• Update the Select Link text file for assignment (1_Inputs\3_Highway\SelectLink_Assign.txt)
  o Copy or Save As the current example file
  o Copy and paste the block of text for the number of select links/nodes desired
  o Update the matrix numbers incrementing by 1 and keeping the matrix and assignment values consistent
  o Update the select link/node value
  o Save the file

• Update the Select Link summary file (1_Inputs\3_Highway\SelectLink_Summary.txt)
  o Copy or Save As the current example file
  o Copy and paste the block of text for the number of select links/nodes desired
- Update the volume set numbers with the clean name to refer to the appropriate Select Link volume group
- Save the file

```
; Select Link 1 Trips
; AM Peak Period
; Directional
A03_DA_SL1=LI1.V6_1
A03_SR2_SL1=LI1.V7_1
A03_SR3_SL1=LI1.V8_1
A03_TRK_SL1=LI1.V9_1
A03_PAS_SL1=A03_DA_SL1+A03_SR2_SL1+A03_SR3_SL1
A03_VOL_SL1=A03_PAS_SL1+A03_TRK_SL1

; Non-Directional
TOT_A03_DA_SL1=LI1.V6T_1
TOT_A03_SR2_SL1=LI1.V7T_1
TOT_A03_SR3_SL1=LI1.V8T_1
TOT_A03_TRK_SL1=LI1.V9T_1
TOT_A03_PAS_SL1=TOT_A03_DA_SL1+TOT_A03_SR2_SL1+TOT_A03_SR3_SL1
TOT_A03_VOL_SL1=TOT_A03_PAS_SL1+TOT_A03_TRK_SL1

; Mid-Day Period
; Directional
M07_DA_SL1=LI1.V6_2
M07_SR2_SL1=LI1.V7_2
M07_SR3_SL1=LI1.V8_2
M07_TRK_SL1=LI1.V9_2
M07_PAS_SL1=M07_DA_SL1+M07_SR2_SL1+M07_SR3_SL1
M07_VOL_SL1=M07_PAS_SL1+M07_TRK_SL1

; Non-Directional
TOT_M07_DA_SL1=LI1.V6T_2
TOT_M07_SR2_SL1=LI1.V7T_2
TOT_M07_SR3_SL1=LI1.V8T_2
TOT_M07_TRK_SL1=LI1.V9T_2
TOT_M07_PAS_SL1=TOT_M07_DA_SL1+TOT_M07_SR2_SL1+TOT_M07_SR3_SL1
TOT_M07_VOL_SL1=TOT_M07_PAS_SL1+TOT_M07_TRK_SL1
```

- The total volume is the same as the directional, with the addition of T in the volume set name. V6 is directional, V6T is non-directional.

- Update the scenario key Cube Catalog for the scenario being evaluated
  - Check “Adjust Trips to match value” for Fratar to be active
- Enter zone number(s) for Fratar trips, or leave box unchecked and zone as 101 for no change from model generated trips

- Browse to reference file created and modified to reflect the project trips for the scenario. Note that the full path should show in the box, unlike the example below which uses only the file name as an example.

- Refer to the Select Link text file for traffic assignment. The file includes samples of select node/zones, a link in one direction, and a link in both directions. By using a text file, multiple select links can be conducted with the same run of the post-processor.

- Save and exit the scenario

- Select the scenario for evaluation

- Browse in the Applications to SelectLink
• Click on the Run... button located on the top Home ribbon. This will open the Run Application window.

• Check the Run Current Group Only button.
• Click **OK** and proceed with model run.

• To view results double click on the personal geodatabase in the Data pane

• To view results on the Cube Network, open `09_Assignment\SCENARIO_SL_LinkVolumes.NET`
• The variables can be posted using multi-bandwidth and/or labels and use the same naming convention as the full assignment, with the exception that project trip variables include _SL at the end. For example, P01_DA_SL is the PM peak 1hr (P01) Drive Alone (DA) select link (SL).

• For multi-bandwidth, select Analysis and then Multi-Bandwidth, and one or more variables to be posted. Click ok and zoom to the study zone(s) to view the results.

• Next, to post the values, select Home and then Post All in the Link section, and one or more variables to be posted. Click ok and zoom to the study zone(s) to view the results.
Percentage of project trip distributions can be calculated using the Link Calculation functions, as needed.

If the result are not matching the target, verify that the Catalog Keys and the input file are correct. The ITEFratar step applies the targets to the AM 1hr, PM 1hr, and proportional to the times of day that add to create daily.

- Review the inputs (FRATARIN is the original and SL is the output) and outputs of this step to confirm the results match what is expected for the row and column totals.

- The auto trips (drive alone, shared ride 2, and shared ride 3+) and truck trips are all adjusted based on the land use trip generation. Only XX trips are not adjusted.

- The example below, the AM 1hr row total (outbound) and column total (inbound) for the original matrix file (left) was adjusted to match the target values, as shown on the output matrix file (right).

- Although comparing each mode is possible, the total on the first tab for each time period is the most effective in QA since mode share by zone may vary and quickly determining if the trips match by mode is more difficult than total vehicles.
ENVIRONMENTAL JUSTICE

The Environmental Justice application post-processes the model data to calculate the various performance metrics for Environmental Justice areas compared to the overall model area.

- Define environmental justice data in Cube Application keys
- Select scenario in Scenario pane
- Click Next for second page of scenario keys
- Define environmental justice data

- Define the Environmental Justice zones in column ‘EJ’ of the “TAZData_Inputs” tab in the parameters workbook. Make sure this ‘TAZData’ parameter file is the one used in your scenario
• Define the Environmental Justice links in variable ‘EJ’ of the master highway network. Make sure this master highway network file is the one used in your scenario.
Double click on *Environmental Justice* in the App Pane. This will bring up the *Environmental Justice* application group.
- Click on the **Run...** button located on the top **Home** ribbon. This will open the Run Application window.

- Check the **Run Current Group Only** button.
• Click **OK** and proceed with model run.

• The following files are created in `Scenario_Name\Temp\09_Assignment`:
  
  o EJ_Accidents.csv
  
  o EJ_TravelTime.csv
  
  o EJ_TransitPMT.csv
  
  o EJ_Congested_VMT.csv
  
  o EJ_Delay.csv
  
  o EJ_Accidents.csv
INTERREGIONAL TRANSIT

Purpose

The post-processor is intended to shift auto trips traveling using the gateways parallel to interregional transit (transit exiting the model area) from the gateway to the park-and-ride lot of the rail station. The implementation is most useful for interregional rail (i.e. Amtrak or ACE), but can be used for similar interregional transit when the mode is not represented in the model already.

Process

Within the Post-Processing application of the MIP model is an application called Interregional Transit. This application adjusts the auto trip table based on user inputs of person trips to the gateway(s) that would be shifted from driving out of the model area to auto access at the interregional transit station. The adjusted auto trip matrices are then assigned to the highway network and SB 375 VMT summary by speed bin is produced.

Input Preparation

1. Run a full model for the scenario to be evaluated
2. Select the file in the catalog for the Interregional Rail input on the Post-Processor tab using the Browse button
3. Click Edit to change the input values.

4. If developing data for a new scenario, Select Yes when prompted to save the file as a new name. Otherwise edit the original file with new values.

5. Verify that zone numbers match the external gateways and the internal zones where parking for the station is located. The “No Project” input file is shown below.

<table>
<thead>
<tr>
<th>ZONE</th>
<th>DESCRIPTION</th>
<th>TRIPS_P</th>
<th>TRIPS_A</th>
<th>XX_P</th>
<th>XX_A</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td>SR 99 North</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>64</td>
<td>I-5 North</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>37</td>
<td>I-5 South</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>692</td>
<td>Downtown HSR Station</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1944</td>
<td>Dummy Station</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. For Highspeed rail (HSR), PB provided data for trips that shifted from auto to HSR and origin-destinations of trips for each future year. This information can be used to estimate the ridership and direction of travel/gateway used by trips. ACE, Amtrak, and other planning studies often have estimates of ridership.

7. The Trips_P (Produced, exiting the model area) and Trips_A (Attracted, entering the model area) represent ridership values at each of the stations. The values for internal zones are daily boardings (P) and alightings (A), and the gateways are the distribution of those trips based on the gateway the trip would have driven out of. The sum of the gateway trips and station trips should be equal.

8. The XX_P and XX_A trips represent auto trips that travel through the model area on HSR. The Productions from one direction should equal the attractions at the other direction.

9. An example scenario and input file representing the coding for the scenario are:
   a. HSR will run parallel to SR 99 in the north and I-5 in the south of the model area with zone numbers 69 and 37, respectively. Trips traveling out of I-5 to the north (zone 64) may also take HSR.
   b. 3,000 trips travel through the model network that would be on HSR when implemented in 2035. 2,500 of them previously used SR 99 on the north, the remaining 500 previously used I-5.
   c. The downtown transit station for HSR is zone 692. There are forecasted to be 1,100 productions and 500 attractions per day. Of these, the auto trips were without the project were distributed to the gateways as:
      i. SR 99 north: 300 productions, 300 attractions
ii. I-5 North: 100 productions, 150 attractions

iii. I5-South: 700 productions, 50 attractions

d. The result of this scenario would be an input as shown below

<table>
<thead>
<tr>
<th>ZONE</th>
<th>DESCRIPTION</th>
<th>TRIPS_P</th>
<th>TRIPS_A</th>
<th>XX_P</th>
<th>XX_A</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td>SR 99 North</td>
<td>300</td>
<td>300</td>
<td>2500</td>
<td>2500</td>
</tr>
<tr>
<td>64</td>
<td>I-5 North</td>
<td>100</td>
<td>150</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>37</td>
<td>I-5 South</td>
<td>700</td>
<td>50</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>692</td>
<td>Downtown HSR Station</td>
<td>1100</td>
<td>500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1944</td>
<td>Dummy Station</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. As an example for demonstration purposes only, the following approach was used to estimate trips for the post-processor:

a. 2030 daily weekday ridership estimates by route were used from the SJRRC Service Expansion Analysis

b. The route ridership was assumed to equal both the productions and attractions of the adjacent freeway gateway and the total productions and attractions of all stations along the route (with ridership distributed evenly across all stations)

c. Total gateway productions and attractions were set equal to the corresponding route daily ridership plus the ridership at stations along the route that are outside of the model area, summed up for all routes

d. Station productions and attractions within the model area were similarly summed up for all routes

e. Approximate station zone locations were identified in the model

f. If available, station-level boarding and alighting data is preferable to this approach

**QUICK-RESPONSE TOOL**

The quick-response tool allows the user to quickly determine impacts of smart growth, travel demand management (TDM), and transportation system management (TSM) in an off-model tool. The quick response tool contains two modules: the Mixed Use Development (MXD) Trip Generation and TDM Module and the TSM Module. Users should note that the MXD and TDM calculations are based on research related to smart growth and TDM effects at the project scale and may not be fully transferrable across an entire TAZ. As such, the tool is intended for quick-response or sketch exercises.

The quick-response tool template can be found in `1_Inputs\Support\Tools`
MIXED USE DEVELOPMENT (MXD) TRIP GENERATION AND TRAVEL DEMAND MANAGEMENT (TDM) MODULE

The effects of smart growth and TDM are quantified in this module. The user inputs a land use and TDM profile in a user-defined TAZ with smart growth characteristics.

Instructions

1. Find "TAZSUMMARY.dbf" in the ScenarioName(10_Reporting) model directory
2. Copy paste the values of "TAZSUMMARY.dbf" into the "MXD-TDM Input" tab
3. Select the Traffic Analysis Zone (TAZ) where you are planning your project
4. Enter the land use associated with your project
5. Select transportation demand management (TDM) measures for your project
6. Enter the amount of participation in TDM measures for your project

- Open “TAZSUMMARY.dbf” from the Data Pane
• Paste values into the quick response tool

• Input TAZ and land use for development intended for analysis
### Land Use Input

<table>
<thead>
<tr>
<th>Number of Dwelling Units</th>
<th>Quantity</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family</td>
<td>770</td>
<td>DU</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>2,748</td>
<td>DU</td>
</tr>
<tr>
<td>High Rise Condo</td>
<td>3,432</td>
<td>DU</td>
</tr>
<tr>
<td>Retail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Retail other than those listed below</td>
<td>140</td>
<td>ksf</td>
</tr>
<tr>
<td>Supermarket</td>
<td>0</td>
<td>ksf</td>
</tr>
<tr>
<td>Bank</td>
<td>0</td>
<td>ksf</td>
</tr>
<tr>
<td>Health Club</td>
<td>0</td>
<td>ksf</td>
</tr>
<tr>
<td>Restaurant (non-fast food)</td>
<td>0</td>
<td>ksf</td>
</tr>
<tr>
<td>Fast-Food Restaurant</td>
<td>0</td>
<td>ksf</td>
</tr>
<tr>
<td>Gas Station</td>
<td>0</td>
<td>ksf</td>
</tr>
<tr>
<td>Auto Repair</td>
<td>0</td>
<td>ksf</td>
</tr>
<tr>
<td>Office</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Medical</td>
<td>3,000</td>
<td>jobs</td>
</tr>
<tr>
<td>Medical</td>
<td>0</td>
<td>jobs</td>
</tr>
<tr>
<td>Industrial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light Industrial</td>
<td>0</td>
<td>jobs</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0</td>
<td>ksf</td>
</tr>
<tr>
<td>Warehousing / Self-Storage</td>
<td>0</td>
<td>ksf</td>
</tr>
<tr>
<td>Lodging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hotel (including restaurant, facilities, etc...)</td>
<td>0</td>
<td>Rooms</td>
</tr>
<tr>
<td>Motel</td>
<td>0</td>
<td>Rooms</td>
</tr>
<tr>
<td>Movie Theater</td>
<td>0</td>
<td>Screens</td>
</tr>
<tr>
<td>School</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>0</td>
<td>Students</td>
</tr>
<tr>
<td>High School</td>
<td>0</td>
<td>Students</td>
</tr>
<tr>
<td>Middle School</td>
<td>0</td>
<td>Students</td>
</tr>
<tr>
<td>Elementary</td>
<td>0</td>
<td>Students</td>
</tr>
</tbody>
</table>

- Input TDM measures for development intended for analysis
### Transportation Demand Management (TDM) Input

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Implement?</th>
<th>Participation %</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Joaquin Valley Air District Rule 9410</td>
<td>No</td>
<td>0%</td>
</tr>
<tr>
<td>Requires employers with &gt;100 employees to attain a Average Vehicle Ratio (AVR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(employees on site / vehicles on site) of 1.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>New target</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modify target AVR?</td>
<td>No</td>
<td>1.3</td>
</tr>
</tbody>
</table>

### Other TDM Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Implement?</th>
<th>Participation %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home-based Work TDM Measure Trip Reduction</td>
<td>No</td>
<td>0%</td>
</tr>
<tr>
<td>Home-based Other TDM Measure Trip Reduction</td>
<td>No</td>
<td>0%</td>
</tr>
<tr>
<td>Non home-based TDM Measure Trip Reduction</td>
<td>No</td>
<td>0%</td>
</tr>
</tbody>
</table>

- Review outputs
TRANSPORTATION SYSTEM MANAGEMENT (TSM) MODULE

The effects of Transportation System Management (TSM) are quantified in this module.

- Edit the variable “TSM” on the master highway network to assign management measures to links
  - Value of 1 means Congestion Mitigation
  - Value of 2 means Traffic Smoothing
  - Value of 3 means Speed Management
  - Value of 4 means Congestion Mitigation and Traffic Smoothing

- Double click on TSM in the App Pane. This will bring up the TSM application group.
• Click on the **Run...** button located on the top **Home** ribbon. This will open the Run Application window.

• Check the **Run Current Group Only** button.
Click **OK** and proceed with model run.

**Instructions**

1. Find "VMT_TSM_ScenarioName.WSV" in the ScenarioName\10_Reporting\ model directory.
2. Copy paste values of "VMT_TSM_ScenarioName.WSV" into "TSM Input" tab.
3. Return to "TSM Tool" tab to view reductions attributable to TSM measures.

Paste values from VMT_TSM_ScenarioName.csv to 'TSM Input' tab.
- Review outputs
CREATING A NEW SCENARIO

RECOMMENDED PROJECT WORKFLOW

Although each project, application, and modeler may have a different approach to modeling, a recommended practice is to clearly define the scenario, type of analysis needed, sample work product, review inputs and outputs, and then document and archive the data. Evaluating scenario input data should be conducted prior to running the model. An example memo using the RTP/SCS scenarios is attached which looks at household and employment growth, and provides insight to the potential need and method for adjusting interregional factors.

An example workflow is below.
PREPARE SCENARIO INPUT DATA

Network Links

A recommended practice is to check the highway network for accurate information and link connectivity before running model scenarios. The master network should be checked prior to running the Input Processing application and compared to the RTP project list. After running the Input Processing application, the scenario network outputs in tabular form (lane miles by facility type, changes form 2005) and network form (.NET and geodatabase) should be reviewed.

Each model has a master network file called MPO_MASTERNETWORK.NET or HWYNET if contained in the geodatabase. The master network file contains links and nodes, which can be checked for accuracy within Cube.

The first step is to open the master network file in Cube and visually inspect the density of the network file in rural, suburban, and urban areas. Cube automatically visualizes the network links as blue and the centroid connectors as grey. The information below describes how to color code the link by variable values (i.e. Functional Type).
Highway Network

Changes to any network link attribute are described below using Facility Types and a .NET file as the primary example. The geodatabase example follows the .NET instructions.

Facility types categorize the network according to the type of service provided by the roadway. Examples of facility types include freeways, highways, expressways, and arterials. During assignment, the facility type is used to determine link capacity and volume delay functions, and ultimately impacts total volumes assigned to the links.

Facility types can be checked by color-coding the links with the facility type categories. This can be done in Cube under the Home tab, and clicking on Post Link Color. See CREATING MAPS USING VMIP MODELS for instructions on using Arc GIS for the scenario output network(s).

Any errors in facility types can be fixed in two ways.

1. Fixing facility type errors manually – best for editing a few links

By clicking on the link, Cube opens a window with the link attributes. Located the facility type field and input the correct facility type for the base year and any improvement year facility types if applicable. Note this is only for errors in facility types, not upgrades.
2. Fixing facility type errors by calculation – best for editing many links

Under the Link tab is Compute, in which the change to facility type is entered as an equation. This method is best used with a polygon boundary. A polygon boundary can be drawn around the incorrect links by clicking on New under the Drawing Layer Tab.

Once the polygon is drawn, the facility types can be changed using Link, Compute and applying changes inside/outside the polygon boundaries. Additional conditions can be added if needed.
The same process can be repeated for **speeds**, **number of lanes**, and **area type**.

1. To edit the network in GIS, edit the highway network and the file will automatically open in an ArcGIS editor window.
2. Switch the active layer to the HWNetwork_Link and select under the Edit menu.

3. Feature explorer is used to view and edit the attributes of the links and nodes, and is often hidden to the right of the screen. Click it and then click the pin to have it easily accessible.

4. Using the Select Feature tool, select the link(s).

5. To edit all links at once, enter the new value in the column on the right. To edit links by direction, first select roadway based on direction and A-B node.
6. To save the changes on the link, click . To reject the changes, click .

7. To add new links, use the Create Feature tool.

8. After making edits, keep or reject them in the Feature Explorer and then under the ArcGIS editor.

9. To exit Edit mode, select Stop Editing.
**Link improvement logic checks**

To minimize the coding of networks, the MIP models only require future projects to be coded as the project year, project number, and the values of the key variables after a project is implemented. The checks described in this section are intended to validate continuity and accuracy of the network improvements. The logic implemented in the Master to Scenario network assume chronologic progression from BASE to IMP1 then to IMP2. The Master to Scenario process compares the network year defined in the catalog to the IMP1_PRJYR and if the year is equal or greater, implements the values in IMP1, then checks IMP2_PRJYR and implements IMP2 values if the year is equal or greater. The PRJYR is the value when the project is complete (i.e. open to traffic or closed to traffic). The IMP1 and IMP2 value should be coded as the value at the end of the project, not the change in value. For example, a roadway changing from 1 lane in each direction to 2 lanes in each direction in 2018 should have BASE_LANES=1, IMP1_PRJYR=2018, IMP2_LANES=2, and the other IMP1 attributes such as facility type, use code, etc the same as BASE.

1. IMP_PRJYR exists but no change in lanes #
   - IMP1_PRJYR<>0 & (BASE_LANES=IMP1_LANES) or
   - IMP2_PRJYR<>0 & (IMP1_LANES=IMP2_LANES)

2. Lanes # change but no IMP_PRJYR
   - (IMP1_LANES<>0 & (BASE_LANES<>IMP1_LANES)) & IMP1_PRJYR=0 or
   - (IMP2_LANES<>0 & (IMP1_LANES<>IMP2_LANES)) & IMP2_PRJYR=0

3. 3+ improvement links – the Standard Network Variables have been set up to track only 2 improvements.
   - BLDYEAR<>0 & IMPYEAR<>0 & DELYEAR<>0 or
   - BLDYEAR<>0 & IMPYEAR<>0 & IMPYEAR1<>0 or
   - BLDYEAR<>0 & DELYEAR<>0 & IMPYEAR1<>0 or
   - IMPYEAR<>0 & DELYEAR<>0 & IMPYEAR1<>0

4. Out-of-order years
   - (IMP1_PRJYR<>0 & IMP2_PRJYR<>0) & IMP1_PRJYR=IMP2_PRJYR

5. IMP1_PRJID and IMP2_PRJID missing on all improvement projects
Network Nodes

Cleaning network nodes is recommended for the model development team but not recommended for by MPO staff. If incorrect nodes are removed, the model will not complete a full estimation.

A common error is the presence of ‘overlapping’ nodes where one node is not connected and therefore an ‘unused’ node. If scenario land use is associated to the unused node, the model will run, but it will estimate no impact from the scenario inputs. Since the land use inputs are located in a separate parameter workbook, it is important to have the correct node attached to the roadway.

1. The first step is to check if the unused nodes have the same ID as the underlying TAZ.

Save the network file as a test network.

Flag unused nodes in the Node tab and delete all flagged nodes under the Node, Compute tab. The formula is $\text{delete}=T$, the condition is _FLAG=1. This removes all unused nodes from the dataset.
Transit Network

The transit lines require the highway network to display and function, so opening the transit line file will automatically open the associated highway network in an ArcGIS editor window.

1. Load the Highway geodatabase in the Data Manager by Clicking Add Data and browsing to the 3_Highway directory.
2. To load the transit lines, double click on the PT network you wish to open. The transit line and highway network will open
3. Similar to highway editing, switch the active layer to the transit line and select Start Editing under the Edit menu.

4. To show only lines needing to be edited, click the Display Lines and then select the desired line (click to select/clear multiple lines)
5. Feature explorer is used to view and edit the attributes of the line, and is often hidden to the right of the screen. Click it and then click the pin to have it easily accessible.

![Feature Explorer](image1.png)

6. Using the Edit Feature tool, select the line and then double click a node\stop to begin editing from that location in the direction of travel.

![Edit Feature](image2.png)

7. The node selected is large and magenta, with the previous nodes/links to the edit point shows in magenta and the remainder shows in orange.

![Selected Node](image3.png)

8. The bottom of the screen gives helpful hints on modifying the transit lines

   Click=auto route w/stop node, Alt-Click=auto route w/non-stop node, Shift-Click=direct link

9. To add new lines, use the Create Feature tool.

![Create Feature](image4.png)
10. After making edits, keep or reject them in the Feature Explorer and then Save Edits under the ArcGIS editor.

![Feature Explorer](image)

11. To exit Edit mode, select Stop Editing

![Stop Editing](image)

**Transit System, Factors, and Fares**

After adding or modifying the transit lines, the transit system, fares, and factors files might also need to be updated if new modes or operators are added. If only lines are changed within an existing operator, mode, and fare system these files do not need to be updated.

1. Using a text editor, edit the Public Transport System (PTS), Fare System (FAR), and Factors (FAC) files to remove the lines no longer needed. Keeping the same mode number as in the original is preferred so the sub-area and full model can transfer data easily back and forth. Save files with the sub-area model name. Remember to change the file type from TXT to all.
### After

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; ; WAITCURVES FROM CITIES EXAMPLE ;

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; ; WAITCURVES FROM CITIES EXAMPLE ;

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WAITCROSS NUMBER=2 LONGNAME="TransferWait" NAME="XferWait", CURVE=1.0,10,0,60.0,60
WAITCROSS NUMBER=3 LONGNAME="ScheduledTransferWait" NAME="SchedXferWait", CURVE=1.0,10,0,60.0,60
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FAR
/*For Route Enumeration*/

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FARESYSTEM23, MODE=23

MAXXERS=2 ; not a maximum, routes with more than 2 transfers :
EXTRAXERS1 = 2 ; CITILABS EXAMPLE
EXTRAXERS2 = 1 ; CITILABS EXAMPLE
SPREADFACT = 1.1 ; min time then x fact CITILABS EXAMPLE model was
SPREADFUNC = 2 ; CITILABS EXAMPLE combination of generalized cost
SPREADCONST = 5 ; min transit time x 1.1 then add 5 min

/*For Route Evaluation*/

; no XFERGEN for now
;XFERGEN = 1, FROM-1 TO-1
;XFERGEN = 1, FROM-1 TO-2
;XFERGEN = 1, FROM-2 TO-1
;XFERGEN = 1, FROM-2 TO-2
;XFERGEN = 1, FROM-3 TO-1
;XFERGEN = 1, FROM-3 TO-2
;XFERGEN = 1, FROM-3 TO-3

/*For Route Enumeration and Evaluation*/

; no XFERGEN for now
;XFERGEN = 1, FROM-1 TO-1
;XFERGEN = 1, FROM-1 TO-2
;XFERGEN = 1, FROM-2 TO-1
;XFERGEN = 1, FROM-2 TO-2
;XFERGEN = 1, FROM-3 TO-1
;XFERGEN = 1, FROM-3 TO-2
;XFERGEN = 1, FROM-3 TO-3
Option to use/export .NET or .LIN files in VMIP 2 Models

Although GIS files are needed to do special analysis, sometimes you may want to share or edit the Cube format files rather than GIS based files.

Master files in geodatabase

Right click and export the master to .net or .lin as appropriate
Edit file in Cube as usual, remembering to have the transit lines on as you edit the master network (and remembering that roadways will turn on/off based on the year and lanes)

Save with a unique name and create a new scenario referring to the file.

- FC05_BASE
  - FC05_BASE
  - FC05_GIS

Original GIS master network key

<table>
<thead>
<tr>
<th>Master highway network</th>
<th>D:\ITDF_WorkingModels\WC14-3115_VMIP\NetworkTools\Fresno\GIS\FresnoNetwork_Deliverable2.gdb\FresnoNetwork</th>
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<tbody>
<tr>
<td>Peak transit lines file</td>
<td>D:\ITDF_WorkingModels\WC14-3115_VMIP\NetworkTools\Fresno\GIS\FresnoNetwork_Deliverable2.gdb\FresnoNetwork_65</td>
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.Net and .LIN network keys

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To import the .NET or .LIN back into GIS, the original master geodatabase will be used and Add data to an existing geodatabase for the edited highway or transit network.
Land Use Preparation

The `1_Inputs\_Support` directory contains the spreadsheet VMIP2_LandUsePrep_MODEL.XLSX. This file is the TAZ level disaggregate control total for each land use category (10 residential, 21 employment, 4 group quarters population, and 3 school enrollment) for the validation year and SB 375 years. Although the travel model aggregates the land use categories for travel forecasting, the land use preparation spreadsheet allows for more disaggregate land use planning at the TAZ level. The **NOTES** worksheet contains the data dictionary.

To update the land use for any of the years that are included and/or for years other than the SB 375 years, the data from adjacent years can be interpolated/extrapolated or other forecasting methods (UPlan, Envision Tomorrow, etc) can be used to obtain the control totals.

Socio-Economic Data Preparation

The `1_Inputs\_Support` directory contains the spreadsheet VMIP2_SCENARIOPrep.XLSX. This spreadsheet is used to develop the socio-economic data (SED), gateway productions and attractions (Gateways), special generators (SpecialGenerators) and TAZ data (TAZ_Date) for a specific scenario. This spreadsheet contains four main types of data: **Inputs**, **Outputs**, **Local Factors**, and **Interregional Factors**.

The input to the file is the scenario Land Use developed in the VMIP2_LandUsePrep_MODEL.XLSX which is copied and pasted as values into the **LU_Detailed** worksheet. The detailed land uses are automatically aggregated and summarized into the travel model categories on the **LU_Input_Template** using the residential classification and NAICS equivalencies shown in the **Land Use** table. Once aggregated, the travel model residential land use categories are multiplied by the factors obtained from the Census on the **SED_Cross_ClassRates_Template**, with the resulting cross-classified households, population, employment, group quarters population, and school enrolment being calculated on the **SED_Final** worksheet.

**Local Factors**

Local factors include the cross-classification of the households, employment sector income (high, medium, and low), and aggregation of land use variables for the travel model. Although the spreadsheet contains demographics at the TAZ level based on Census as a starting point, scenarios wishing to change the demographics (household size, income, average population per household, or age distribution) can make changes at the zone level by adjusting the values on the **SED_Cross_ClassRates_Template** worksheet. Conditional formatting is implemented to flag where the total does not add to 100% within a classification. The data for parking pricing, developed area, transit headways (for models without transit networks), EJ,
AirBasin, and the employment by income is a TAZ level variable on the \textit{TAZ\_Interm} worksheet. The variables are updated as needed at a TAZ level and the employment by income values are currently at a county level, and all of these values should be evaluated for each scenario. Changing the aggregation of land use is only recommended during model development since the trip generation rates must be consistent with the land use aggregation. The TAZ local and interregional information are combined on the \textit{TAZ\_Data} worksheet and used in the model process.

\textit{Special Generators}

The \textit{SpecialGenerators} is the final worksheet that is scenario dependent. The values are used to adjust the trips being generated by the model land use to match a target for a special generator and can be the total trips when no land use is used in the model or an adjustment value when the land use is included in the model.

The following pages contain examples of each of the worksheets and the Trip Generation section contains a flowchart showing how the files integrate to produce trips by purpose by zone.

\textbf{VMIP2\_SCENARIO\_Prep.XLSX}

- Geographic information is in white and includes TAZ and Jurisdiction

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- Residential information is in light orange and includes total households by unit types 1-10 based on Census. The units are occupied households.
- Employment information is in light green and includes total employees and detailed employee types. The units are total employees by zone.

<table>
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- Group Quarters Population information is in dark green and includes dorm, assisted living, military, and institutional population (prison, mental health, etc). The units are persons excluding employees and household population.

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</table>
• School enrolment information is in dark blue and includes elementary, high school, and college enrolment. The units are students and excludes employees.

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**LU_Input_Template**

This worksheet aggregates the residential and employment data from the [LU_Detailed] worksheet.

• Geographic information is in white and includes TAZ and Jurisdiction, and relations to Census 2010

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• Residential information is in light orange and includes total households by unit types 1-10 based on Census and residential groups 1-3, with spares in grey. The units are occupied households.
• Employment information is in light green and includes total employees aggregated by type with spares in grey. The units are total employees by zone.

• Group Quarters Population information is in dark green and includes dorm, assisted living, military, and institutional population (prison, mental health, etc). The units are persons excluding employees and household population.
• School enrolment information is in dark blue and includes elementary, high school, and college enrolment. The units are students and excludes employees.

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SED_final

This worksheet is the product of the percentage allocation on SED_Cross_ClassRates_Template and the control total on LU_Input_Template with the result being cross-clarified households and population, employment, group quarters population, and student enrolment by TAZ.

• Geographic information is in white and includes TAZ and Jurisdiction, and relations to Census 2010

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• Residential household information is in light orange and includes total households, total household population, and households by aggregated group types, with spares in grey.
- Residential population information is in light blue and includes household population by aggregated group types, with spares in grey. Population is not used directly in the model except for the age of population. Total households, population, and households by group are not used to generate trips but are in the calculation of per-capita performance measures and residential development density.

- Residential household cross-classified information by household type and then by income, and household size is in light green. Cross-classified residential units are the generator of home-based productions and minor amount of non-home based productions and attractions.
Residential households by age of the head of household in purple and is aggregated by residential unit group type. The households by age of head of house is used to modify trip generation by purpose.

Residential household population by age range is in green. The resident by age is used to generate school trips.
Employment information is in light green and includes total employees aggregated by type with spares in grey. Employees generate home-based attractions and non-home based productions and attractions. For schools, employees generate the non-school related purposes (i.e. homework) and the household population and school enrolment generate the school related purpose.

Group Quarters Population information is in dark green and includes dorm, assisted living, military, and institutional population (prison, mental health, etc). The group quarters population does not generate trips.
• School enrolment information is in dark blue and includes elementary, high school, and college enrolment. The school enrolment generates the attractions of school based trips.

This worksheet has the same structure as the worksheet with the exception that the values are average (population for household) or percentage. This worksheet is based on data at a Census geography (Block Group, Place, or PUMA) but can be modified at a TAZ level.

**Interregional Factors**

The two primary required input updates for subarea model are the gateway station weights and the through trips. The gateway station weights attract/produce beyond the model study area, so when the subarea model is developed the relative proportion of trips at each gateway should be evaluated and updated as needed. The through trips are those that travel from one gateway to another gateway without stopping in the model area.
Gateways

The station weights are productions and attractions by purpose at each gateway that interact with the trips generated within the study area. The station weights can remain constant over time and the values will be used as percentages rather than absolute values, but should be evaluated to ensure the land use growth and travel patterns warrant the distribution of trips remaining constant.

The interregional factors include the internal and external percentage of trips by purpose, gateway productions and attractions, and home-work income distribution at the gateways. The interregional values on the IX XI worksheet (internal external trips by purpose by Census place) and the internal distribution for home-work trips on the Gateway HNL worksheet are based on the CHTS, while the gateway values on the Gateway Raw worksheet are derived from passenger vehicle forecasts from the California Statewide travel demand model. The interregional data only need to be updated for scenarios where the results of trip generation are not balanced for home-work by income or when significantly different scenarios are being developed. The values can be updated based on the Statewide model or modified to test alternative scenarios. The gateway values and high/medium/low income data are combined into the Gateway Final worksheet for use in the model.

IX XI

The percentage of trips that are imported (IX) or exported (XI) by purpose and Census Place, with home-work purposes being by high, medium, and low income.

| Name     | County | IX | R  | C  | D  | E  | F  | G  | H  | I  | J  | K  | L  | M  | N  | O  | P  | Q  | R  | S  | T  |
|----------|--------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Arizona  | Kings  | 0.35 | 0.37 | 0.27 | 0.2 | 0.07 | 0.25 | 0.02 | 0.31 | 0.05 | 0.04 | 0.06 | 0.04 | 0.06 | 0.04 | 0.06 | 0.04 | 0.06 | 0.04 | 0.06 | 0.04 | 0.06 |
| Arvin    | Kern   | 0.048 | 0.123 | 0.055 | 0.043 | 0.049 | 0.03 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Atwater  | Merced | 0.072 | 0.035 | 0.016 | 0.151 | 0.062 | 0.008 | 0.007 | 0.023 | 0.086 | 0.057 | 0.045 | 0.045 | 0.045 | 0.045 | 0.045 | 0.045 | 0.045 | 0.045 | 0.045 | 0.045 |
| Avenal   | Kings  | 0.35 | 0.37 | 0.27 | 0.2 | 0.07 | 0.25 | 0.02 | 0.31 | 0.05 | 0.04 | 0.06 | 0.04 | 0.06 | 0.04 | 0.06 | 0.04 | 0.06 | 0.04 | 0.06 | 0.04 | 0.06 |
| Bakersfield | Kern | 0.061 | 0.016 | 0.014 | 0.009 | 0.003 | 0.004 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 | 0.013 |
| California City | Kern | 0.048 | 0.123 | 0.055 | 0.049 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 |
| Coroec | Stanislaus | 0.08 | 0.004 | 0.059 | 0.011 | 0.074 | 0.015 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| Chowchilla | Mariposa | 0.453 | 0.075 | 0.197 | 0.091 | 0.296 | 0.11 | 0.1 | 0.011 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 |
| Clovis | Fresno | 0.064 | 0.067 | 0.038 | 0.081 | 0.015 | 0.057 | 0.015 | 0.023 | 0.007 | 0.002 | 0.027 | 0.14 | 0.052 | 0.179 | 0.052 | 0.022 | 0.039 | 0.051 |
| Coalinga | Fresno | 0.064 | 0.067 | 0.038 | 0.081 | 0.015 | 0.057 | 0.015 | 0.023 | 0.007 | 0.002 | 0.027 | 0.14 | 0.052 | 0.179 | 0.052 | 0.022 | 0.039 | 0.051 |
| Corcoran | Kings | 0.35 | 0.37 | 0.27 | 0.2 | 0.07 | 0.25 | 0.02 | 0.31 | 0.05 | 0.04 | 0.06 | 0.04 | 0.06 | 0.04 | 0.06 | 0.04 | 0.06 | 0.04 | 0.06 | 0.04 | 0.06 |
| Cutler | Tulare | 0.005 | 0.009 | 0.008 | 0.081 | 0.012 | 0.059 | 0.021 | 0.059 | 0.005 | 0.004 | 0.244 | 0.011 | 0.008 | 0.022 | 0.017 | 0.007 | 0.007 | 0.044 |
| Delano | Kern | 0.048 | 0.123 | 0.055 | 0.045 | 0.049 | 0.03 | 0.006 | 0 | 0 | 0 | 0.013 | 0.009 | 0.01 | 0.015 | 0.010 | 0.016 | 0.024 | 0.121 | 0.043 |

Gateway HNL

The percentage of high, medium, and low home-work trips at each gateway for imported (IX) or exported (XI) trips.
The relative value of imported (IX) or exported (XI) trips for each purpose by gateway. The initial values are based on observed trips and the gateways are balanced to the internal trip generation. Home-work trips for high, medium, low are set as the same value if gateway percentages are used. If the number of trips are estimated independently, the percentages should be set at 100% in the Gateway HML worksheet.

The basic internal TAZ information such as Airbasin, total and developed area, terminal times, and transit frequency (for scenarios or models using synthetic transit). Hard coded.

The through trips can be obtained by running select link on the Statewide model and outputting the OD matrix, using big data, or assumed to be similar to the original model depending on the scale difference.
between the original and subarea model. A common approach is to calibrate the internal trips, and the count at the gateways is the difference between internal generated attractive trips and the through trips.

The following process should be implemented after determining the values of through trips, to update the through trip file:

1. Use the existing through trip structure and change the values for the daily through trips by purpose.
   a. Column A is the origin zone (1-100)
   b. Column B is the purpose (1=HW 2=HS 3=HK 4=HC 5=HO 6=WO 7=OO 8=HY. Although replaced by the truck matrix, the other purposes are 9=TS 10=TM 11=TH)
   c. Column C is the matrix file (always 1)
   d. Column D repeats the origin number (1-100 same as A)
   e. Columns E-DA are the destination with E=1 and DA=100
2. Save the file as a CSV when finished editing

**Economic Factors**

The percentage of employees by job type for high, medium, and low income groups. Hard coded.

The hard coded information on this tab combined with the lookup value for imported and exported trips by each Census place are combined into the TAZ_Data worksheet.

**Trip Generation**

When changing the land use control totals, socio-economic data assumptions (household income, size, etc), evaluating large development projects or specific/general plans, or significant changes within our outside the model area, checking the trip generation balancing and interregional travel from the Statewide Model is appropriate. The flowchart on the following page describes how the data and processes for trip generation interact and where the interregional factors come are integrated with the model. The flowchart
on the subsequent page shows the interaction with the Statewide model (or household survey/Big Data). For instructions on changing the inputs, see the previous sections for Land Use Preparation or Socio-Economic Data Preparation. The Non-Highway Validation spreadsheet summarizes the production and attraction balancing by purpose, and the following section describes using the trip generation spreadsheet to adjust the local and interregional factors to balance the trip generation.

Other Factors

The model was estimated and calibrated to reflect the base year travel conditions and to roughly approximate data from multiple sources (CHTS, HPMS, traffic counts, etc). The inputs such as demographics, income ranges, split between job classes, etc as described in the previous sections along with associated the interregional travel are the most frequently modified inputs to reflect scenarios or assumptions, but other factors such as auto operating cost, vehicle ownership\availability, sensitivity to mode, value of time, are generally assumed constant. Calibration factors are usually only modified based on new data refer to the Model Development Report to determine when\how to update the values.
CREATE A SCENARIO IN CUBE

Setting up a new scenario can be very helpful to test the effects of variations in your input data (i.e., land use, network). In the model catalog, scenarios are hierarchical in nature and can be managed in the Scenario pane. Cube has helpful tools to easily create or delete scenarios.

Child Scenario

A child scenario will inherit the key values from its parent. This means that all files and parameter settings will be copied to this new scenario. Any variation will have to be edited after the scenario is created. A child scenario will be placed a level below the parent scenario.

- In the Scenario pane, Click on the scenario from which you would like to create a new child scenario.

* Click on the Scenario ribbon tab.

* Click on Add Child.
• Type in the name of the new scenario. Press **Enter**. This will open the Scenario Properties window.

![Scenario Properties Window](image)

• Type in a description of the new scenario. Click **OK**.

![Scenario Properties Window](image)

• To edit scenario specific input data, double-click on the child scenario to open the input key window.

**Sibling Scenario**

A sibling scenario is placed at the same level of the scenario it was created from. It will inherit the key values from that scenario as well. A sibling scenario cannot be created from the base scenario automatically created in the model catalog (**Scenarios**). You can insert or append a sibling scenario to a list of existing scenarios.

• In the Scenario pane, Click on the scenario from which you would like to create a new sibling scenario.
• Click on the **Scenario** ribbon tab.

![Scenario ribbon tab](image)

• Click on **Append Sibling** or **Insert Sibling**.

![Append Sibling and Insert Sibling](image)

• Type in the name of the new scenario. Press **Enter**. This will open the Scenario Properties window.

![Scenario properties window](image)

• Type in a description of the new scenario. Click **OK**.

![Scenario with new sibling](image)
To edit scenario specific input data, double-click on the sibling scenario to open the input key window.

**Delete Scenario**

Deleting a scenario will remove the scenario and any of its children.

- In the Scenario pane, Click on the scenario you would like to delete.

- Click on the **Scenario** ribbon tab.

- Click on **Delete Scenario**.
CUBE LAND

Cune Land is the land use allocation model implemented within the VMIP 2 models. In runs in-line with the travel models as an optional component. To turn on Cune Land, check the Run Land in the catalog key.

**CATALOG KEY INPUTS:**

Most of the catalog keys in the model are the same as in the travel demand model.

The added keys pertaining to Cune Land, are listed below:

— Average rent for single-family development in first zone: all rent estimates output by Cune Land are defined relative to the user-specified rent for a single reference location option. For this model, single-family housing in zone one was chosen as the reference location.

— Characteristics of agents (households and jobs) by type: one of two inputs located in a special Land-specific geodatabase (TCM08_Base_Land.mdb) in the sub-folder "CATALOG_DIR\1_Inputs\7_Land", this table provides all the information necessary regarding the agents to be allocated by the model, especially control totals and attributes.

Agents 1-25 are households, cross-classified by size and income. Agents 26-31 are SJV MIP 2 employment categories.

The control totals to be allocated are in the column "NAGENT", which should be updated for forecasting as well as backcasting applications. Other required fields include:

* **PERSONS:** average number of people per household or jobs per establishment

* **WRKLOWWAGE:** average number of low-wage workers per household (under $1,250/month)

* **WRKHIWAGE:** average number of high-wage workers per household (over $3,333/month)
* TOTWORKERS: average total workers per household

* POP_18_64: total number of working-age (18-64 y.o.) persons per household

— Real estate attributes: this table lists the attributes for every combination of zone and real estate type in the model. This is currently stored as a DBF but could easily be converted into GIS layers. Fields include:

  * IDZONE: internal Cube Land zone number (not the same as MIP TAZ number – see ZONE_NAMES.DBF for crosswalk)
  * IDREST: real estate type (1=single-family, 2=multi-family, 3=retail, 4=office, 5=industrial, 6=other)
  * IS_SF, IS_MF, DUMID, DUMO, DUMR, OTHERNR: dummy variables for specific real estate types
  * SF_EMP: square feet per employee (non-residential market only)
  * IS_BIG: probability (0-1) that a residential real estate unit is big (more than 2,000 square feet)
  * FAR: floor-area ratio (floorspace to lot size)
  * DU_ACRE: development density in dwelling units per acre
  * PCT_RES: average percent of residential development in a given parcel
  * PARKSPPAC: average number of parking spaces per acre
  * SF_DU: average square feet per dwelling unit

— Initial zonal attributes for Cube Land: a polygon feature class containing input zonal data for Cube Land.

Key fields include:

  * TAZ_MIP: SJV MIP TAZ number (note: different from numbering system internally used by Cube Land)
  * INTDENS: intersection density (based upon HERE data and calculated as part of accessibility)
  * WRKLOWWAGE: initial estimate of low-wage workers living in zone
  * WRKHIWAGE: initial estimate of high-wage workers living in zone
  * TOTWORKERS: initial estimate of total workers living in zone
INSTRUCTIONS FOR DYNAMIC VALIDATION:

1. Copy the TCM08_Base_Land.mdb file to a new geodatabase, TCM14_Base_Land.mdb, in the same folder.

2. Edit the Agent_Info table in the new geodatabase to update control totals and attributes as needed.

3. Create a new child scenario under TCM14_BASE in Cube.

4. Point the agent attributes catalog key reference to the new geodatabase and Agent_Info table.

5. Run the scenario. Cube Land will be automatically included in the full model feedback process, overwriting the input SE_Detail file with the results of allocating the control totals by agent type to zones after the first iteration. The SE Detail file generated by Cube Land will be used for all travel model calculations, and the skims produced by the travel model will be used to calculate updated accessibility measures for Cube Land as well.

6. Compare outputs to observed data. The SE Detail file produced by Land is at: 
   "{SCENARIO_DIR}\SE_DETAIL_LAND.CSV". If zone-level observed socio-economic data are not available, jurisdiction or community-level summaries may be suitable for dynamic validation purposes.
CREATING MAPS USING VMIP MODELS

Although the base and model data can be used to make many different maps, the recommended maps to review inputs and most often used output maps are automated and have GIS files and MXD map files included with the model structure. The information below summarizes the maps already included in the model and highlights the process for setting up, reviewing, and modifying the maps.

OVERVIEW OF VMIP MODEL GIS MAPS AND DATA

Before starting to make maps, some key things to keep in mind.

- Cube Catalog and Application Manager rely on the relationships (parent, child, sibling) between scenarios and inherited attributes (i.e. file locations and variable values). This concept was replicated in the included GIS map MXD files by referencing model data in a relative file structure (see details below)
- Base data that do not change by scenario are located in the Master.GDB and all other scenario specific data are contained in the Results.MDB within the scenario directory.
- To make maps using different symbology or variables, refer to the documentation tables for list of variables and values.

GIS MODEL DIRECTORY STRUCTURE

- Model Directory
  - 1_Inputs: Input files, Parameters Workbooks, Scenario Summary
  - App: Model scripts and applications
  - GIS
    - Master.gdb: street centerline files, city and county boundary, TAZ boundary
    - Blank.mdb: empty template geodatabase correctly projected for each model. When model is run file is copied as Results.mdb in the scenario directory. During the model run, scenario highway networks (input and loaded) and post-processor results are copied for access by the scenario MXD.
- Default.mxd: template map file used for input review before running full model and output mapping for scenarios. When model is run file is copied as SCENARIO_NAME.mxd in the scenario directory. Relative reference to Master.gdb and Results.mdb.

- MODELNAME.mxd: Master map file used for displaying the basic comparisons of standard scenarios (2005, validation year, 2020, 2035, and 2040). Relative link to Master.gdb and Results.mdb for standard scenarios.

- Images and layer files for background information or layout file for printing: F&P logo, north arrow, and National Geographic topographic and aerial maps.

  - Scenarios: Model runs. Example for 2 years and 3 scenarios below
    - SCENARIOYR1_BASE
      - SCENARIOYR1_NAME1
        - Model directories (13 directories of model data)
        - Results.mdb
        - SCENARIOYR1_NAME1.mxd
      - SCENARIOYR1_NAME2
        - Model directories (13 directories of model data)
        - Results.mdb
        - SCENARIOYR1_NAME2.mxd
      - SCENARIOYR1_NAME3
        - Model directories (13 directories of model data)
        - Results.mdb
        - SCENARIOYR1_NAME3.mxd
    - SCENARIOYR2_BASE
      - SCENARIOYR2_NAME1
◊ Model directories (13 directories of model data)
◊ Results.mdb
◊ SCENARIOYR2_NAME1.mxd

♦ SCENARIOYR2_NAME2
◊ Model directories (13 directories of model data)
◊ Results.mdb
◊ SCENARIOYR2_NAME2.mxd

♦ SCENARIOYR2_NAME3
◊ Model directories (13 directories of model data)
◊ Results.mdb
◊ SCENARIOYR2_NAME3.mxd

An example from the Tulare model is shown in the image to the right, with the directory tree expanded. Contents of the GIS directory (left) and the TU05_BASE scenario (right).
IMPORTING\EXPORTING DATA FROM GEODATABASES

The GIS maps can only work with GIS based data (geodatabases and shape file), not the Cube standard files (highway .NET or transit .LIN). Cube has an easy to use data manager to import and export data between the different formats.

- If the database is not already loaded, click on and load the data in the 01_Inputs\3_Highway

- To export a highway network or transit line, right click on the layer and select Export. Select the output location (default is the geodatabase so most likely change to a directory instead) and output type (this example is .LIN), enter a file name for the output, and then click OK. After the Operation Complete message shows up, click Close.

- To import a highway network or transit line, the same dialog box is used as export but the Input data should be a .NET or .LIN.
  - For a highway network, a shape file that relates to the .NET can be specified for a true shape display within the geodatabase.
For a .LIN, an underlying highway network must also be specified. Other datasets can also be added to the geodatabase, but it is recommended that most other files be added to the master geodatabase rather than the highway database to limit file size, maximize usability, and reduce the risk of corrupting the highway or transit networks.

MASTER MODEL MAP FILE

The MODELNAME.mxd is used to map the inputs for the standard scenarios (2005, validation year, 2020, 2035 and 2040) and is contained within the MODELDIRECTORY\GIS folder with relative link to the scenario results geodatabase for only two levels of scenario directories following the MODELDIRECTORY\Scenarios\Level1\Level2\Results.mdb

The master model map file contains three basic types of information:

- Highway network lanes, facility type and speed
- TAZ boundary
- Background layers such as county or city boundary, and aerial or topographic maps

The Table of Contents of this Map file is shown below to the right.

MASTER MAP HIGHWAY DATA

The highway network lanes, facility type, and speed are bold colors for the scenario year (after improvements are implemented), with the same symbology but muted intensity for the validation year. By overlaying the information and toggling on or off, the changes between years can quickly be seen. The change between the validation year and the scenario year are not yet standard outputs, but will be in upcoming enhancements. A discussion of each of the primary highway network maps is in the following sections.
Master Map Lane Improvements

- Layers
  - Lane Improvements
    - 2005 Lanes
    - 2007 Lanes
    - 2020 Lanes
    - 2035 Lanes
      - Through Lanes per Direction
        - 1
        - 2
        - 3
        - 4
  - 2040 Lanes
  - Base Lanes
    - Through Lanes per Direction
      - 1
      - 2
      - 3
      - 4

Master Map Facility Type Improvements

- Layers
  - Lane Improvements
  - Facility Type Improvements
    - 2005 Facility Type
    - 2007 Facility Type
    - 2020 Facility Type
    - 2035 Facility Type
      - Invalid Class
      - Freeway
      - Highway
      - Expressway
      - Arterial
      - Collector
      - Local
      - Ramp
      - Connector
  - 2040 Facility Type
  - Base Facility Type
    - Invalid Class
    - Freeway
    - Highway
    - Expressway
    - Arterial
    - Collector
    - Local
    - Ramp
    - Connector
Master Map Speed Improvements

- **Layers**
  - Speed Improvements
    - 2005 Speed
    - 2007 Speed
    - 2020 Speed
    - 2035 Speed
      - Speed (mph)
        - 30 or lower
        - 31 - 40
        - 41 - 50
        - 51 or greater
  - 2040 Speed
  - Base Speed
    - Speed (mph)
      - 30 or lower
      - 31 - 40
      - 41 - 50
      - 51 or greater

Master Map TAZ Data

- **Layers**
  - Speed Improvements
    - Land Classification
      - TAZs
        - Traffic Analysis Zones
MASTER MAP BACKGROUND DATA

Master Map Background Base Data

- Layers
  - Lane Improvements
  - Facility Type Improvements
  - Speed Improvements
  - Land Classification
  - Background Layers
    - City
    - County
    - RoadCL
COMMON VARIABLES AND VALUES FOR CREATING GIS MAPS

This section has most commonly used variables and values. For full descriptions see the model documentation.

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<tr>
<td></td>
<td>BLOCK</td>
<td>Census block ID</td>
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</tr>
<tr>
<td></td>
<td>MODEL</td>
<td>Model ID</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PLACETYPE</td>
<td>Placetype category</td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td>TOTHH</td>
<td>Total Households</td>
<td>Households</td>
</tr>
<tr>
<td></td>
<td>RU1, RU2, ... RU10</td>
<td>Households by Residential Unit Type</td>
<td>Households</td>
</tr>
<tr>
<td></td>
<td>RUG1, RUG2, RUG3</td>
<td>Households by Residential Unit Type Groups</td>
<td>Households</td>
</tr>
<tr>
<td></td>
<td>RUG1SPARE, ... RUG7SPARE</td>
<td>Unused in current model but available for expanding grouping of residential unit types.</td>
<td></td>
</tr>
<tr>
<td>Non-residential</td>
<td>TOTEMP</td>
<td>Total employees</td>
<td>Employees</td>
</tr>
<tr>
<td></td>
<td>EMPEDU</td>
<td>Educational Services (61-63)</td>
<td>Employees</td>
</tr>
<tr>
<td></td>
<td>EMPFOO</td>
<td>Accommodations (721), Food Services (722), Arts, Entertainment and Recreation (71)</td>
<td>Employees</td>
</tr>
<tr>
<td></td>
<td>EMPGOV</td>
<td>Public Administration (92)</td>
<td>Employees</td>
</tr>
<tr>
<td></td>
<td>EMPIND</td>
<td>Utilities (22), Construction (23), Other Services Except Public Administration (81), Wholesale Trade (42), Transportation and Warehousing (48-49)</td>
<td>Employees</td>
</tr>
<tr>
<td></td>
<td>EMPMED</td>
<td>Health Care and Social Assistance (62)</td>
<td>Employees</td>
</tr>
<tr>
<td>Type</td>
<td>Attribute</td>
<td>Description</td>
<td>Units</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td></td>
<td>EMPOFC</td>
<td>Information (51), Finance and Insurance (52), Real Estate, Rental and Leasing (53), Professional, Scientific, and Technical Services (54), Management of Companies and Enterprises (55), Administrative/Support, Waste Management &amp; Remediation (56)</td>
<td>Employees</td>
</tr>
<tr>
<td></td>
<td>EMPOTH</td>
<td>Mining, Quarrying, Oil and Gas Extraction (21), Manufacturing (31-33)</td>
<td>Employees</td>
</tr>
<tr>
<td></td>
<td>EMPRET</td>
<td>Retail Trade (44-45)</td>
<td>Employees</td>
</tr>
<tr>
<td></td>
<td>EMPAGR</td>
<td>Agriculture, Forestry, Fishing and Hunting (11)</td>
<td>Employees</td>
</tr>
<tr>
<td></td>
<td>EMPSPARE1, ...</td>
<td>Unused in current model but available for expanding employment categories</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EMPSPARE8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>POPDORM</td>
<td>Group Quarters population: School (Dormitory, Fraternity, Sorority)</td>
<td>People</td>
</tr>
<tr>
<td></td>
<td>POPASSIST</td>
<td>Group Quarters Population: Medical (Assisted living, retirement home)</td>
<td>People</td>
</tr>
<tr>
<td></td>
<td>POPMILITARY</td>
<td>Group Quarters Population: Military (Military base if not special generator)</td>
<td>People</td>
</tr>
<tr>
<td></td>
<td>POPINST</td>
<td>Group Quarters Population: Institutionalized population (prison, mental health, etc)</td>
<td>People</td>
</tr>
<tr>
<td></td>
<td>ELEM</td>
<td>Elementary and middle school enrollment</td>
<td>Student Enrollment</td>
</tr>
<tr>
<td></td>
<td>HS</td>
<td>High school enrollment</td>
<td>Student Enrollment</td>
</tr>
<tr>
<td></td>
<td>COLLEGE</td>
<td>College enrollment</td>
<td>Student Enrollment</td>
</tr>
<tr>
<td></td>
<td>YEAR</td>
<td>Scenario year</td>
<td></td>
</tr>
<tr>
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<td>SCEN</td>
<td>Scenario name</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MPO</td>
<td>MPO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comments</td>
<td>Scenario comments</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. See Table 3.2-3 for place type categories.
2. See Table 3.2-4 for residential unit type categories.
3. Non-residential description contains NAICS sector number(s).
### ROADWAY NETWORKS

Highway network variables and values are listed below.

<table>
<thead>
<tr>
<th>Highway Facility Type (FACTYP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Freeway</td>
</tr>
<tr>
<td>2. Highway</td>
</tr>
<tr>
<td>3. Expressway</td>
</tr>
<tr>
<td>4. Arterial</td>
</tr>
<tr>
<td>5. Collector</td>
</tr>
<tr>
<td>6. Local</td>
</tr>
<tr>
<td>7. Ramp: Freeway-Freeway</td>
</tr>
<tr>
<td>8. Ramp: Slip</td>
</tr>
<tr>
<td>9. Ramp: Loop</td>
</tr>
<tr>
<td>10. Connector: Dist. ≤ 0.25</td>
</tr>
<tr>
<td>11. Connector: Dist. &gt; 0.25</td>
</tr>
</tbody>
</table>

Master network variables

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nodes</strong></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>X-coordinate of node in Nad 83</td>
</tr>
<tr>
<td>Y</td>
<td>Y-coordinate of node in Nad 83</td>
</tr>
<tr>
<td>N</td>
<td>Node number</td>
</tr>
<tr>
<td>TAZ</td>
<td>Traffic Analysis Zone Number</td>
</tr>
<tr>
<td>DISTRICT</td>
<td>Super district number used for aggregation</td>
</tr>
<tr>
<td>SOI</td>
<td>Sphere of influence used to number TAZs alphabetically</td>
</tr>
<tr>
<td>STYINT</td>
<td>Study location number used to record turning movements when non-zero</td>
</tr>
<tr>
<td>COUNTY</td>
<td>County where node is located</td>
</tr>
<tr>
<td>JURISDICTION</td>
<td>Political jurisdiction where node is located</td>
</tr>
<tr>
<td>COMMUNITY</td>
<td>Community/district name</td>
</tr>
<tr>
<td><strong>Links</strong></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>A node</td>
</tr>
<tr>
<td>Attribute</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>B</td>
<td>B node</td>
</tr>
<tr>
<td>DISTANCE</td>
<td>Distance in miles</td>
</tr>
<tr>
<td>ST_NAME</td>
<td>Local street name</td>
</tr>
<tr>
<td>ROUTE</td>
<td>Numerical state route number</td>
</tr>
<tr>
<td>TERRAIN</td>
<td>Terrain (F=Flat , R=Rolling, M=Mountain)</td>
</tr>
<tr>
<td>JURISDICTION</td>
<td>Political jurisdiction where link is located location</td>
</tr>
<tr>
<td>SCREENLINE</td>
<td>Screenline by direction (See Figures 3-1.1 through 3.1.10)</td>
</tr>
<tr>
<td>XXXX_PRJD</td>
<td>RTP Project ID number</td>
</tr>
<tr>
<td>XXXX_PRJYR</td>
<td>RTP Project Opening Year</td>
</tr>
<tr>
<td>XXXX_FACTYP</td>
<td>Facility type by year</td>
</tr>
<tr>
<td>XXXX_APPY</td>
<td>Area type by year</td>
</tr>
<tr>
<td>XXXX_LANES</td>
<td>Number of directional through travel lanes by year</td>
</tr>
<tr>
<td>XXXX_AUX</td>
<td>Auxiliary lane (0=no, 1=yes)</td>
</tr>
<tr>
<td>XXXX_SPEED</td>
<td>Free-flow speed in miles-per hour by year</td>
</tr>
<tr>
<td>XXXX_CAPCLASS</td>
<td>Capacity class by year (derived from Terrain, Facility type, and Area Type)</td>
</tr>
<tr>
<td>XXXX_CAPACITY</td>
<td>Vehicle per hour (calculated based on Lanes and CapClass)</td>
</tr>
<tr>
<td>XXXX_USE</td>
<td>Identifies vehicle prohibitions by year</td>
</tr>
<tr>
<td>XXXX_TOLL</td>
<td>Code used for cost on toll facilities by year</td>
</tr>
<tr>
<td>AREATYP</td>
<td>Character to store scenario variable</td>
</tr>
<tr>
<td>AIRBASIN</td>
<td>Air basin number for air quality or County number in multi-county models</td>
</tr>
<tr>
<td>TSM</td>
<td>Transportation System Management</td>
</tr>
<tr>
<td>EJ</td>
<td>Environmental Justice designation (0 or 1)</td>
</tr>
</tbody>
</table>

Notes:

XXX represents BASE (calibration/validation year), IMP1 (status after first improvement), and IMP2 (status after second improvement). In addition to calibration/validation year which varies by MPO, required years to be covered by improvement are 05, 20, 35, and 40.

0 or 1=facility open to all (“general purpose”); 2=Carpool 2; 3=Carpool 3+; 4=Combination trucks prohibited; 5=Walk or bike only
CREATING SUBAREA MODELS

The VMIP 2 model structure is intended to be transferable to other areas and used in easily developing subarea models for individual projects or jurisdictions. The process below describes the tasks specific to the subarea model development, with references to the previous sections of the user guide when the steps are similar.

Due to the geographic scale of the model and the focus on regional VMT forecasts for air quality conformity and greenhouse gas analysis in the RTP/SCS, local-scale project applications should verify the model’s performance within the local study area. Normally, this will be done by performing a subarea validation in recognition that use of regional MPO models for purposes other than regional planning should ensure that the model provides the appropriate scale and sensitivity for applications at a sub-regional level such as corridor, sub-area, or local planning studies. Below the regional level, model refinements are likely necessary to ensure the model meets the validation targets and is appropriately sensitive to smaller scale changes associated with sub-regional studies.

Common checks for subarea models include all the same type of checks described in the Creating a New Scenario and the Review Model Outputs sections of this user guide. In addition, the model sensitivity to the type of project being evaluated should be conducted. This often includes splitting TAZs, adding roadway network detail, refining land use inputs and converting square-footages to employees, modifying demographics of the project, and validating overall trip magnitude (trip generation rates) and trips for specific times of day (diurnal factors).

As the base scenario was validated and future scenarios were evaluated, the following notes were made in the model development report that includes the accuracy of project level forecasts.

1. **Model households, population, and total employment not matching identically to the growth forecast:** Some scenarios deviate from the control totals of the regional forecast purposefully. Small differences due to rounding may occur and result in less than 0.5% overall error. For differences larger than 0.5%, verification of input data and implications on regional travel, PA balancing, etc. should be conducted as described in the attached memo. Although population is used for school trips only, ensuring the household size by income group reflects the plan is important as it influences travel for all purposes.

2. **Lower than expected person and auto trips per household:** Multiple factors when combining the disaggregate data into a single value like total trips per household rather than percentages. The most likely factors are:
- CHTS households and total trips not being the same as the model due to different years and also the weighting of CHTS
- Small percentage deviation allowed in calibration of mode share over a large number of trips causes larger numerical difference (ex. transit mode choice with only 2% difference resulting in 120% overestimate of transit ridership compared to agency reported observed boardings). Shift between drive alone, shared ride 2, and shared ride 3+ have a direct impact on the vehicles per household calculation
- Using single average value by purpose for persons per vehicle for auto 3+ mode share

3. Updated regional plans, statewide model, or other factors influencing through trips and through trip VMT within the study area: The passenger vehicle through trips are extracted from the CSTDM and adjusted based on internal generated trips for the base year. The adjustment was applied to the interpolated years between the base and future years on the CSTDM. At the time the model was developed, the CSTDM did not include the SJV MPO regional plans. Since the development of the model, the CSTDM may have been updated and future forecasts also updated to reflect the plans and also the recovery from the recession.

4. Time of day turn movements do not match counts: The model was calibrated at a link level based on the time of day information recommended by the RTP Guidelines at a regional scale. Local factors such as land use activity, local congestion, intersection control, roadway network and TAZ detail, that influence turn movements and subregional travel were not calibrated. For metrics other than VMT by time of day and speed, local validation and potentially calibration is recommended. For turn movements, it is recommended that a method such as NCHRP 255 or 716 are applied rather than using the model volumes directly.

PREPARING THE SUBAREA MODEL INPUT FILES

The input file structure and content for the subarea model should be identical to the overall model, but more specific to the details and values of the model. The required changes are the high network, transit system, external gateways, and interregional trips. Other changes to land use and socioeconomics, zone system, and calibration factors are optional but recommended to at least confirm the reasonableness.

CREATING SUBAREA HIGHWAY AND TRANSIT

The example below uses the .NET and .LIN format. Editing in GIS is similar and the files can be edited in GIS or Cube native format, and transferred between each as described in the Importing\Exporting data from geodatabases.

1. Copy all original model files to a new directory
2. Open the master highway network

3. Identify the geographic coverage of the sub-area model and create a polygon from the Drawing Layer menu and then select New. A boundary file from a planning area, city limits, etc could also be used and loaded to select from instead and loading the model TAZ boundary file may also be useful.

4. Draw a polygon around the sub area, making sure all centroids that you wish to remain in the model are connected to roadways and minimizing gateways. Click to make the vertices of the polygon and double click to close. Zoom in to refine the lines as needed, then save with a name for later use.
5. Load all of the existing and future transit lines (if applicable).

6. Based on the extent of the sub-area model being developed, identify transit lines that are completely with the boundary and those cross the boundary but that might be included in the sub-area model (turning on stop nodes may be useful).

7. Using the Line Manager, remove all the lines that are not within the sub-area from each of the transit line files.
8. Save each the transit lines with the sub-area model name.
9. Using a text editor, edit the Public Transport System (PTS), Fare System (FAR), and Factors (FAC) files to remove the lines no longer needed. Keeping the same mode number as in the original model is preferred so the sub-area and full model can transfer data easily back and forth. Save files with the sub-area model name. Remember to change the file type from TXT to all.
10. Repeat steps 6-9 to remove all transit lines that cross the boundary of the study area and save files as a new name.

11. Delete all nodes outside of the model sub-area
12. The links and nodes outside of the polygon will be deleted, keeping those within (but not crossing) the polygon only.

UPDATING GATEWAYS FOR SUBAREA

The highway network that was previously internal to the model and is not external to the model is represented by gateways at the point the model network was extracted in the step above. To create new gateways:

1. Determine the gateway numbers to be used (1-100 are used for externals).

2. Copy an existing centroid connector and paste the link, connecting to the network link and having the new node be the gateway number selected, drawing the centroid connector in the direction of travel.

3. The endpoint of the new centroid connector will prompt for a node number from the unused zone numbers. Use the node number determined in Step 1 for each location.
4. Save the network

UPDATING INTERREGIONAL TRAVEL FOR SUBAREA

Although the model will run without updating these files, the model should not be used without updating the values or the results will be meaningless. For more details see Updating Interregional Travel

Subarea Gateway Station Weights

The station weights are productions and attractions by purpose at each gateway that interact with the trips generated within the study area. This process is the same as described in Gateway Station Weights, with the exception that the gateways are different at locations and should have different values.

Subarea Through Trips

The other piece of information needed for the new subarea network is the trough trips. Since the model is a subarea from a larger model, the through trips can be obtained by running select link on the original model (or a larger model containing the subarea like the statewide model) and outputting the OD matrix, using big data, or assumed to be similar to the original model depending on the scale difference between
the original and subarea model. Once the values of through trips are determined, the process described to update the Through Trips can be implemented.

UPDATING OTHER DETAILS FOR SUBAREA

Although the model will run without updating these files, the current values were determined for regional planning and should not be used within confirming they are appropriate for subarea model.

TAZs

Keeping the zone number of externals 1-100 and the internals from 101 to the max number needed is required. It is recommended internal zones be renumbered and TAZs split/joined as needed. Keeping a relationship between the subarea zone number and the new zone number is also recommended. If zone numbers are going to be changed, the relationship to the previous land use/TAZ number are critical to maintain so the land use is allocated back in the same place. If the number of zones exceeds the previous model, renumbering the nodes will also be required. Renumbering non-centroids is only recommended if needed and is recommended as the final step in the process since turn penalty and A-B link designations with counts may also need to be updated.

After determining the zone numbers, renumbering the

1. Update the TAZ boundary and the TAZ_Data tab in VMIP2_SCENARIOPrep.XLSX (particularly the developed and total acres)
2. Create an equivalency between the previous node numbers and the new node numbers (possibly only for TAZs) where the first column is the current node number and the second is the new node number. Use the VMIPZoneRenumber.csv as a template.
3. Modify the VMIP2_NodeRenumber.s script to read in the correct network and correlation file
4. Run the script
5. Verify the process worked correctly

Land Use and Special Generators

At a minimum, updating the control totals for each zone and verifying special generators are accurate for each zone. If zone changes are made from the original model, verify the control totals are the same before updating with refined data to ensure that the split\aggregation of zones is working properly.
Socioeconomic Details

Verify that the control total, TAZ allocation, and socio-demographic data for each zone is accurate. This is both the **SED_Cross_CasRates_Template** for the residential and the **TAZ_Data** for the interregional travel of households and the income by job type.

Calibration Factors

The average vehicle occupancy, value of time, maximum walk\bike distance and similar values in the calibration parameters should be evaluated for the subarea model in relation to the overall model. Updated values can be implemented in the scenario keys as needed. If the values are changed, update the top level Scenario and the values will carry forward to each child scenario. A new catalog should be created with a distinct name so factors that are not often used are clearly different. Also document the changes in **VMIP2_XX_Parameters.xlsx** and Subarea Model Development Report.