CAMBRIDGE SYSTEMATICS

Think Forward

Corridor Review & Definition

presented to

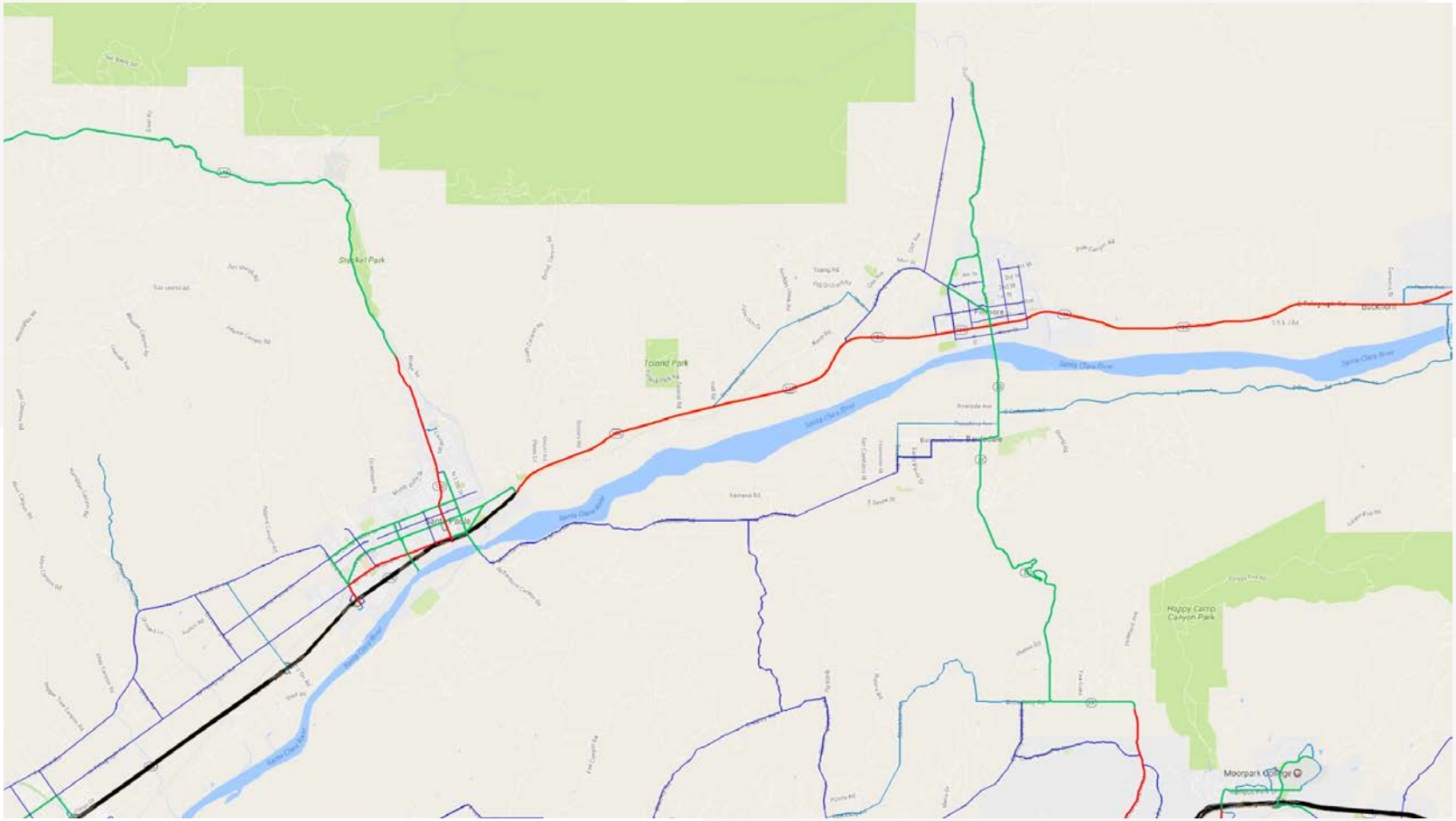
Caltrans

presented by

Cambridge Systematics, Inc.

2/22/2017

VEN-126 Corridor



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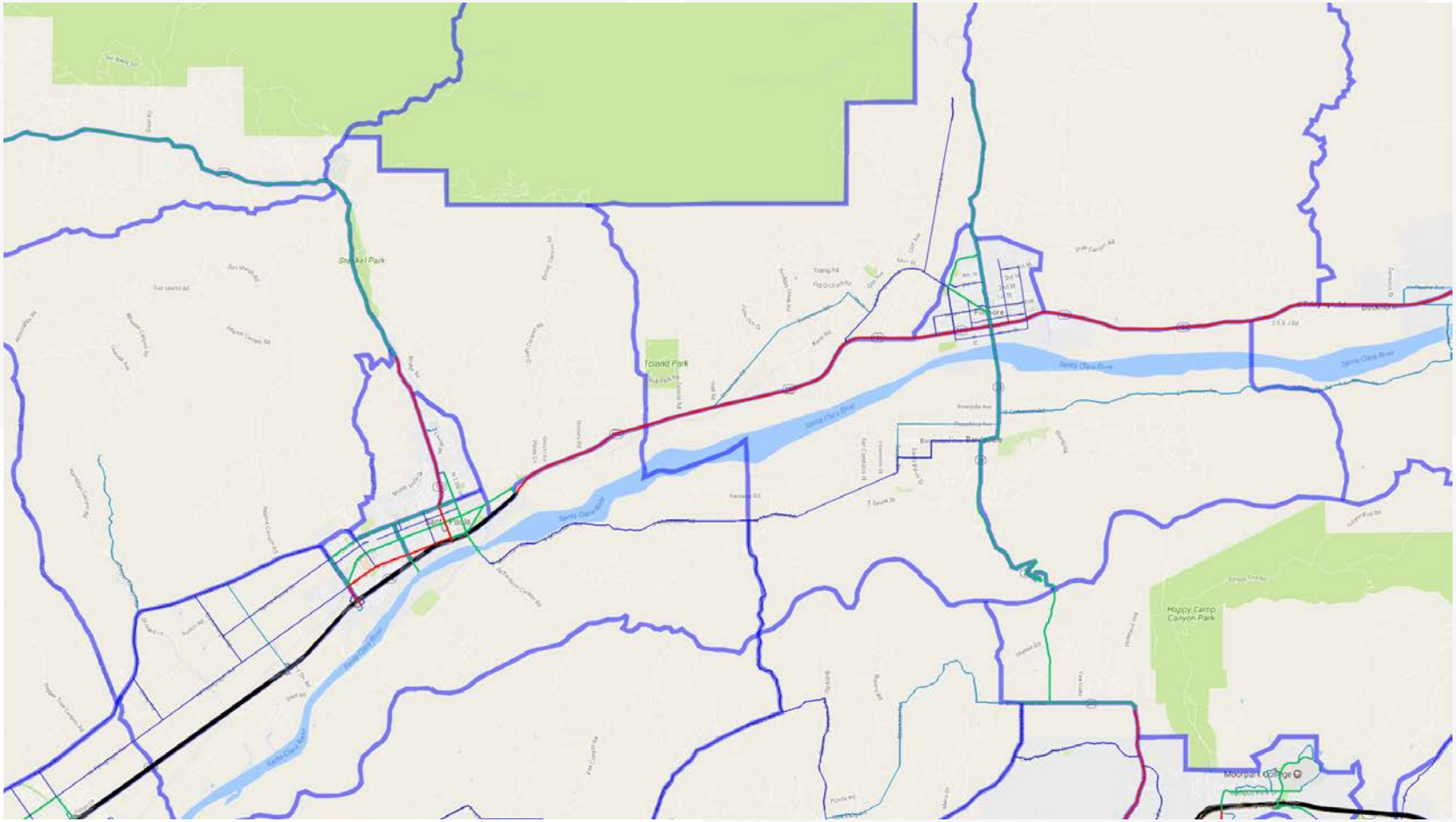
VEN-126 Corridor



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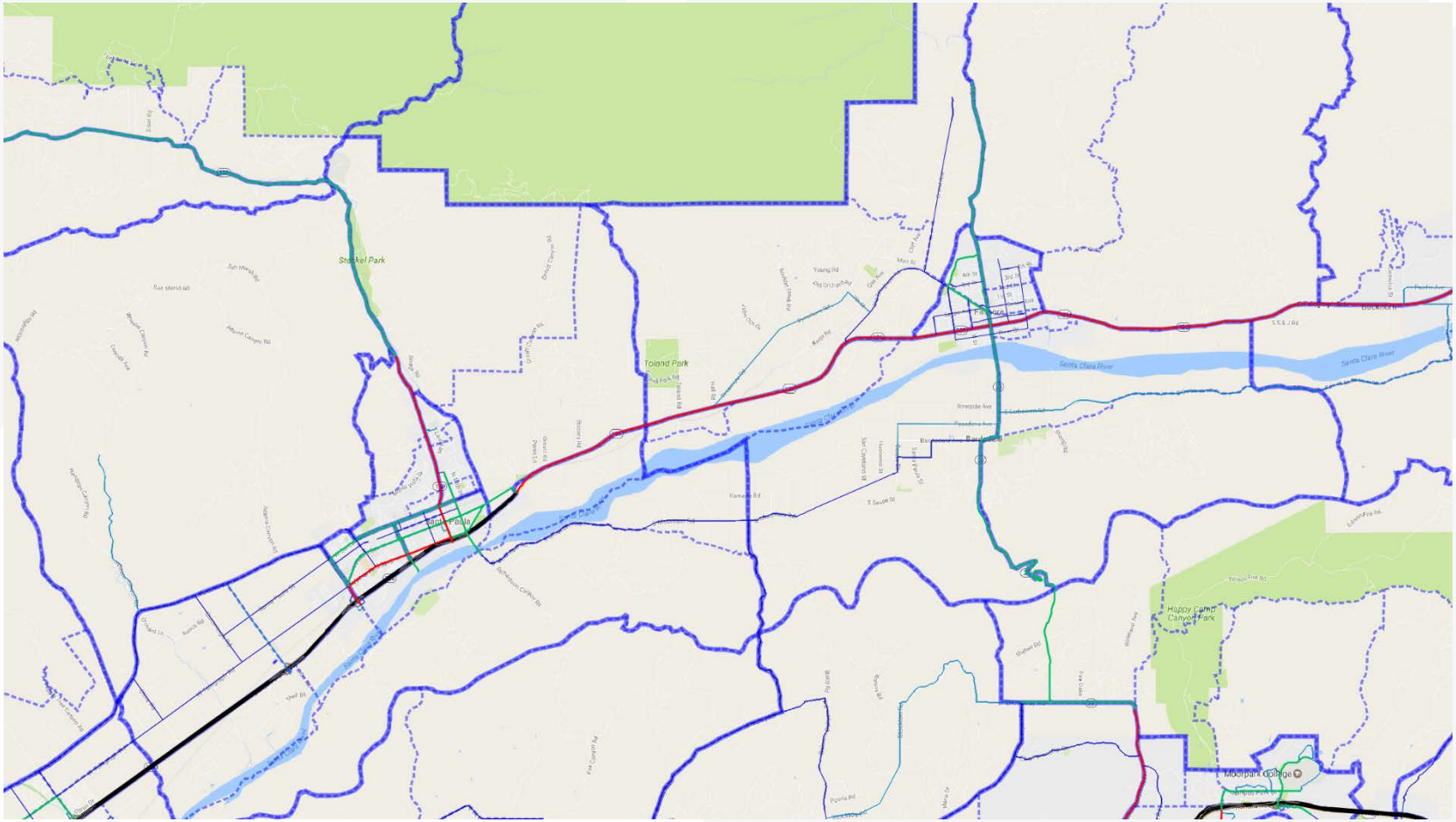
VEN-126 Corridor



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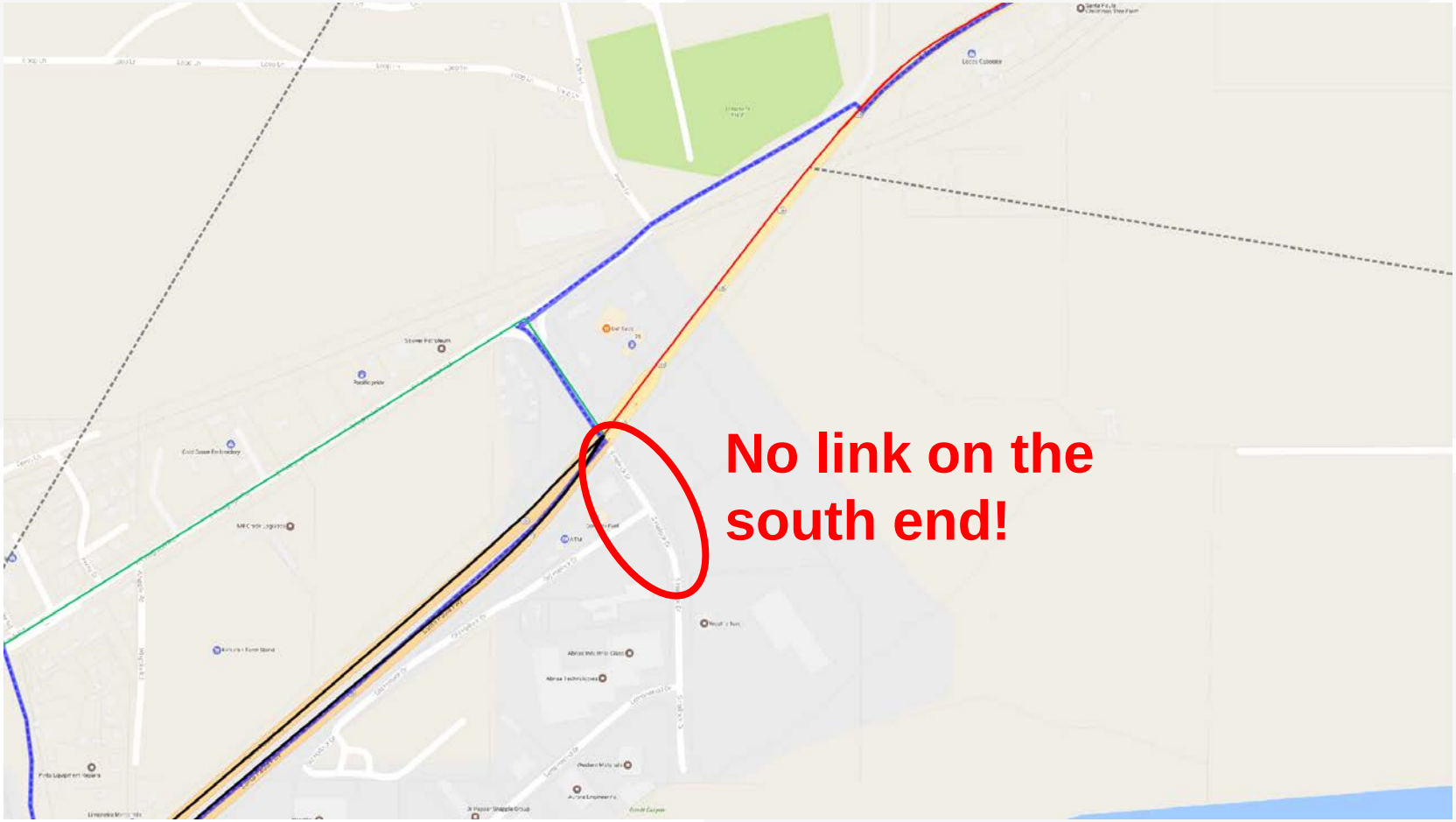
VEN-126 Corridor – Hallock Dr



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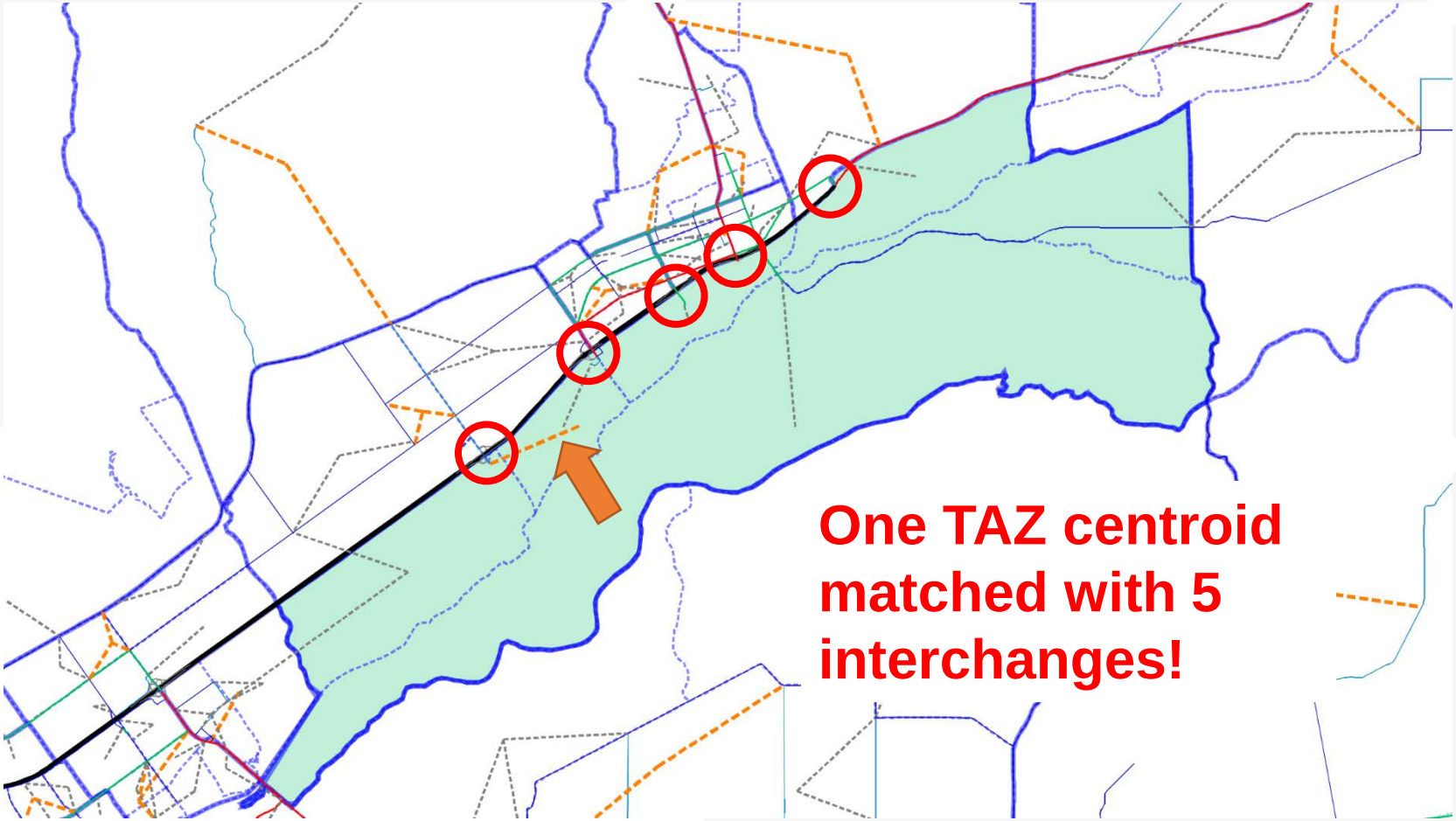
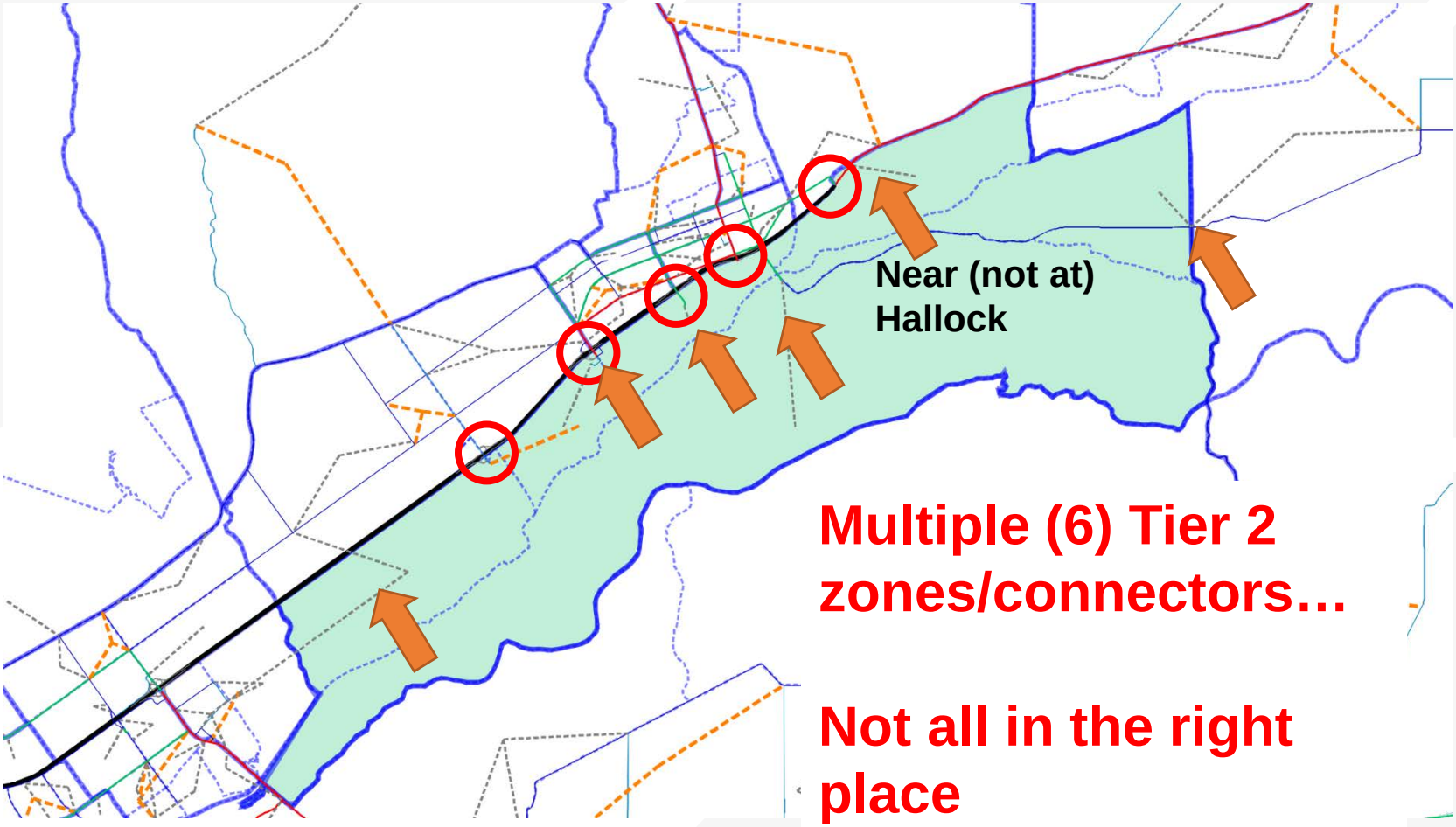
Options to Address

- Look for existing data?
  - Traffic study counts, forecasts
- Manually allocate TAZ Centroid Volumes?
- Consider disaggregating zones
  - Tier 1 → 2
  - Custom splits beyond Tier 2?

Relevant Zones/Centroids



Relevant Zones/Centroids



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Using model growth?

- Tier 1 CC is the best bet if we have no

Existing Data/Studies

- Use existing count data as available
- Work with local jurisdictions to determine growth plans
  - Traffic studies?
  - Land use plans (General or specific plans)
  - Jurisdiction staff knowledge?
  - Use model growth % and apply to count?
- Evaluate options and select the most reasonable

Last Resort!

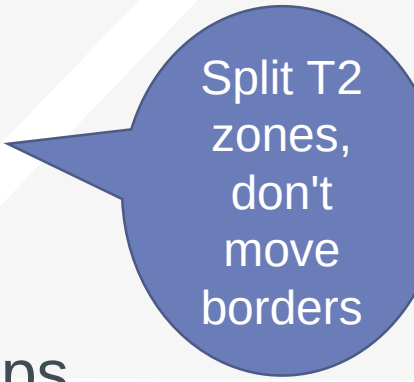
Other methods better

Manual Allocation

- Identify travel-shed to interchange based on Tier 2 Zones
- Look at Tier 2 Mode Choice results to approximate share of Tier 1 Connector
- Use this share as an estimate for the missing intersection leg

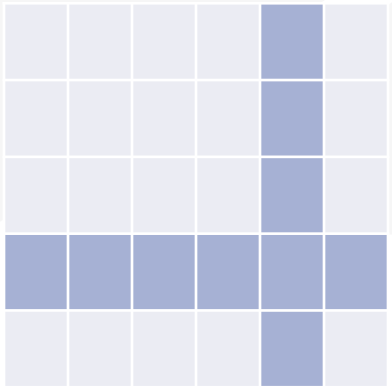
Subarea Modeling

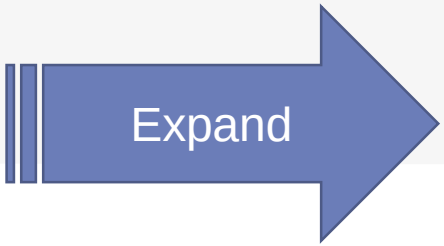
- Adjust Centroid connector placement
- Are Tier 2 zones the right geography
  - » If not, consider making further refinements
- Identify % share of trips in each
  - » Use Tier 2 Mode Choice results, vehicle trips
  - » Origins and Destinations vs. Productions and Attractions! *(Future Topic)*
- Revises network and OD matrix files
- Assign the disaggregated matrix



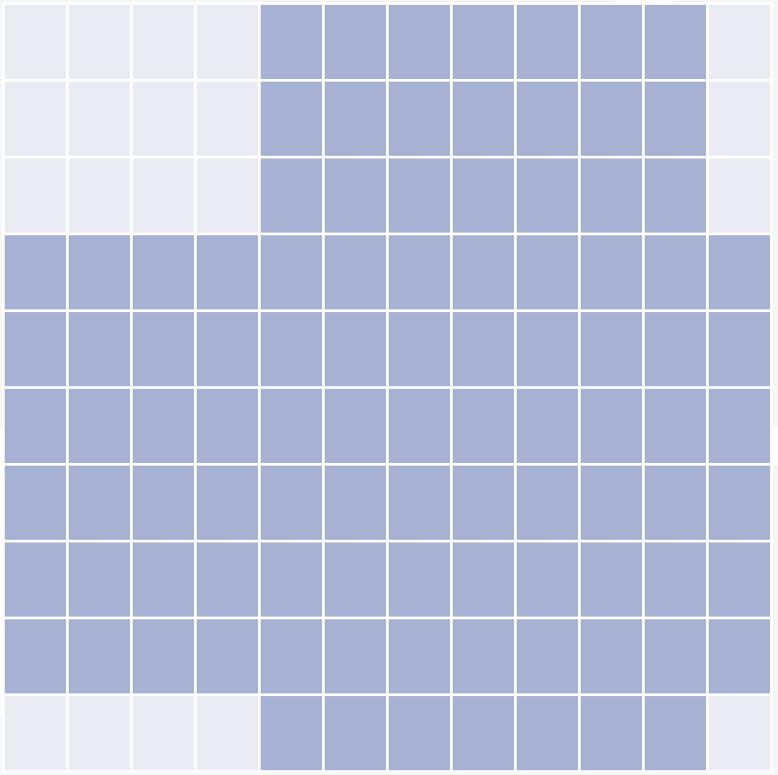
Subarea Matrix Expansion

Original T1





Expanded T2



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Subarea Options

- Simplest (often best in this case):
  - Expand the OD table and run **assignment only**
- More difficult:
  - Update complete SCAG model
  - Make subarea Tier 2 or custom zones "Tier 1" in a modified model
  - Borrow zones from elsewhere, or attempt to add to the total
  - Run either full feedback or a single loop

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Think Forward

Automated Data Preparation for AQ Analysis

presented to

Caltrans District 7

presented by

Cambridge Systematics, Inc.

Chao Wang, Sean McAtee

February 22nd and 23rd 2017

Procedures of Data Preparation for AQ Analysis

- Re-run SCAG models
  - Code the project in the network
  - Re-run the traffic assignment step only in most cases
- Extract data from SCAG models (Practice 1)
  - Define project links
  - Extract data from traffic assignment results

In previous version of the AQ Tool

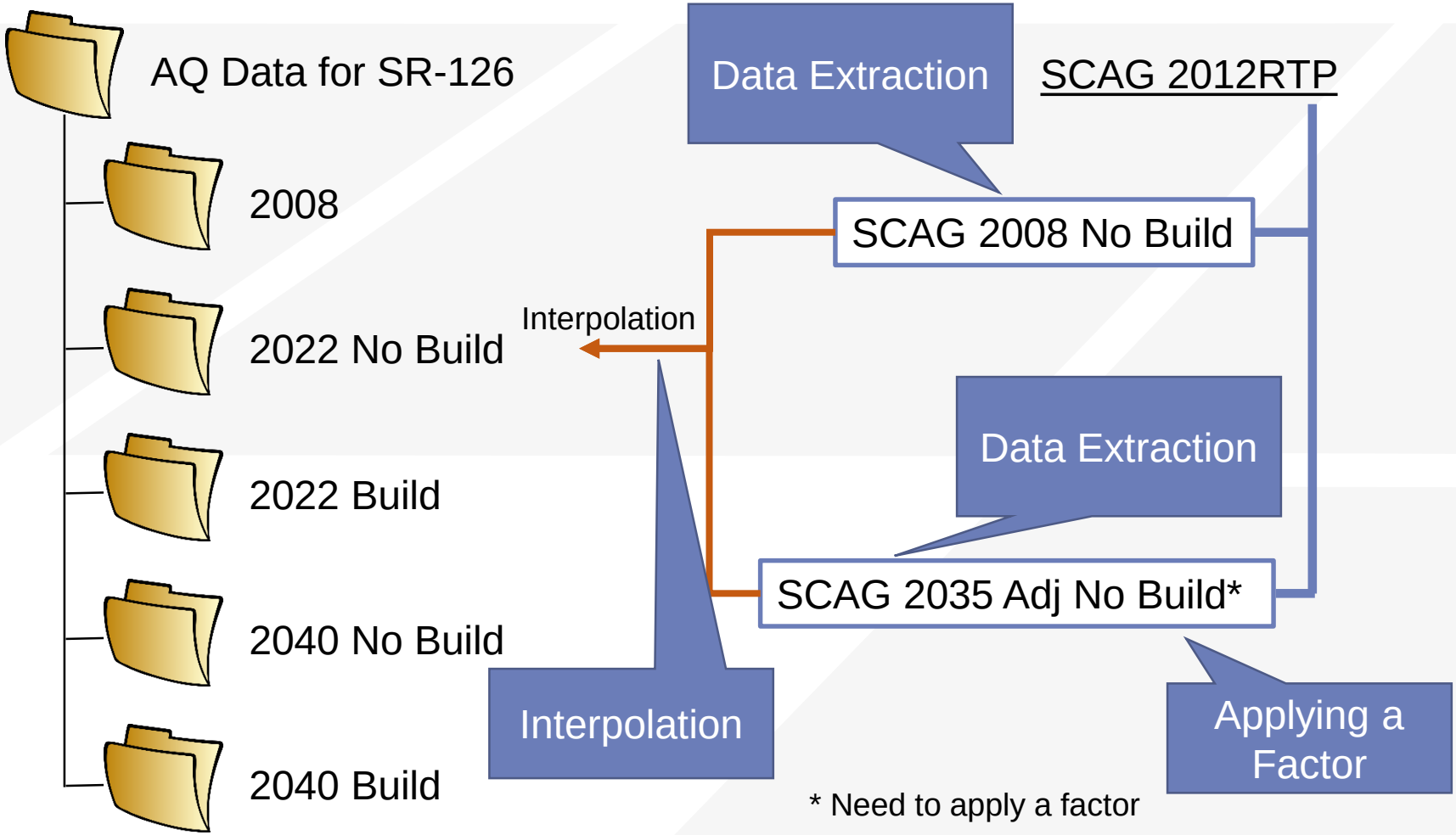
- Apply a factor to adjust modeled traffic volumes, and update the congested speed (Practice 3)

New function added to the AQ Tool

- Interpolate/extrapolate traffic volumes for opening year or future year (Practice 2), and update the congested speed (Practice 3)

New function added to the AQ Tool

Match of AQ Data Needs and SCAG Models



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Input

- SCAG highway network
  - Define project links
  - Obtain the link attributes
- Excel file
  - Output template
  - with description of the project links
- Traffic assignment bin files
  - Modeled volume
  - Congested speed

Data Extraction Directly from the SCAG Model

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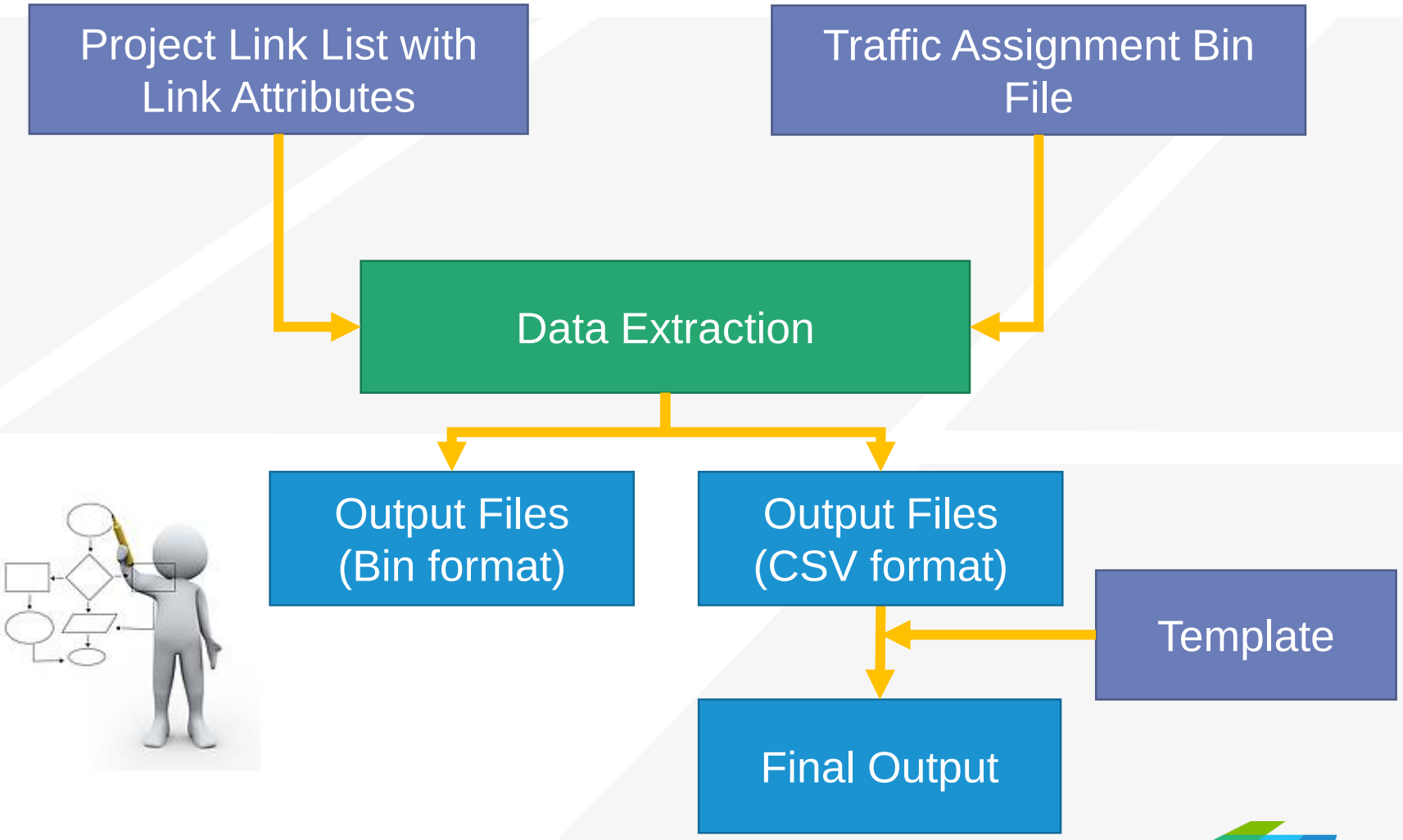
Flow Chart (Data Extraction)



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Output

- Four CSV Files
  - Two freeway csv files, one for each direction
  - One ramp csv file
  - One arterial csv file

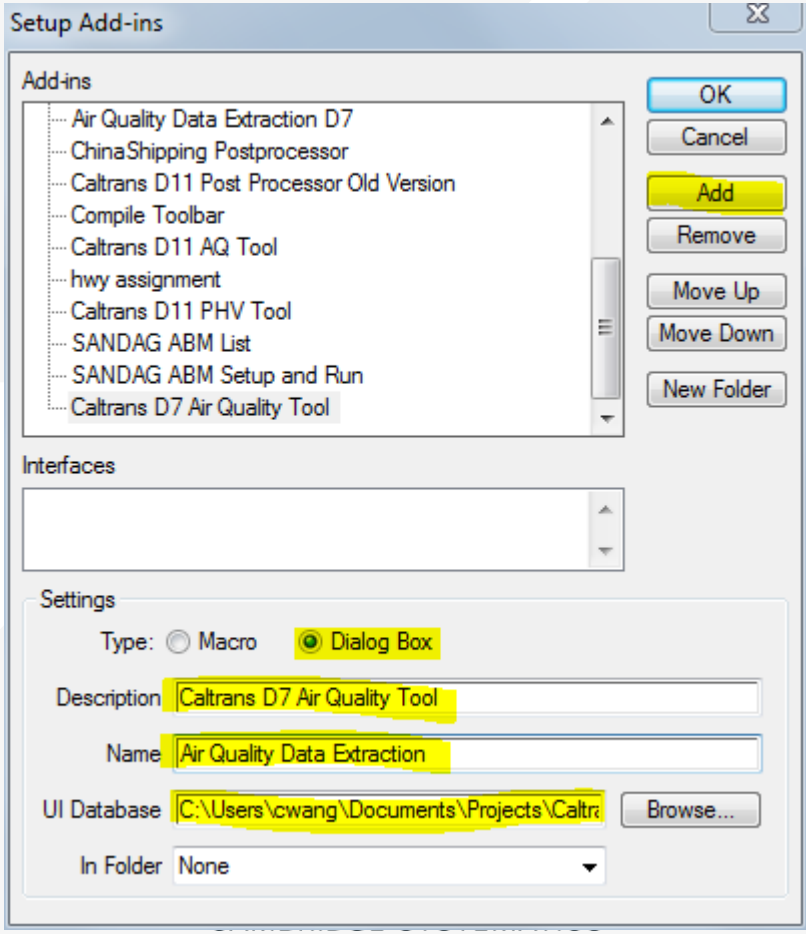
- Copy to the Excel Template File
  - Copy values only

Exercise 1: Run the AQ Tool

- Install the AQ Tool (TransCAD Add-ins)
- Run the function “Data Extraction”
- Examine the results

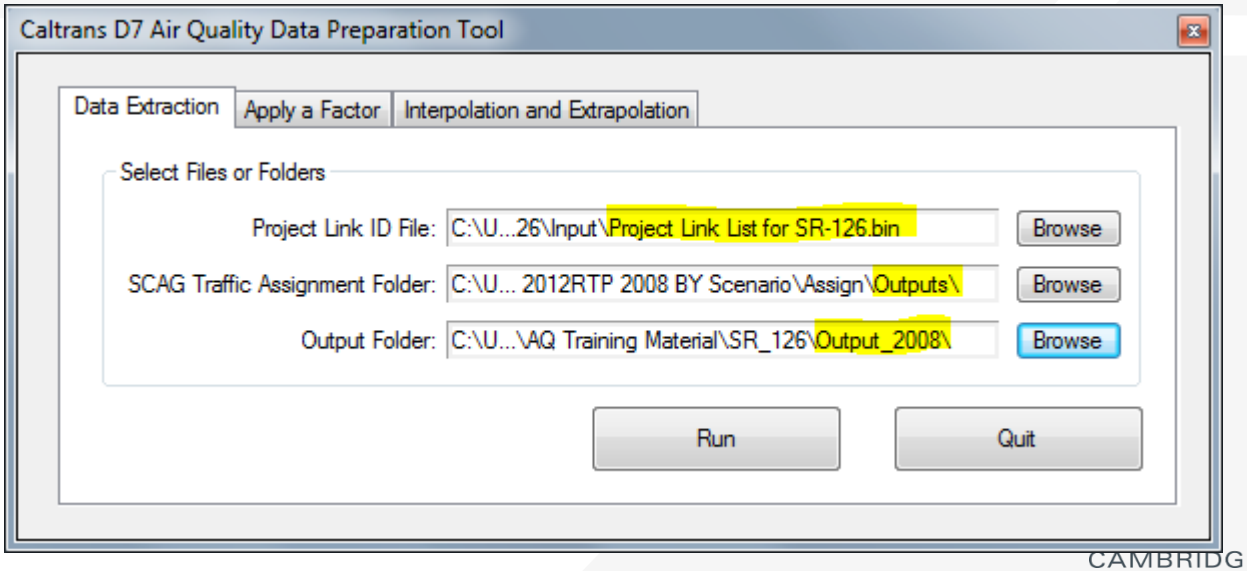
Exercise 1-1: Install the AQ Tool

- Step 1: In TransCAD, click Tools → Setup Add-Ins
- Step 2: In the Setup Add-ins window
  - Click the button “Add”
  - For Settings → Type, select “Dialog Box”
  - For Settings → Description, enter a description of the tool
  - For Settings → Name, enter “Air Quality Data Extraction” (must be exactly the same, case sensitive, no quotation marks)
  - Click the “Browse” button to specify the UI Database, which is “d7_airquality_dataextraction.dbd” in the folder of “\Tool”.
  - Click the “OK” button to close the window.



Exercise 1-2: Run “Data Extraction”

- Step 3: Select the AQ tool from Tools → Add-Ins
- Step 4: On the “Data Extraction” tab, specify the inputs and output folder, and click “Run” to run the tool
  - Project Link ID file is “\SR_126\Input\Project Link List for SR-126.bin”
  - SCAG Traffic Assignment Folder is “\SCAG 2012RTP 2008 BY Scenario\Assign\Outputs\”
  - Output Folder is “\SR_126\Output_2008\”



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Exercise 1-3: Create the Final Output

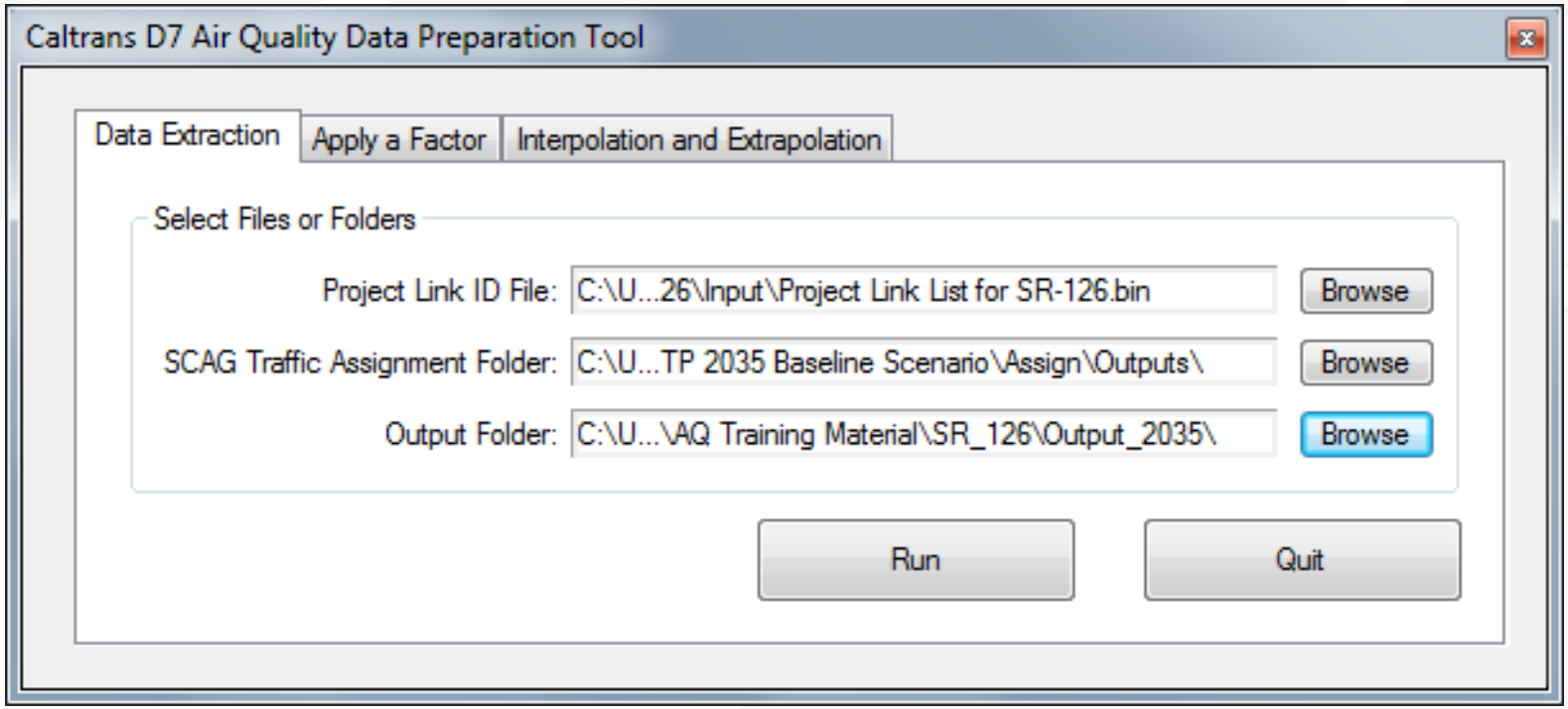
- Step 5: Open the csv files* in Excel and copy values to the corresponding spreadsheet in the template Excel file "\SR_126\SR-126 Air Quality 2008.xlsx"

Tips

- When copy from the CSV file, use Ctrl + Shift + → (pressing three keys together) on the keyboard to select all columns, then use Ctrl + Shift + ↓ to select all rows
- When paste to the Excel file, paste values only to preserve the format in the Excel file. To do that, right click the cell where you want to paste in Excel and choose in the popup window.

Exercise 1-4: Run the 2035 Scenario

- Repeat Exercise for the 2035 Baseline. The SCAG Traffic Assignment Folder is “\SCAG 2012 RTP 2035 Baseline Scenario\Assign\Outputs”



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Applying a Factor

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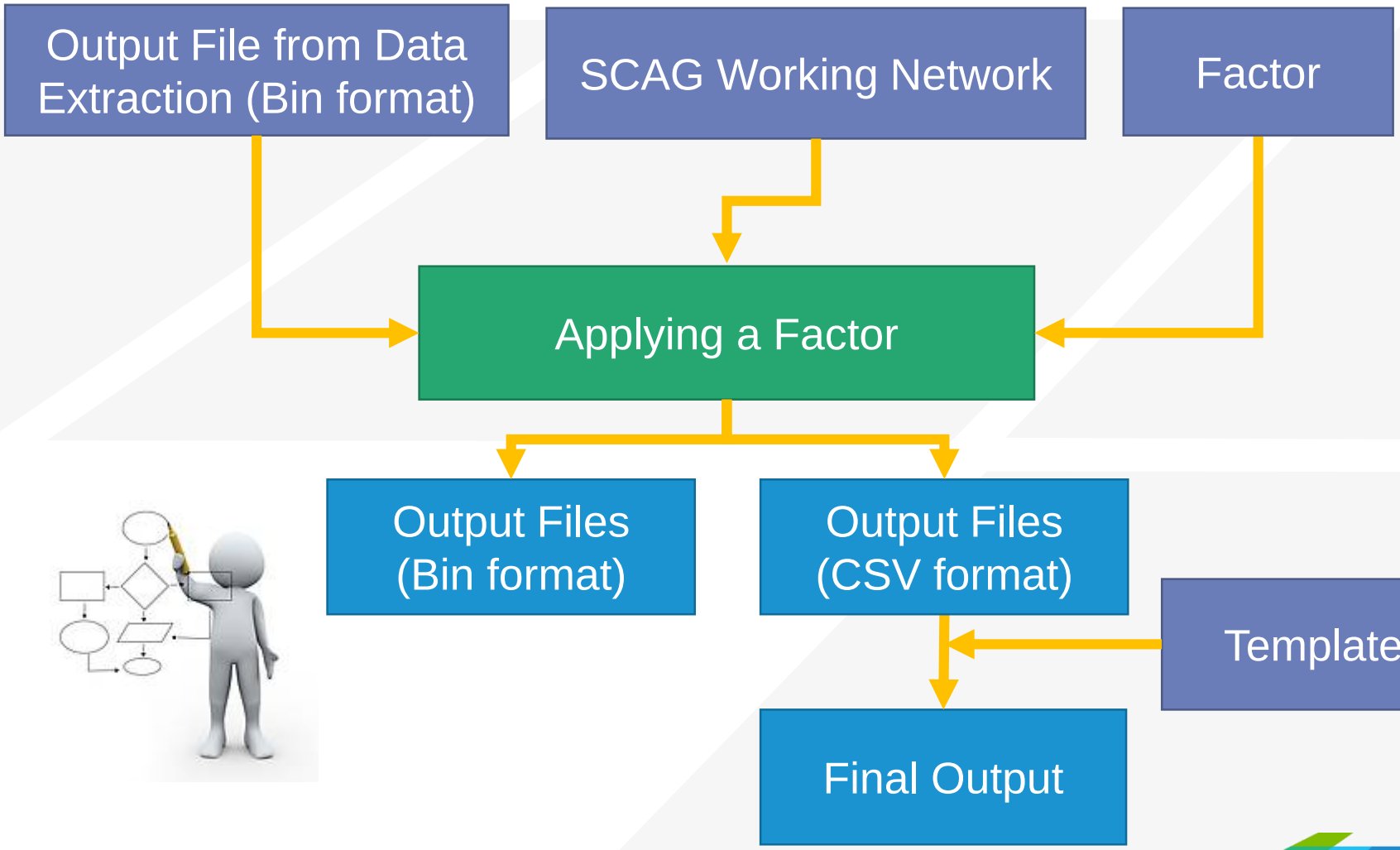
Flow Chart (Applying a Factor)



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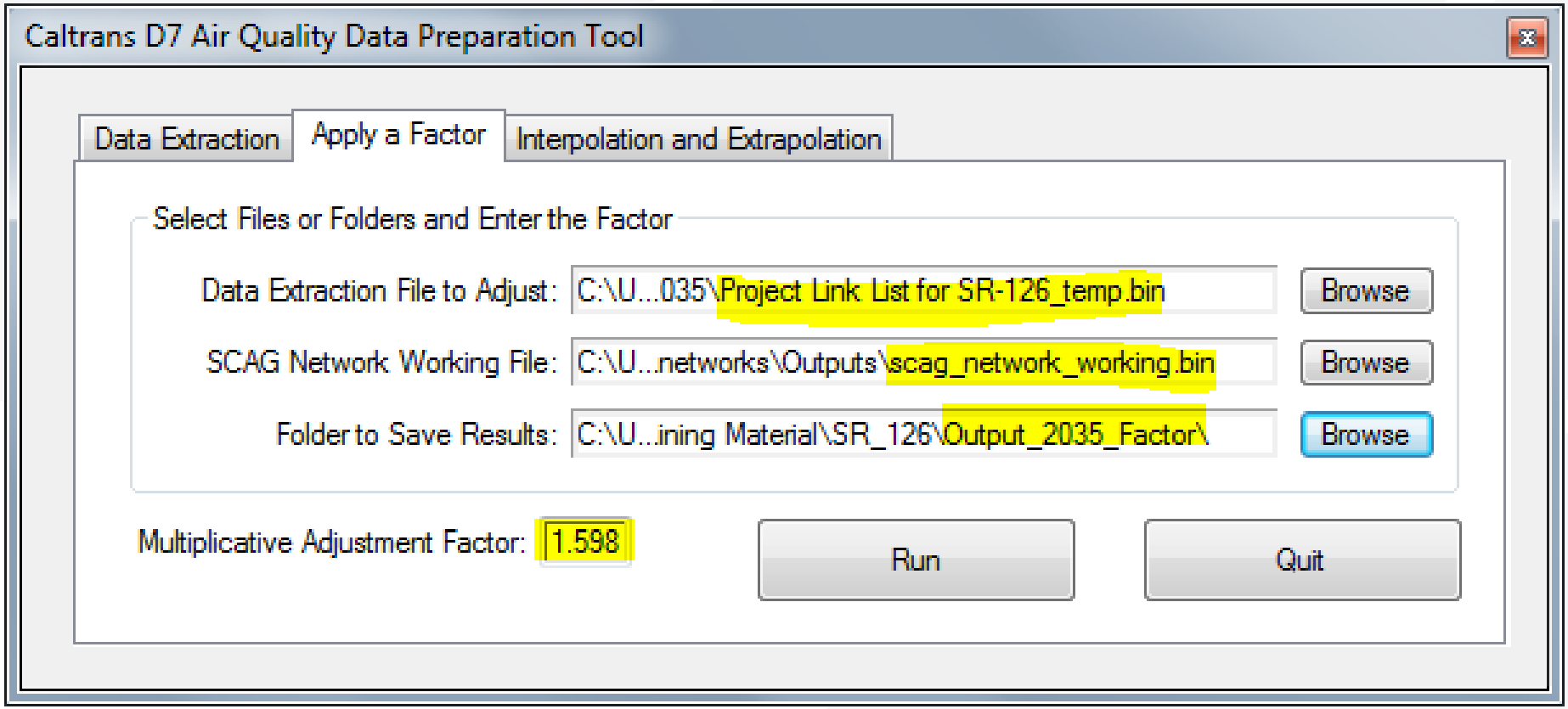
Exercise 2-1: Run “Apply a Factor”

- Step 1: Select the AQ tool from Tools → Add-Ins
- Step 2: On the “Apply a Factor” tab, specify the inputs and output folder, and click “Run” to run the tool
  - Data Extraction File to Adjust is “\SR_126\Output_2035\Project Link List for SR-126_temp.bin”
  - SCAG Network Working File is “\SCAG 2012 RTP 2035 Baseline Scenario\networks\Outputs\scag_network_working.bin”
  - Output Folder is “\SR_126\Output_2035_Factor\”
  - The adjustment factor is 1.59849

Exercise 2-1: Run “Apply a Factor”



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Exercise 2-2: Create the Final Output

- Open the csv files* in Excel and copy values to the corresponding spreadsheet in the template Excel file “\SR_126\SR-126 Air Quality 2035.xlsx”

Interpolation and Extrapolation

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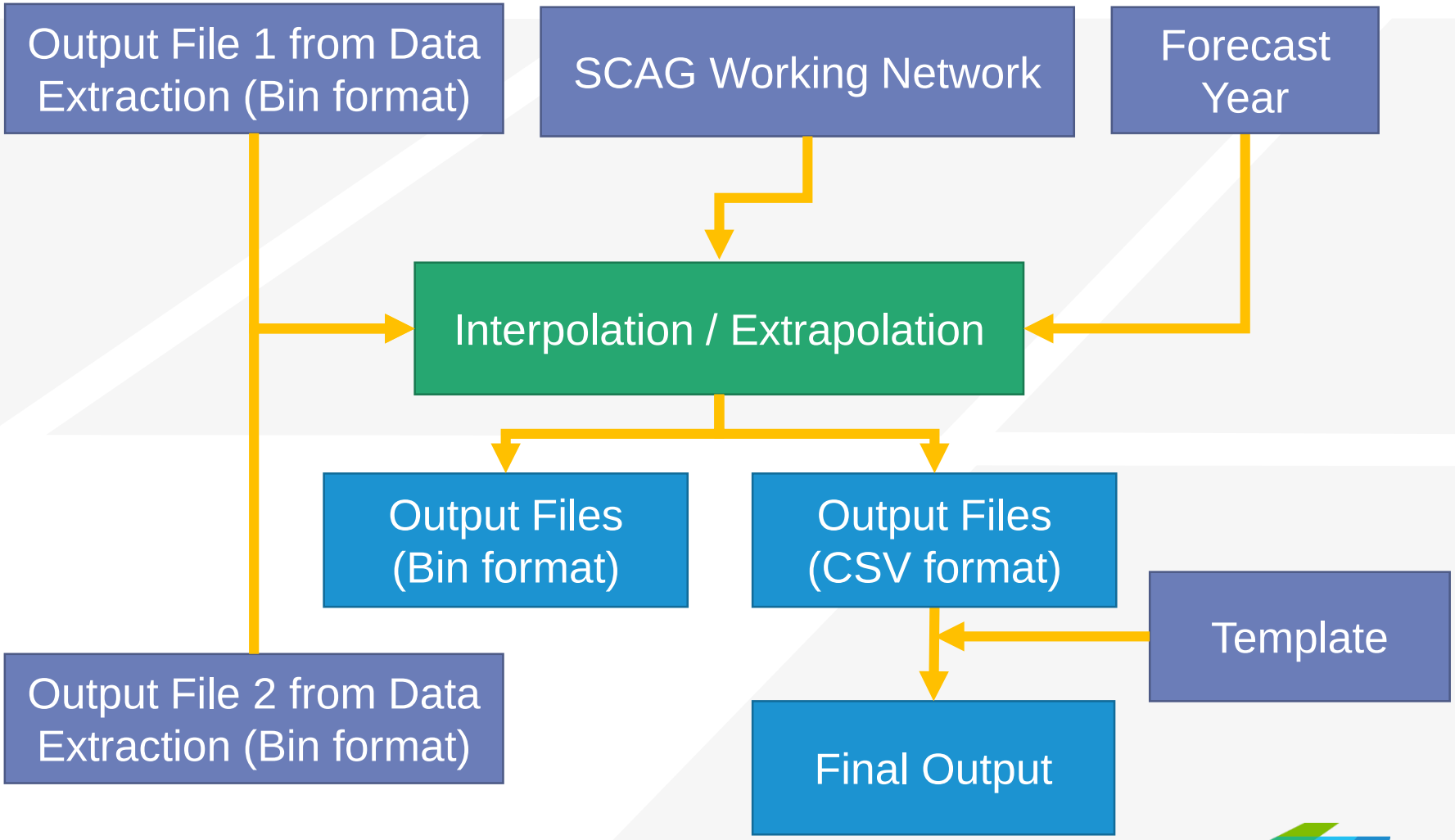
Flow Chart (Interpolation/Extrapolation)



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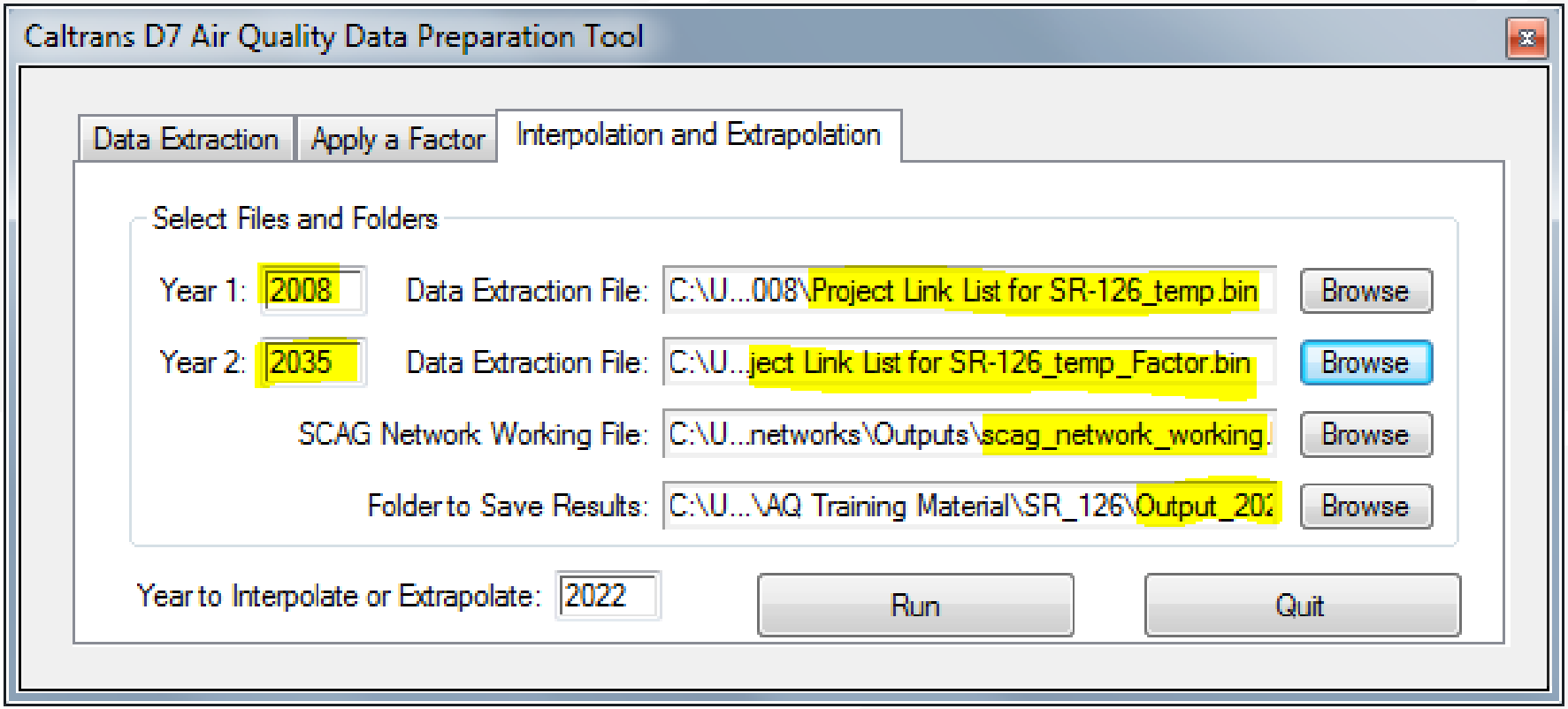
Exercise 3-1: Run “Interpolation and Extrapolation”

- Step 1: Select the AQ tool from Tools → Add-Ins
- Step 2: On the “Interpolation and Extrapolation” tab, specify the inputs and output folder, and click “Run” to run the tool
  - Year 1 is 2008, the Data Extraction File is “\SR_126\Output_2008\Project Link List for SR-126_temp.bin”
  - Year 2 is 2035, the Data Extraction File is “\SR_126\Output_2035_Factor\Project Link List for SR-126_temp_Factor.bin”
  - SCAG Network Working File is “\SCAG 2012 RTP 2035 Baseline Scenario\networks\Outputs\scag_network_working.bin”
  - Output Folder is “\SR_126\Output_2022\”
  - Year to interpolate or extrapolate is 2022

Exercise 3-1: Run “Apply a Factor”



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Exercise 3-2: Create the Final Output

- Open the csv files* in Excel and copy values to the corresponding spreadsheet in the template Excel file “\SR_126\SR-126 Air Quality 2022_Interpolate.xlsx”

Prepare the Project Link ID Input File

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Exercise 3: Prepare Input Files

- In Excel, add records
- Remove records
- Re-order records
- Export to CSV files, correct the files in Notepad++
- Export to Bin files and modify the data type in TransCAD

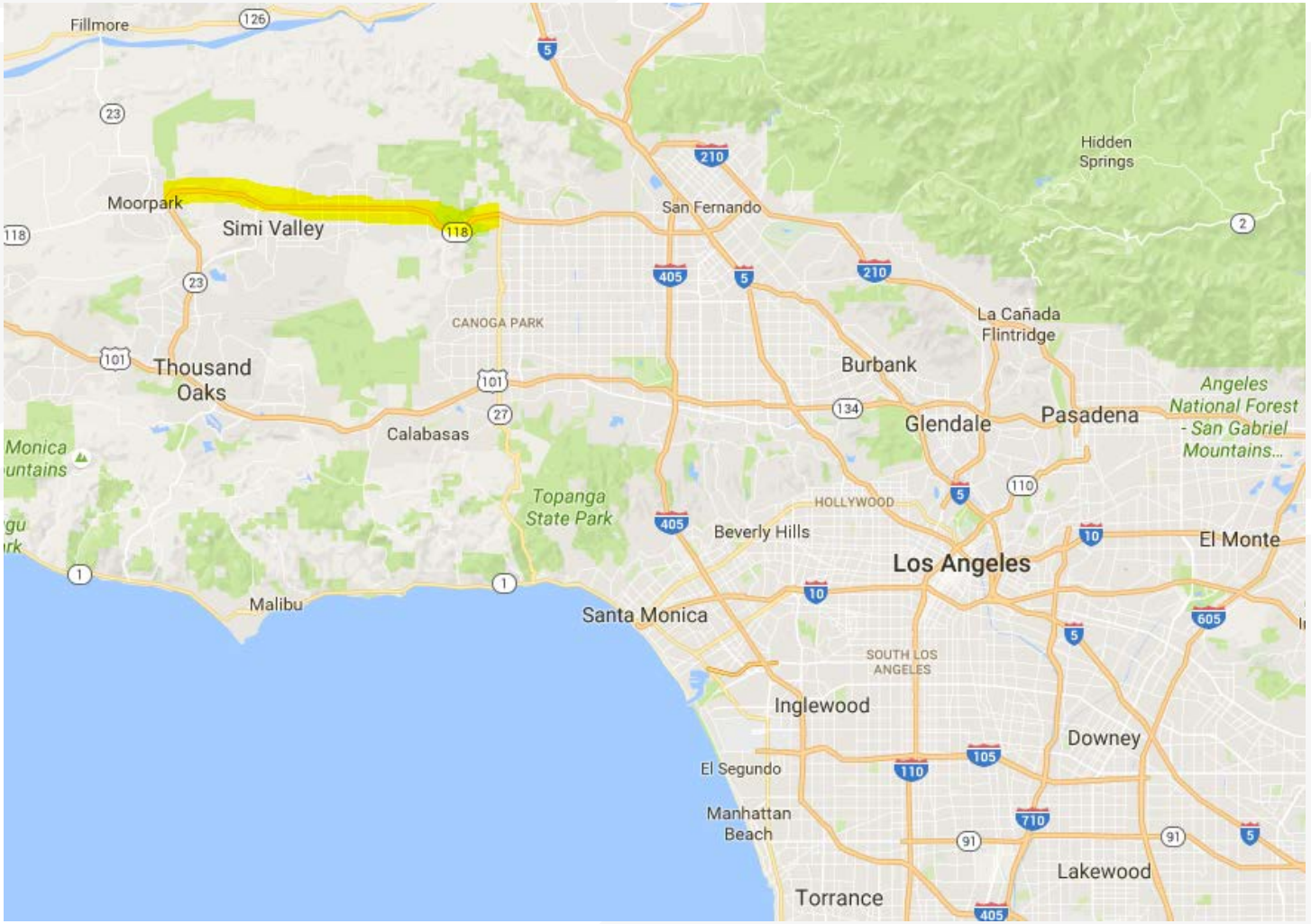
Prepare the Project Link ID Input File in TransCAD

- Step 1: Navigate to the Project Location
  - Purpose: Open the highway network and display project links
  - TransCAD operations:
    - Open a geographic file
    - Navigate a map
    - Show the node layer
- Step 2: Assign and review project link IDs
  - Purpose: Assign project link IDs to each link to be included in the AQ analysis
  - TransCAD operations:
    - Add a new field in the link attribute table
    - Use the “info” tool to enter new link attributes
    - Create a selection set by condition
    - Create labels

Prepare the Project Link ID Input File in TransCAD (continued)

- Step 3: Save the dataview as a *.bin file
  - Purpose: Clean and organize the highway network dataview to show only what will be saved as a *.bin file
  - TransCAD operations:
    - Show only records of interest
    - Show only fields of interest
    - Sort records in TransCAD
    - Save a dataview as a *.bin file
- Step 4: Modify the table – add fields, rename fields, and re-organize fields
  - Purpose: Make sure the project ID input file has the same fields as what was used for the SR-126 and the SR-118 examples.
  - TransCAD operations:
    - Add new fields

SR - 118



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Step 1 : Navigate to the Project Location

- Purpose: Open the highway network and display project links
- TransCAD operations:
  - Open the geographic file

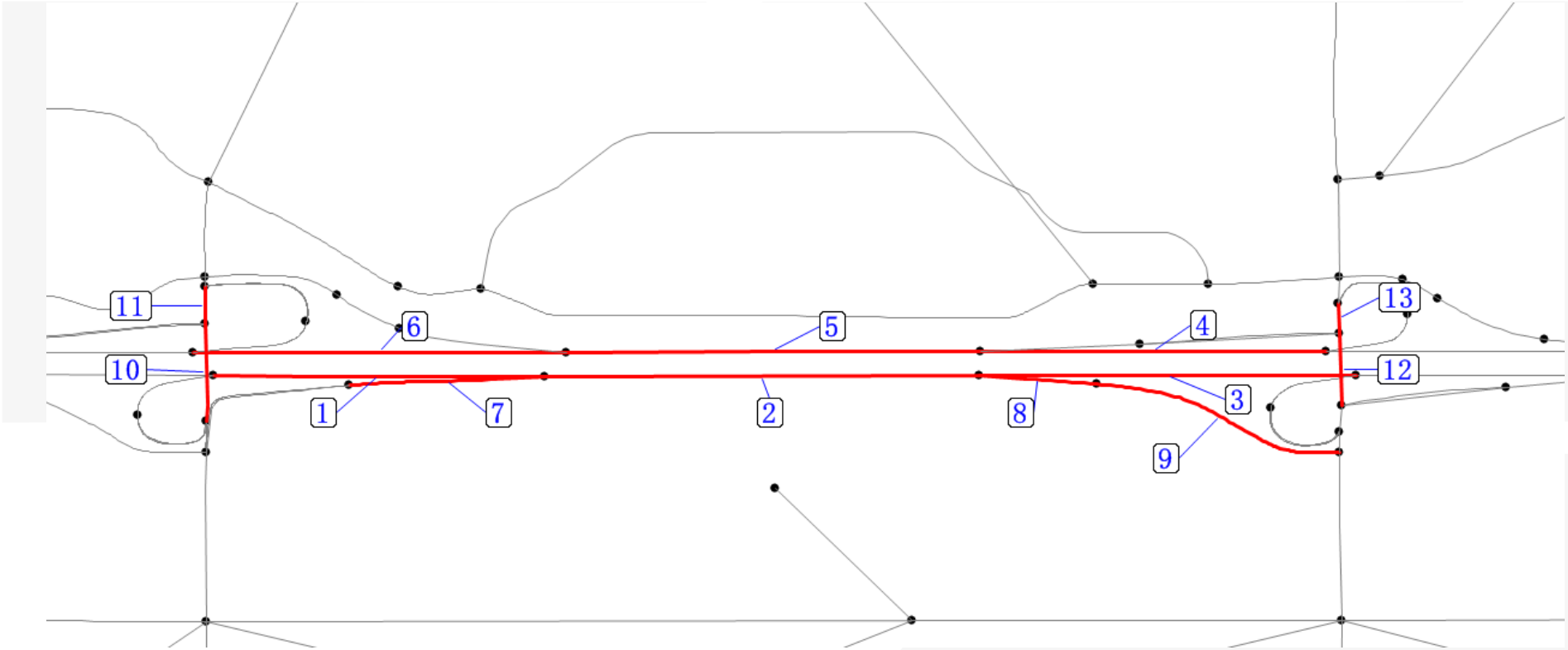
    \AQ Training Material\SCAG 2012RTP 2008 BY Scenario\networks\Outputs\ scag_network_working.dbd

  - Navigate the map
  - Show the node layer

Step 2: Assign and review project link IDs

- Purpose: Assign project link IDs to each link to be included in the AQ analysis
- Detailed Steps:
  1. Add a new field “Proj_Link_ID” in the link attribute table
  2. Select the 13 project links by pointing on each link
  3. Use the “info” tool to enter “Proj_Link_ID” for each of the 13 links
  4. Label “Proj_Link_ID” on the 13 links
- Hints:
  1. Dataview → Modify Table
  2. Selection Toolbox →
  3. Main Toolbox →
  4. Selection Toolbox → →

Project Link IDs used in the Practice



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Step 3: Save the dataview as a *.bin file

- Purpose: Clean and organize the highway network dataview to show only what will be saved as a *.bin file
- Detailed Steps:
  1. Show only records of interest
  2. Show only fields of interest (“ID”, “Length”, “Proj_Link_ID”, “Road Name”, and “Road Type”)
  3. Sort records in TransCAD by “Proj_Link_ID”
  4. Save the dataview as a *.bin file

     File → “Save As” → save as type *.bin

Step 4: Modify the table – add fields, rename fields, and re-organize fields

- Purpose: Make sure the project ID input file has the same fields as what was used for the SR-126 and the SR-118 examples.
- Hints:
  1. Can add fields, rename fields and re-organize fields by

     Dataview → Modify Table
  2. Rename “ID” to “SCAG_Link_ID”, “Proj_Link_ID” to “Project_Link_Number”, and “Road Type” to “Facility_Type”.
  3. Make sure “Facility_Type” is “Fwy –MF” for freeway links, and contains the word “Ramp” or “ramp” for ramp links.
  4. Add a new “ID” field, whose values are sequential from 1 to the number of project links.
  5. All other fields in the SR-126 and the SR-118 examples are optional, but may be very helpful. Users can also add his/her own fields for a better description of the links.

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Think Forward

Data Preparation for AQ Analysis

presented to

Caltrans District 7

presented by

Cambridge Systematics, Inc.

Chao Wang, Sean McAtee

December 13th and 14th 2016

Overview of the SR-126 Project

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SR - 126

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The SR-126 Project

- Project limit
  - SR-126 from SR-150 to SR-23
- Project
  - Convert SR-126 from “continuous left turn arterial” to “fully divided arterial”
- Opening Year
  - 2022
- Future Year
  - 2040

Links for the SR-126 Project AQ Analysis

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What Links should be included for an AQ Analysis

- Project links
- Links connected to project links
  - Usually include links that are within one intersection of the project links
- Optional: Links on alternative routes
  - A project might introduce more traffic on project links due to higher capacities or free flow speeds, therefore leading to more Vehicle Miles Traveled (VMT) and possibly more emission.
  - However, this project should have reduced traffic on alternative routes, and then less emission on alternative routes.
  - In this situation, it is better to include links on alternative routes in the AQ analysis.

Overview of the Air Quality Analysis Process

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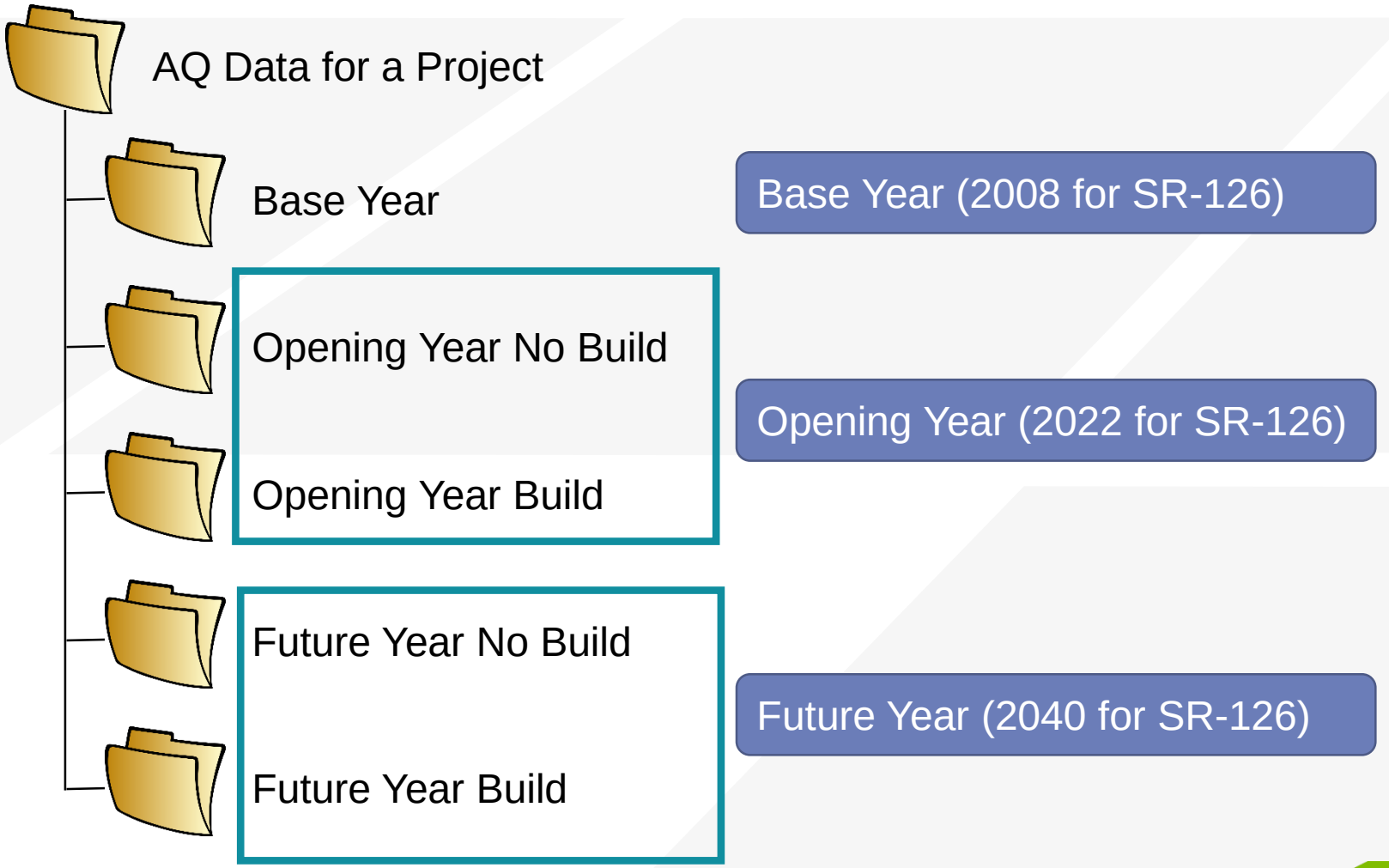
Air Quality Analysis Data Needs

- Key information for an Air Quality (AQ) analysis
  - Total Volume
  - Truck Percent
  - Congested Speed
  - Vehicle Miles Traveled (VMT)

Air Quality Analysis Data Needs



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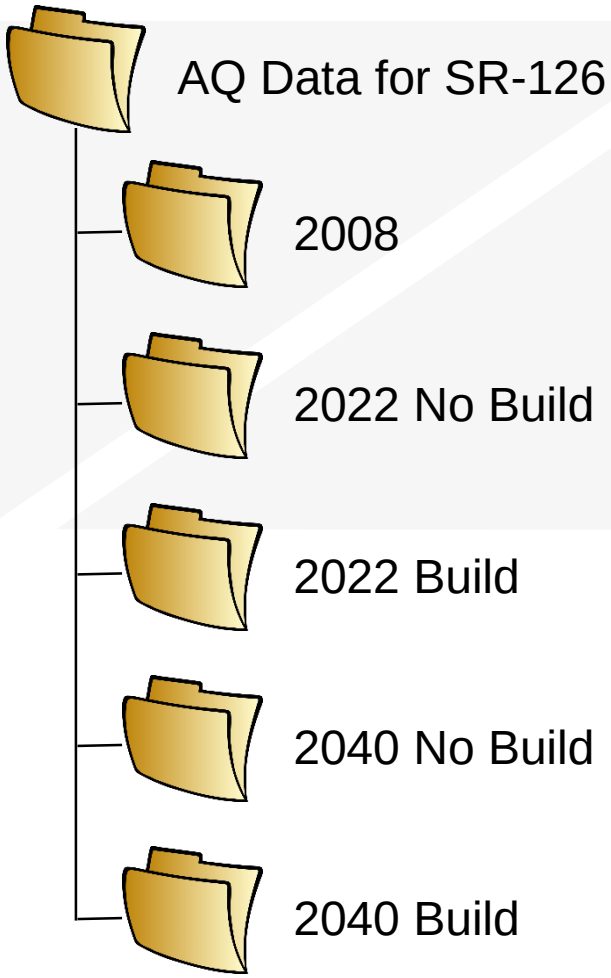
SCAG Model Alternatives

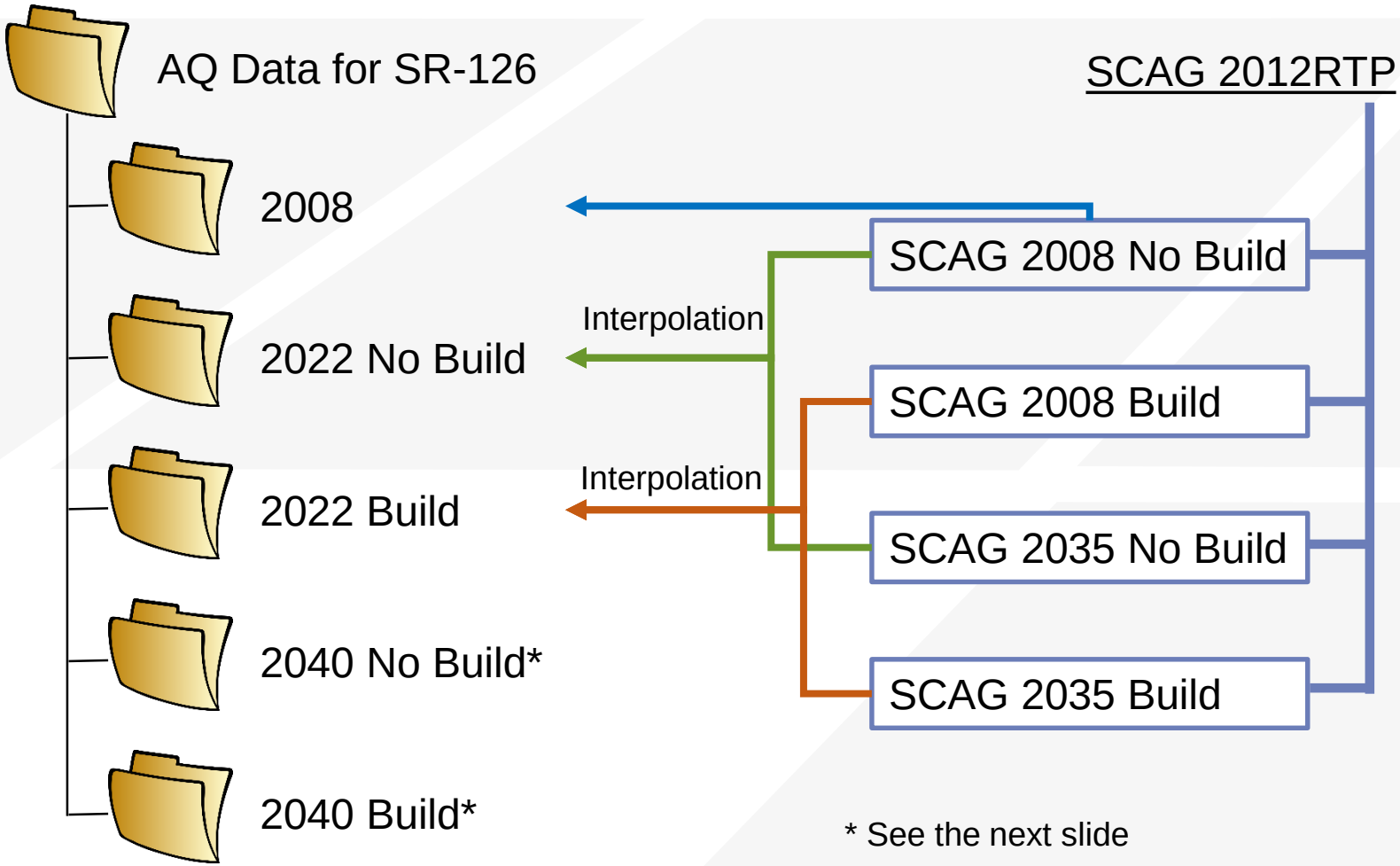


SCAG 2012RTP

- SCAG 2008 No Build
- SCAG 2008 Build
- SCAG 2035 No Build*
- SCAG 2035 Build*

* For the SR-126 project, the official SCAG 2035 model is the no build scenario, and a SCAG 2035 build scenario model needs to be run (the traffic assignment step only).

Match of AQ Data Needs and SCAG Models



* See the next slide

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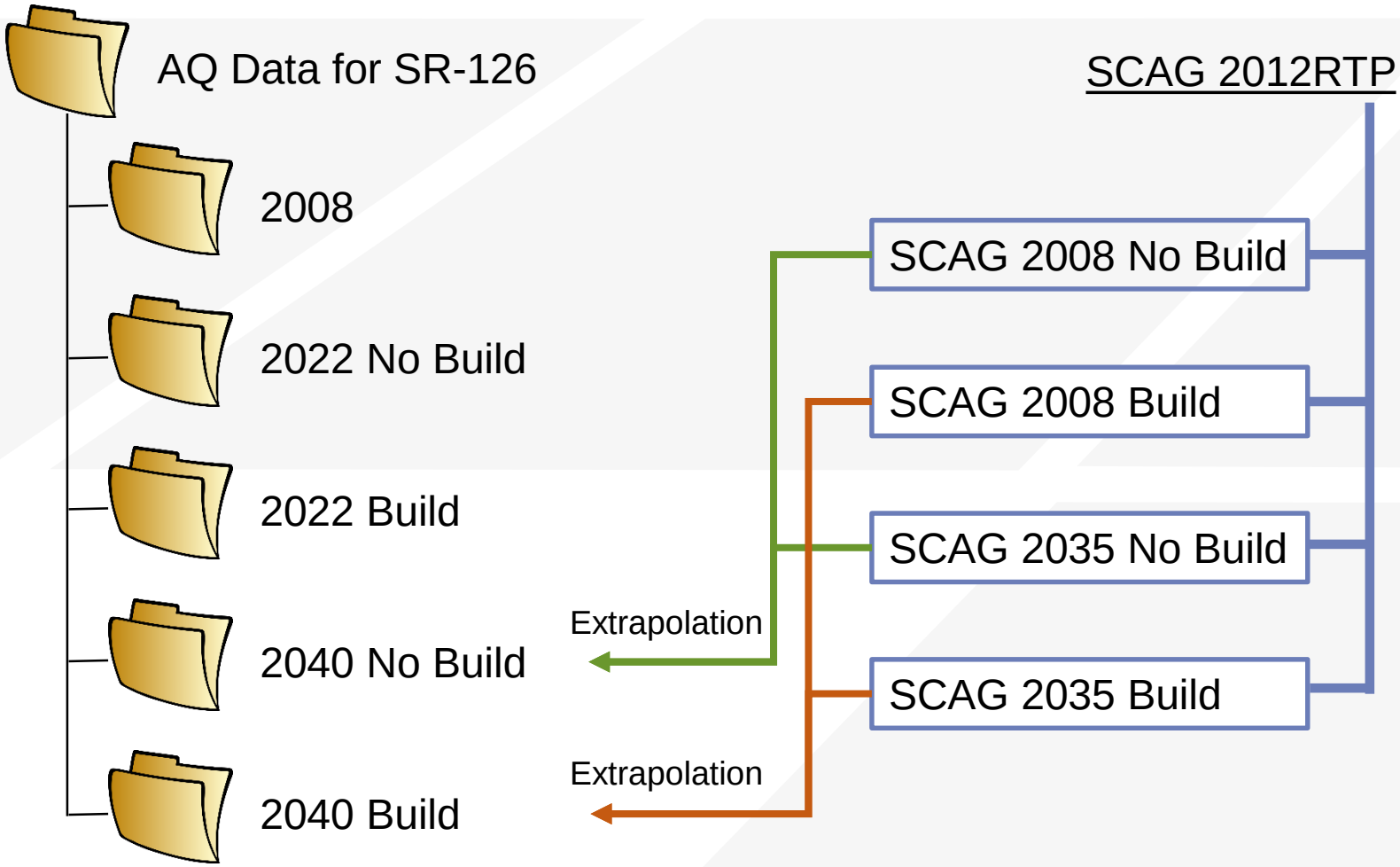
Match of AQ Data Needs and SCAG Models



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Procedures of Data Preparation for AQ Analysis

- Re-run SCAG models
  - Code the project in the network
  - Re-run the traffic assignment step only in most cases
- Extract data from SCAG models (Practice 1)
- Interpolate/extrapolate traffic volumes for opening year or future year (Practice 2)
- Update congested speeds for the interpolated / extrapolated traffic volumes (Practice 3)
- Format to generate the final output (Practice 4)

Data Extraction Directly from the SCAG Model

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Steps to Extract Data Directly from the SCAG Model

- Step 1: Navigate to the Project Location
  - Purpose: Open the highway network and display project links
  - TransCAD operations:
    - Open a geographic file
    - Navigate a map
    - Show the node layer
- Step 2: Assign and review project link IDs
  - Purpose: Assign project link IDs to each link to be included in the AQ analysis
  - TransCAD operations:
    - Add a new field in the link attribute table
    - Use the “info” tool to enter new link attributes
    - Create a selection set by condition
    - Create labels

Steps to Extract Data Directly from the SCAG Model (continued)

- Step 3: Copy link attributes to the AQ Excel file
  - Purpose: Clean and organize the highway network dataview to show only what will be copied to the AQ Excel file
  - TransCAD operations:
    - Show only records of interest
    - Show only fields of interest
    - Sort records in TransCAD
    - Copy and paste
- Step 4: Copy project link IDs to traffic assignment tables
  - Purpose: Copy project link IDs from the highway network dataview to traffic assignment tables, which will be used in Step 5
  - TransCAD operations:
    - Open a *.bin file
    - Create a joint view
    - Fill a field using “Formula”

Steps to Extract Data Directly from the SCAG Model (continued)

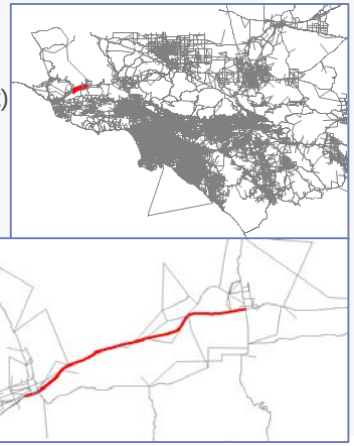
- Step 5: Copy traffic assignment results to the AQ Excel file
  - Purpose: Clean and organize traffic assignment tables to show only what will be copied to the AQ Excel file
  - TransCAD operations
    - Show only records of interest
    - Show only fields of interest
    - Sort records in TransCAD
    - Copy and paste

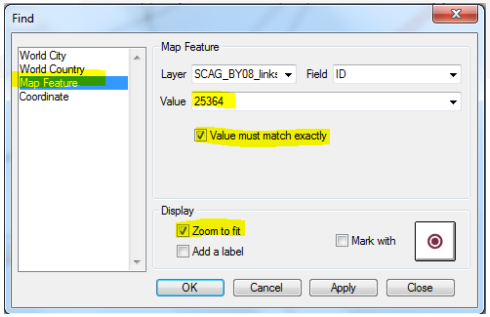
Practice 1: Create and fill the 2008 AQ Excel file

Step 1: Navigate to the SR-126 Project Location

1. Open the SCAG 2008 working geographic network file in TransCAD
   - ✓ In TransCAD, File → Open, then in the file type dropdown next to 'File name:' select Geographic File (*.cdf; *.dbd) option
   - ✓ Browse to the folder where the 2008 working geographic network file is: \AQ Training Material\SCAG 2012RTP 2008 BY Scenario\networks\Outputs
   - ✓ Select the 'scag_network_working.dbd' and click 'Open' button.

2. Navigate the map to show the SR-126 project area
   - ✓ Use the tools on the toolbox to navigate the map to the SR-126 project area (red area in the two figures to the right)
   - ✓ Use to zoom in, to zoom out and to pan. If the toolbox is not shown, press F8 to bring it up
   - ✓ If it is hard to locate the links, following these steps to locate one of the links on SR-126:
   - » Click on the top ribbon in TransCAD
   - » On the "Find" popup window, select "Map Feature", select "SCAG_BY08_links" as Layer, select "ID" as Field, enter 25364 in Value, and Click "OK". The map then zoom to show Link 25364, which is one of the links on SR-126.





3. Show the node layer in the map to see where each link starts and ends
   - ✓ In TransCAD, Map → Layers
   - ✓ On the Layers popup window, select Node and click the "Show Layer" button
   - ✓ On the Layers popup window, select the line layer ("SCAG_BY08_links") to make it as the active layer
   - ✓ Click the "Close" button to close the Layers popup window

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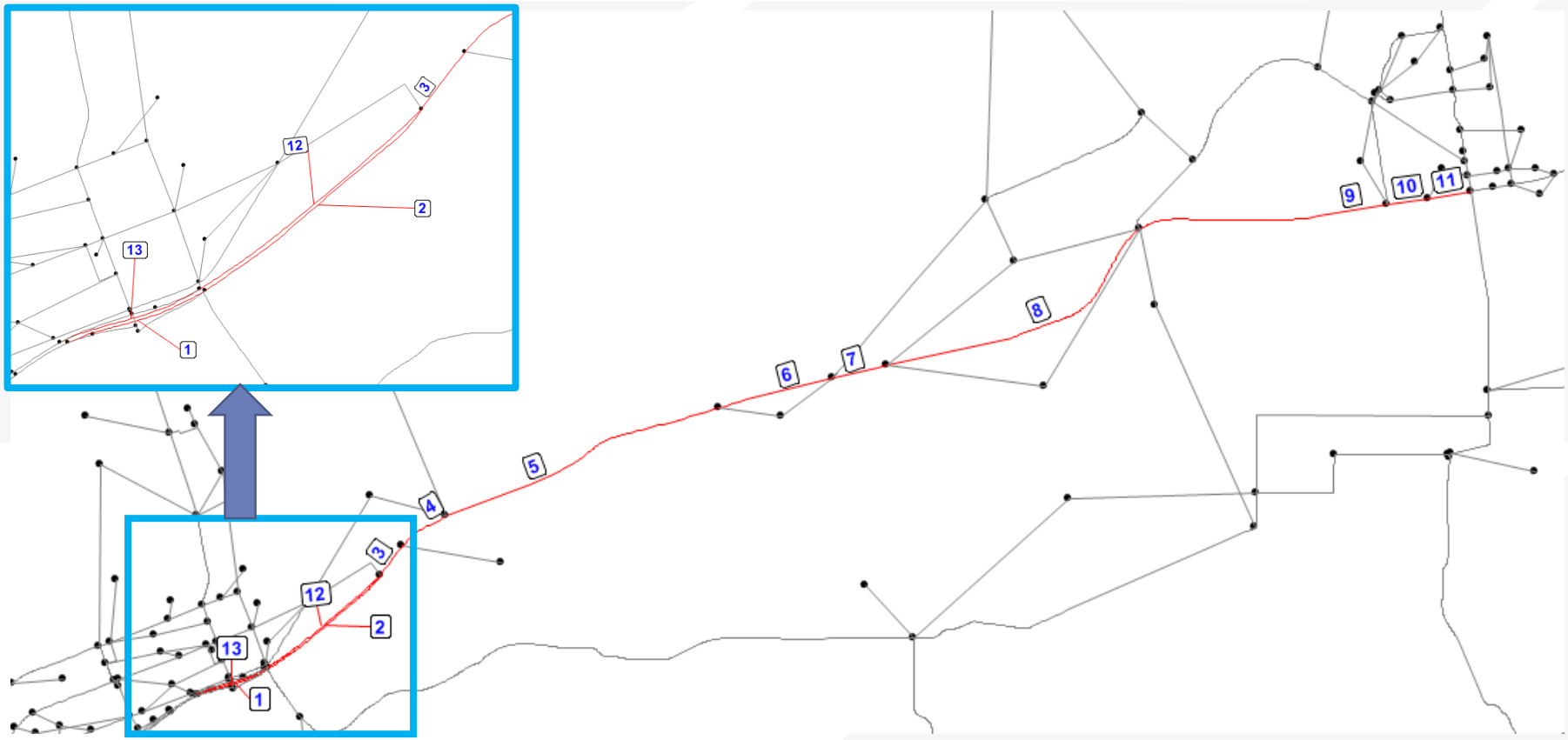
Project Link IDs used in the Practice



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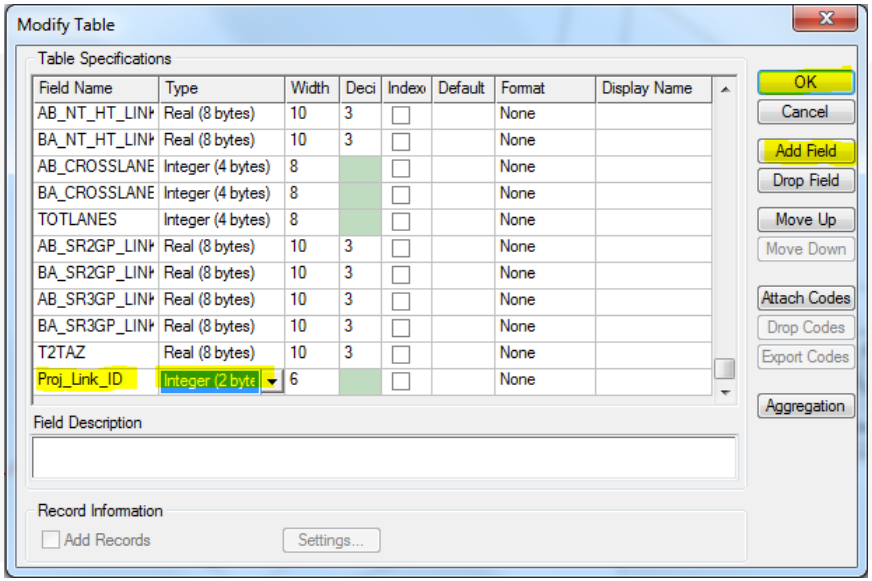
Practice 1: Create and fill the 2008 AQ Excel file

Step 2: Assign and review project link IDs

1. Add a new field for project link ID in the link attribute table
   - ✓ In TransCAD, Dataview → Modify Table
   - ✓ On the popup window, click button “Add Field” to add a new field
   - ✓ Change Field Name to Proj_Link_ID
   - ✓ Change Type to Integer (2 bytes)
   - ✓ Click button “OK” to apply the change and close the popup window
2. Assign project link IDs one by one
   - ✓ Start from the west end of the SR-126 project links
   - ✓ Click on the toolbox and click a project link 1 to open its information window. If the toolbox is not shown, press F8 on keyboard to bring it up.
   - ✓ On the information window, scroll down to the bottom, and enter 1 in Proj_Link_ID.
   - ✓ Repeat the above two operations for the rest of links. The target is that all 13 links have the Proj_Link_ID as shown in the slide of “Project Link IDs used in the Practice”.



3. Create a selection set to make sure the project link IDs have been entered correctly.
   - ✓ On the selection toolbox, click to open the “Select by Condition” popup window. If the selection toolbox is now shown, press F9 on the keyboard to bring it up.
   - ✓ In the “Select by Condition” popup window, enter Proj_Link_ID > 0 in the textbox “Enter a Condition”, and click the “OK” button to create a new selection and close the popup window.
   - ✓ Check whether the new selection set includes all 13 links. If not, repeat sub-step 2 (assign project link IDs) shown above to assign project link IDs to the missing links. Re-create the new selection set by using the condition of “Proj_Link_ID > 0”. Repeat until all 13 links are in the new selection set.
   - ✓ Check whether the new selection includes any links that are not needed for the AQ analysis. If it does, use on the toolbox and click on the link that should not be included to open its information window, from which delete the value in Proj_Link_ID. Re-create the new selection set by using the condition of “Proj_Link_ID > 0”. Repeat until the new selection does not include any links that are not needed for the AQ analysis.

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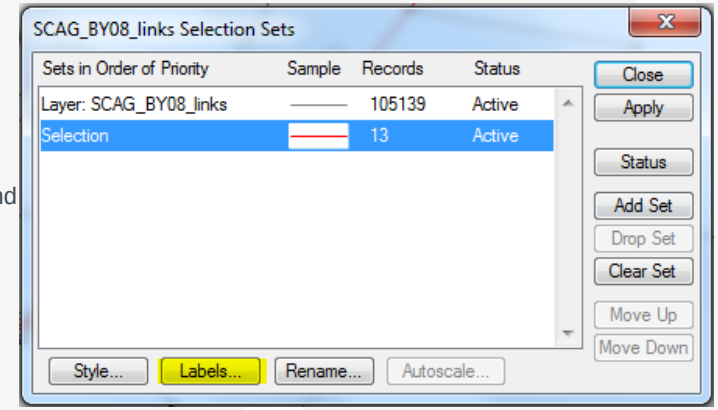
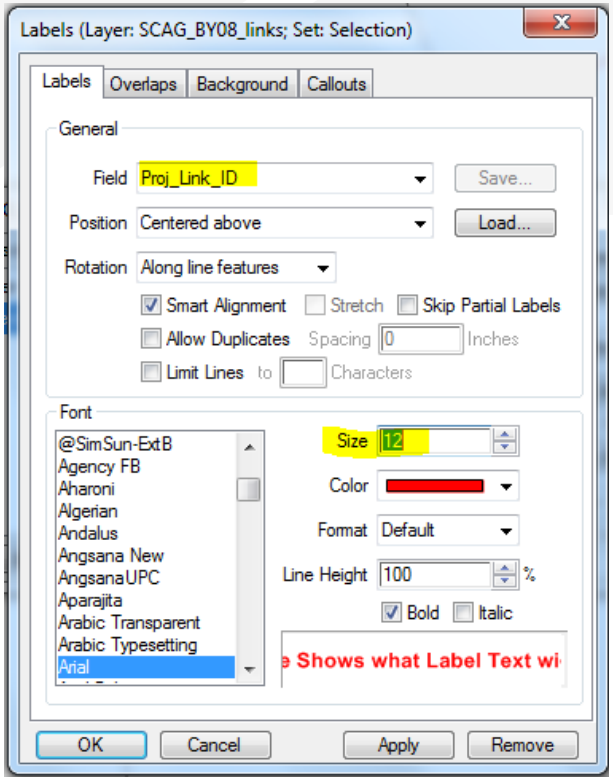
Practice 1: Create and fill the 2008 AQ Excel file

Step 2: Assign and review project link IDs (continued)

4. Label the links in the selection set with project link IDs to make sure the project link IDs have been entered correctly

- ✓ On the selection toolbox, click to open the "Selection Sets" popup window. If the selection toolbox is now shown, press F9 on the keyboard to bring it up.
- ✓ On the "Selection Sets" popup window, click on the row for Selection, and click the button "Labels" to only label the links in the selection set.
- ✓ On the new popup window "Labels", select "Proj_Link_ID" for Field, enter 12 for Size, and click button "OK" to close the popup window "Labels".
- ✓ Click the "Close" button on the "Selection Sets" popup window to apply the labels and close the "Selection Sets" popup window.





5. Review the label of project link IDs for each link in the selection set. If the project link IDs for a link need to be changed, use ℹ on the toolbox to bring up its information window and modify the value for "Proj_Link_ID".

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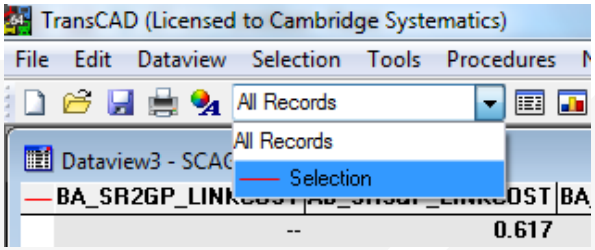
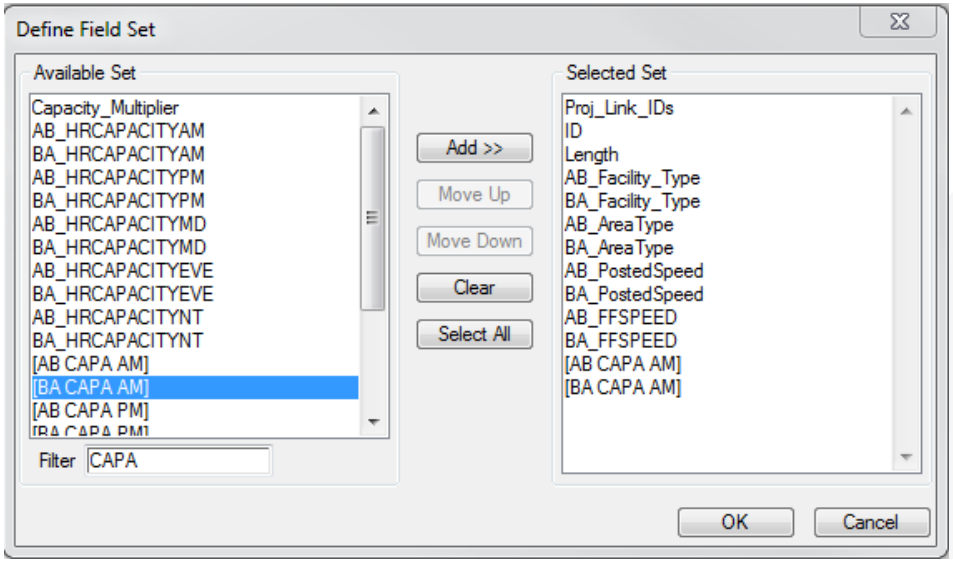
Practice 1: Create and fill the 2008 AQ Excel file

Step 3: Copy link attributes to the AQ Excel file

1. Open the dataview for the SCAG highway network
   - ✓ On the menu bar, click on to open the dataview for the SCAG highway network



2. Show only selected links in the dataview
   - ✓ On the menu bar, select “Selection” from the drop down list to, then only the links in the selection set are shown in the dataview
3. Show only fields to be included in the AQ Excel file
   - ✓ Choose Dataview → Field Sets on the TransCAD menu to open the popup window “Field Sets”
   - ✓ Click the “Add” button on the popup window “Field Sets”
   - ✓ On the new popup window “Define Field Set”, click the “Clear” button to clear all fields from the right box
   - ✓ Click on a field in the left box, then click the “Add>>” button to add it to the right box
   - ✓ Repeat to add all fields of interest to the right box, as shown below
   - ✓ Use the “Move Up” and “Move Down” button to adjust the order of fields in the right box to be in exact the same order as shown below
   - ✓ “Filter” can be used to facilitate locating the field. The left box only shows the fields that contains the characters in the “Filter”
   - ✓ Click the “OK” button and enter the field set name. Click “OK” to close the popup window “Field Sets” and apply the changes.



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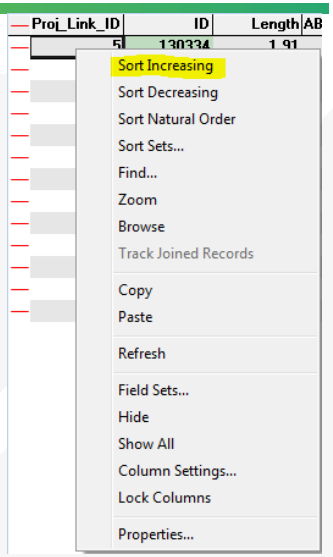
Practice 1: Create and fill the 2008 AQ Excel file

Step 3: Copy link attributes to the AQ Excel file (continued)

4. Sort the records by Project Link ID
   - ✓ Right click any cell in the field of “Proj_Link_ID” to bring up a popup window as shown to the right, select “Sort Increasing” to sort the records in an increasing order of “Proj_Link_ID”



5. Open the AQ Excel file
   - ✓ In Excel, open the AQ Excel file which is \AQ Training Material\AQ Data\ SR-126 Air Quality V1.xlsx
   - ✓ This Excel file has the headers and the description of each link, but other fields are all empty
6. Copy link attributes from the dataview in TransCAD to the AQ Excel file
   - ✓ On the dataview in TransCAD, click and drag to select all records and all but the first field
   - ✓ Right click on the selected area, and click Copy on the popup window
   - ✓ Right click on Cell E4 in Excel, and click on on the popup window to paste to the AQ Excel file
7. Close the dataview in TransCAD by clicking on the upper right corner

Dataview1 - SCAG_BY08_links

Proj_Link_IDs	ID	Length	AB_Facility_Type	BA_Facility_Type	AB_AreaType	BA_AreaType	AB_PostedSpeed	BA_PostedSpeed	AB_FFSPEED	BA_FFSPEED	[AB CAPA AM]	[BA CAPA AM]
1	25367	0.49	10	--	4	--	65	--	70.000	--	12000.000	--
2	25354	0.94	10	--	6	--	65	--	70.000	--	12000.000	--
3	123827	0.24	42	42	6	6	60	60	58.240	58.240	4725.000	5197.500
4	2678304	0.35	40	40	6	6	60	60	56.000	56.000	4500.000	4500.000
5	130334	1.91	42	42	6	6	60	60	58.240	58.240	4725.000	4725.000
6	2675940	0.76	42	42	6	6	60	60	58.240	58.240	5197.500	4725.000
7	143497	0.36	42	42	6	6	60	60	58.240	58.240	4725.000	5197.500
8	2678868	1.97	40	40	6	6	60	60	56.000	56.000	4500.000	4500.000
9	123919	1.62	42	42	6	6	60	60	58.240	58.240	5197.500	5197.500
10	143496	0.27	42	42	4	4	40	40	35.360	35.360	4410.000	5040.000
11	2678870	0.27	42	42	4	4	40	40	35.360	35.360	5040.000	4410.000
12	82175	0.95	10	--	4	--	65	--	70.000	--	12000.000	--
13	25364	0.50	10	--	4	--	65	--	70.000	--	12000.000	--

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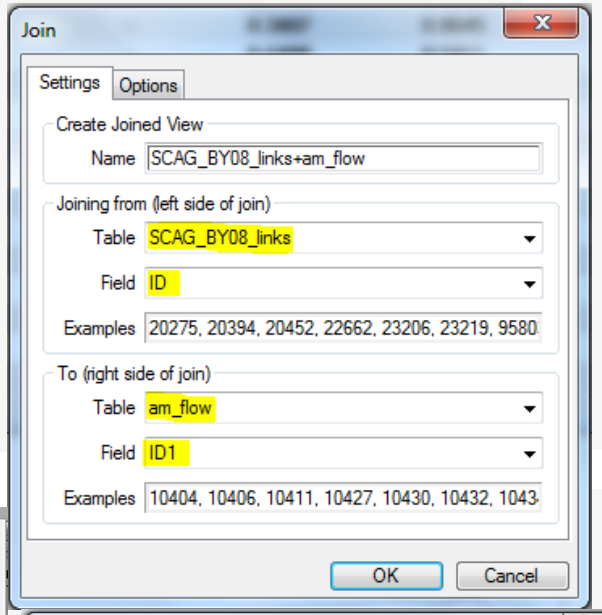
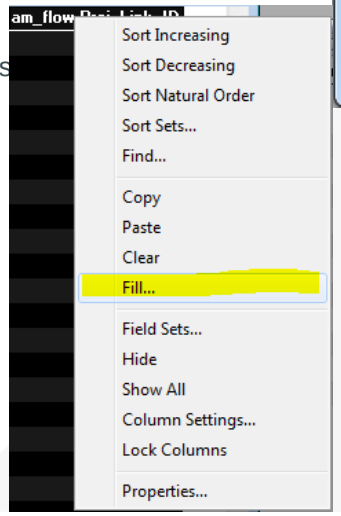
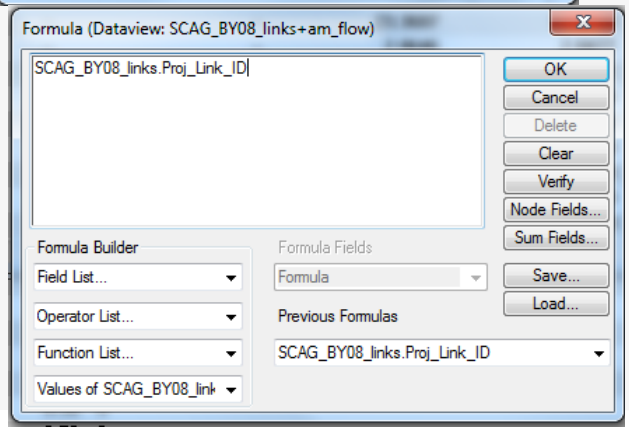
Practice 1: Create and fill the 2008 AQ Excel file

Step 4: Copy the project link IDs to the traffic assignment table

1. Open the Traffic Assignment File (am_flow.bin) in TransCAD
   - ✓ In TransCAD, File → Open, then in the file type dropdown next to 'File name:' select Fixed-format Binary File (*.bin) option
   - ✓ Browse to the folder where the 2008 traffic assignment bin files are located: \AQ Training Material\SCAG 2012RTP 2008 BY Scenario\Assign\Outputs
   - ✓ Select the 'am_flow.bin' and click 'Open' button
2. Add a new field for project link ID in the traffic assignment table
   - ✓ In TransCAD, Dataview → Modify Table
   - ✓ In the popup window, click button "Add Field" to add a new field
   - ✓ Change Field Name to Proj_Link_ID
   - ✓ Change Type to Integer (2 bytes)
   - ✓ Click button "OK" to apply the change and close the popup window
3. Create a joint dataview
   - ✓ In TransCAD, Dataview → Join to open the popup window "Join"
   - ✓ On the popup window "Join", specify Joining from Table and Field, and To Table and Field based on the figure shown to the right
   - ✓ Click button "OK" to apply the settings and close the popup window
4. Fill the "Proj_Link_ID" field in the traffic assignment table
   - ✓ On the joint dataview, right click on the header of the las field "am_flow.Proj_Link_ID", and click on "Fill"
   - ✓ On the popup window "Fill", choose "Formula"
   - ✓ On the popup window "Formula", select "SCAG_BY08_links.Proj_Link_ID" in the "Field List" drop down list. "SCAG_BY08_links.Proj_Link_ID" can also be typed in the text box directly.
   - ✓ Click the "OK" button on the popup window "Formula"
   - ✓ Click the "OK" button on the popup window "Fill"
   - ✓ Close the joint dataview.



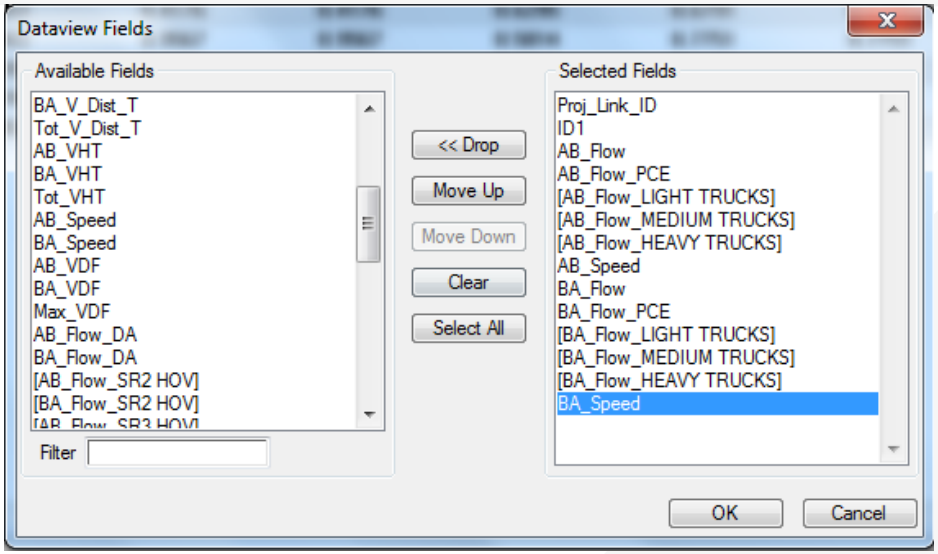




Practice 1: Create and fill the 2008 AQ Excel file

Step 5: Copy traffic assignment results to the AQ Excel file

1. Make a selection set of links to be included in the AQ analysis in the traffic assignment table
   - ✓ Make the dataview am_flow as the active window
   - ✓ Uses the selection toolbox to select links to be included in the AQ analysis
   - ✓ On the selection toolbox, click to open the “Select by Condition” popup window. If the selection toolbox is now shown, press F9 on the keyboard to bring it up.
   - ✓ On the “Select by Condition” popup window, enter Proj_Link_ID > 0 in the textbox “Enter a Condition”, and click the “OK” button to create a new selection and close the popup window.
2. Show only fields to be included in the AQ Excel file
   - ✓ Choose Dataview → Fields on the TransCAD menu to open the popup window “Dataview Fields”
   - ✓ On the popup window “Dataview Fields”, click the “Clear” button to clear all fields from the right box
   - ✓ Click on a field in the left box, then click the “Add>>” button to add it to the right box
   - ✓ Repeat to add all fields of interest to the right box, as shown below
   - ✓ Use the “Move Up” and “Move Down” button to adjust the order of fields in the right box to be in exact the same order as shown below
   - ✓ “Filter” can be used to facilitate locating the field. The left box only shows the fields that contains the characters in the “Filter”
   - ✓ Click “OK” to close the popup window “Dataview Fields” and apply the changes.



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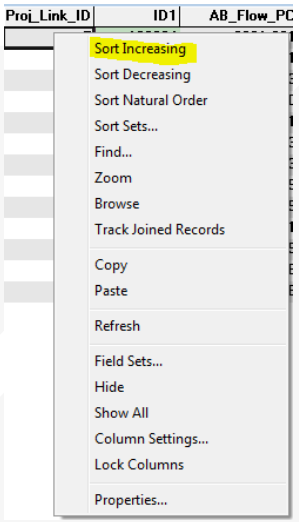
Practice 1: Create and fill the 2008 AQ Excel file

Step 5: Copy traffic assignment results to the AQ Excel file (continued)

4. Sort the records by Project Link ID
   - ✓ Right click any cell in the field of “Proj_Link_ID” to bring up a popup window as shown to the right, select “Sort Increasing” to sort the records in an increasing order of “Proj_Link_ID”



5. Open the AQ Excel file (if it is not open)
   - ✓ In Excel, open the AQ Excel file which is \AQ Training Material\AQ Data\ SR-126 Air Quality V1.xlsx
6. Copy traffic assignment results from the dataview in TransCAD to the AQ Excel file
   - ✓ On the dataview in TransCAD, click and drag to select all records and fields of interest
   - ✓ Right click on the selected area, and click Copy on the popup window
   - ✓ Paste to the corresponding cells in the AQ Excel file
7. Close the traffic assignment dataview in TransCAD by clicking on the uper right corner
8. Use formulas in Excel to calculate the “Truck Percent” and “Vehicle Miles Traveled” in the AQ Excel file
   - ✓ “Truck Percent” = (“Light Heavy Duty Vehicles” + “Medium Heavy Duty Vehicles” + “Heavy Heavy Duty Vehicles”) / “Total Vehicles”
   - ✓ “Vehicle Miles Traveled” = “Length” * “Total Vehicles”

Work with Traffic Volumes not directly from SCAG Models

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Work with Traffic Volumes not directly from SCAG Models

- When the traffic volumes from SCAG models need to be adjusted
  - Example: SCAG models consistently underestimate the traffic volumes on a corridor
  - Solution: to apply a factor to traffic volumes from SCAG models
- When the opening year or future year of a project is not modeled by SCAG.
  - Example: the opening year of SR-126 is 2022, and a 2022 SCAG model does not exist
  - Solution: to interpolate or extrapolate based on existing SCAG models.

Examples of Applying a Factor to SCAG Traffic Volumes

$$V_i^{2035_postprocessed} = \text{Adjustment_Factor} \times V_i^{2035_SCAG}$$

- $V_i^{2035_postprocessed}$ is the post processed 2035 traffic volume on Link i.
- $V_i^{2035_SCAG}$ is the 2035 traffic volume directly from SCAG models on Link i.
- Traffic volumes could be
  - Total Vehicles
  - Total PCE
  - Light Heavy Duty Vehicles
  - Medium Heavy Duty Vehicles
  - Heavy Heavy Duty Vehicles

Examples of Interpolation of Traffic Volumes

$$V_i^{2022} = V_i^{2008} + \frac{2022-2008}{2035-2008} \times (V_i^{2035} - V_i^{2008})$$

- V_i^n is the traffic volume for Year n on Link i. It could be
  - Total Vehicles
  - Total PCE
  - Light Heavy Duty Vehicles
  - Medium Heavy Duty Vehicles
  - Heavy Heavy Duty Vehicles

Examples of Extrapolation of Traffic Volumes

$$V_i^{2022} = V_i^{2008} + \frac{2040 - 2008}{2035 - 2008} \times (V_i^{2035} - V_i^{2008})$$

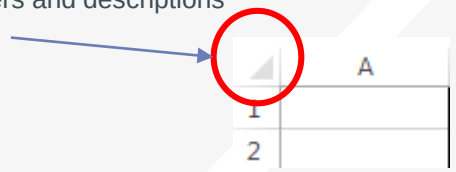
- V_i^n is the traffic volume for Year n on Link i. It could be
  - Total Vehicles
  - Total PCE
  - Light Heavy Duty Vehicles
  - Medium Heavy Duty Vehicles
  - Heavy Heavy Duty Vehicles

Overview of Practice 2

- Practice 2 is to calculate the 2022 No Build traffic volumes by interpolating
  - the 2008 No Build traffic volumes
  - the 2035 No Build traffic volumes
- Practice 1 generated the 2008 No Build traffic volumes
- Repeat Practice 1 on the 2035 working network and the 2035 traffic assignment results to get the 2035 No Build traffic volumes (we have done this for you)
- All work is done in Excel

Practice 2: Calculate the 2022 No Build Traffic Volumes by interpolating the 2008 and 2035 No Build Traffic Volumes

1. Open the Excel file that contains the 2008 and 2035 No Build traffic volumes
   - ✓ The Excel file is: \AQ Training Material\AQ Data\SR-126 Air Quality V2.xlsx
2. Create a new sheet “2022 NB”
3. Copy the entire sheet “2035 NB” and paste to the sheet “2022 NB”, so that we have all the headers and descriptions
   - ✓ In the sheet “2035 NB”, click the upper left corner of the spreadsheet to select the entire spreadsheet
   - ✓ Press Ctrl + C on the keyboard to make a copy of the entire spreadsheet
   - ✓ In the sheet “2022 NB”, click the cell A1
   - ✓ Press Ctrl + V on the keyboard to paste to the sheet “2022 NB”



4. In Excel, calculate the 2022 No Build traffic volumes by interpolating the 2008 and 2035 No Build traffic volumes
   - ✓ Use the formula shown on the slide “Examples of Interpolation of Traffic Volumes” to calculate
   - ✓ Need to calculate these traffic volumes for both AB and BA direction
     - ✓ Total Vehicles
     - ✓ Total PCE
     - ✓ Light Heavy Duty Vehicles
     - ✓ Medium Heavy Duty Vehicles
     - ✓ Heavy Heavy Duty Vehicles
   - ✓ Sample formula to be used in Excel

     For cell Q4 in sheet “2022 NB”, the formula is ='2008 NB'!Q4+(2022-2008)/(2035-2008)*('2035 NB'!Q4-'2008 NB'!Q4)
5. In Excel sheet “2022 NB”, the columns for “Truck Percent” and “Vehicle Miles Traveled” should have been updated automatically since these columns contain formulas. If not, use Excel formulas to update them.

Update Congested Speed

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Update Congested Speeds

- Congested speed is calculated based on volume-delay function

$$Congested\ Speed = \frac{Free\ Flow\ Speed}{1 + \alpha \times (\frac{Volume}{Capacity})^{\beta}}$$

Where:

α and β are parameters

$Volume$: total **PCE volume** for a time period

Capacity: total capacity on all lanes for a time period

Update Congested Speeds

- Congested speed is not a linear function of volume, so it is the best to use the volume-delay function to update congested speeds

Parameters for the Volume-Delay Function

From the SCAG model documentation:

Should be 4.0

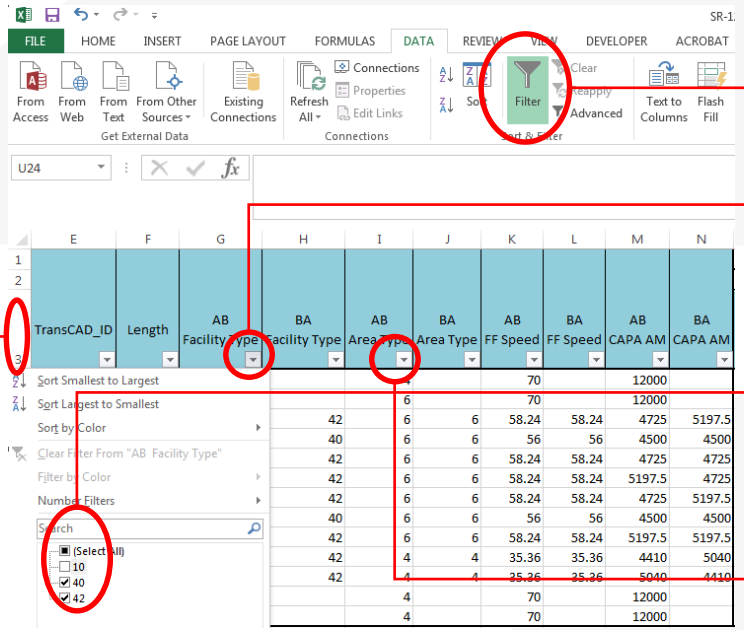
If $\frac{x_i}{C_i}$ <= 1 then β is set to the specific value of 5.0. If $\frac{x_i}{C_i}$ > 1, then α and β are set to values that vary by link facility type, posted speed, and area type according to the values in Table 8-3.

Table 8-3: Volume-Delay Function Parameters

Facility Type	Posted Speed	Area Type	Alpha	Beta
Freeways and HOV	All	All	0.60	8.0
Expressways	<=45mph	1-5	0.60	5.0
Expressways	<=45mph	6-7	0.60	6.0
Expressways	>45mph	All	0.60	8.0
All Others	All	1-5	0.60	5.0
All Others	All	6-7	0.60	6.0

Practice 3: Calculate the Congested Speeds for 2022 No Build Scenarios

1. Open the Excel file that contains the 2008, 2035 and 2022 No Build traffic volumes
   - ✓ The Excel file is: \AQ Training Material\AQ Data\SR-126 Air Quality V3.xlsx
2. In sheet "2022 NB", calculate the "AB AM VOC" and "BA AM VOC"
   - ✓ AB AM VOC = AB AM Total PCE / AB CAPA AM (e.g. the formula for cell AG4 is =R4/O4)
   - ✓ BA AM VOC = BA AM Total PCE / BA CAPA AM (e.g. the formula for cell AJ6 is =Z6/P6)
3. In sheet "2022 NB", determine the values for "AB AM Alpha", "AB AM Beta", "BA AM Alpha" and "BA AM Beta" based on the slide "Parameters for the Volume-Delay Function", VOC, facility type and area type.
   - ✓ Can use "Filter" in Excel to help group records with the same values for Alpha and Beta



1. Click here to highlight Row 3

2. Turn on the Filter

3. Click here to see the list of unique values for AB Facility Type

4. Only check the values that should be shown. In this example, only records with AB Facility Type = 40 or 42 will be shown, so it is easy to treat them as a group.

5. Can repeat step 3 and 4 for another column. For example, we can show only records with "AB Facility Type = 40 or 42" and "AB Area Type = 4"

4. In sheet "2022 NB", calculate the congested speed
   - ✓ Sample formula to be used in Excel

     The formula for cell U4 is =K4/(1+AF4*AE4^AG4)

Format results to Generate the Final Output

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Review of the Procedures to Prepare Data for AQ Analysis

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Procedures of Data Preparation for AQ Analysis

- Re-run SCAG models
  - Code the project in the network
  - Re-run the traffic assignment step only in most cases
- Extract data from SCAG models (Practice 1)
  - Define project links
  - Extract data from traffic assignment results

  In current AQ Tool
- Interpolate/extrapolate traffic volumes for opening year or future year (Practice 2)

  Could be added to the AQ Tool
- Update congested speeds for the interpolated / extrapolated traffic volumes (Practice 3)

  Could be added to the AQ Tool
- Format results to generate the final output (Practice 4)

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Think Forward

Manual Data Preparation for AQ Analysis

presented to

Caltrans District 7

presented by

Cambridge Systematics, Inc.

Chao Wang, Sean McAtee

February 22nd and 23rd 2017

Review of the Manual Air Quality Data Extraction Procedures

CAMBRIDGE SYSTEMATICS

SR - 126

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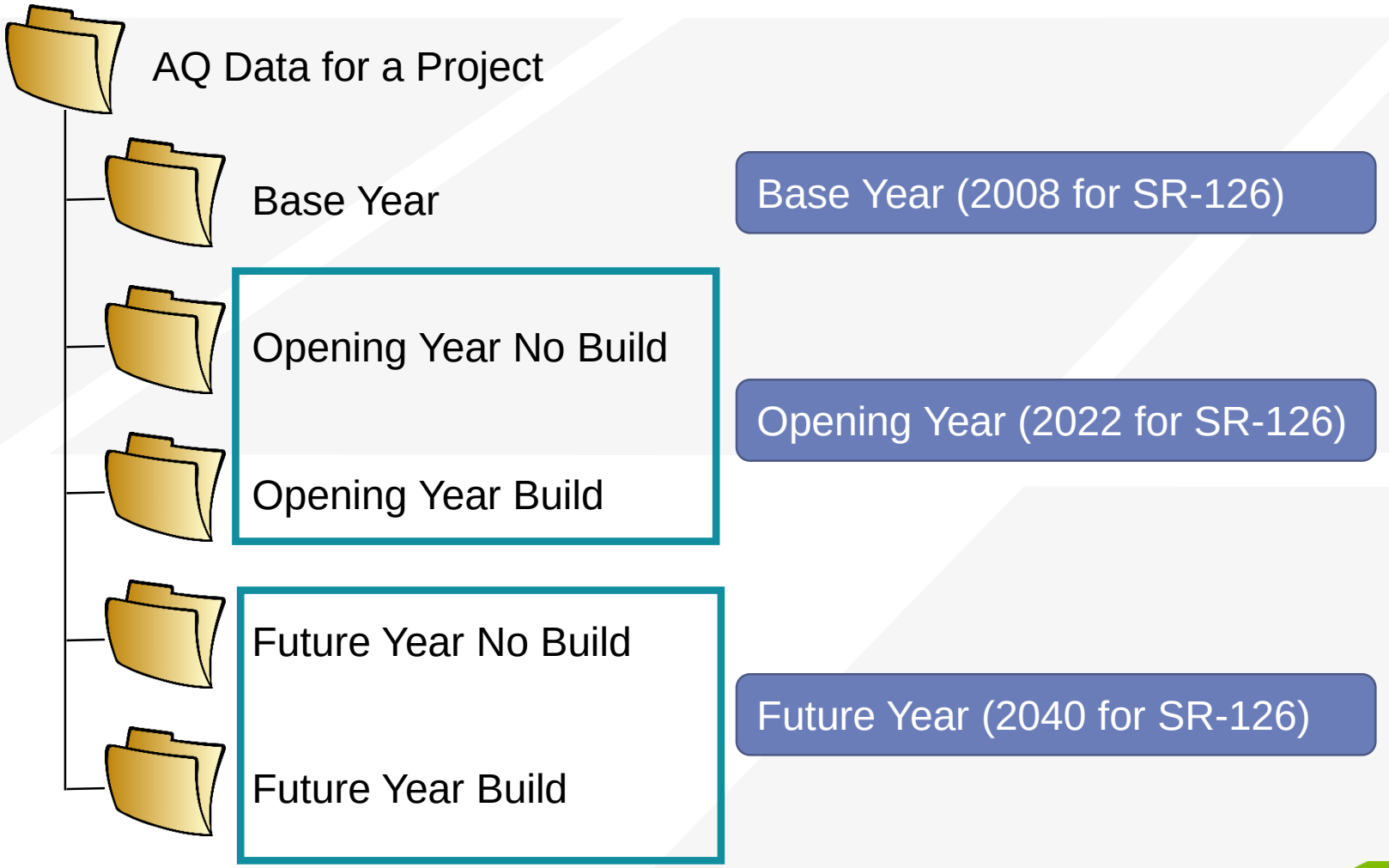
The SR-126 Project

- Project limit
  - SR-126 from SR-150 to SR-23
- Project
  - Convert SR-126 from “continuous left turn arterial” to “fully divided arterial”
- Opening Year
  - 2022
- Future Year
  - 2040

Air Quality Analysis Data Needs

- Key information for an Air Quality (AQ) analysis
  - Total Volume
  - Truck Percent
  - Congested Speed
  - Vehicle Miles Traveled (VMT)

Air Quality Analysis Data Needs



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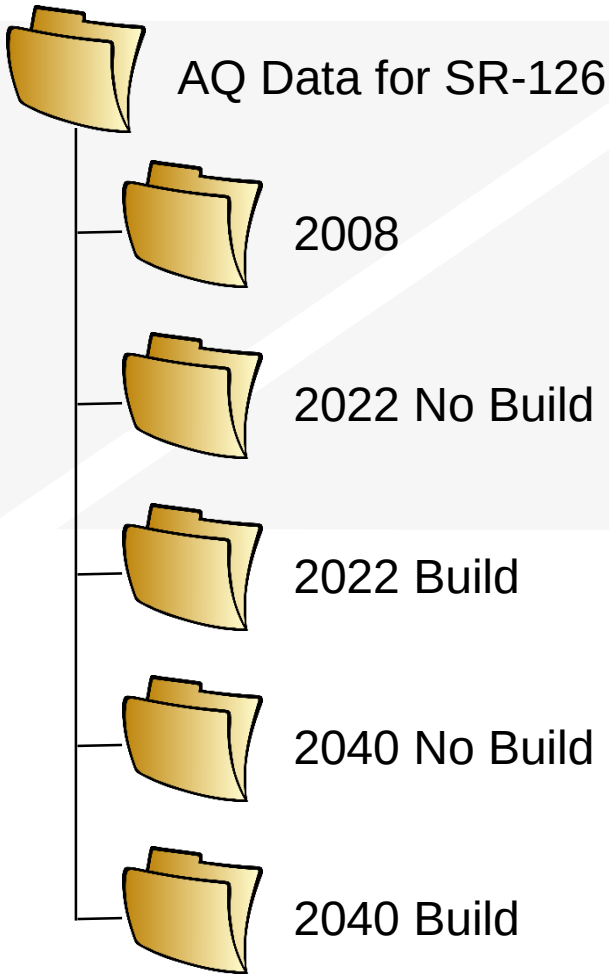
SCAG Model Alternatives

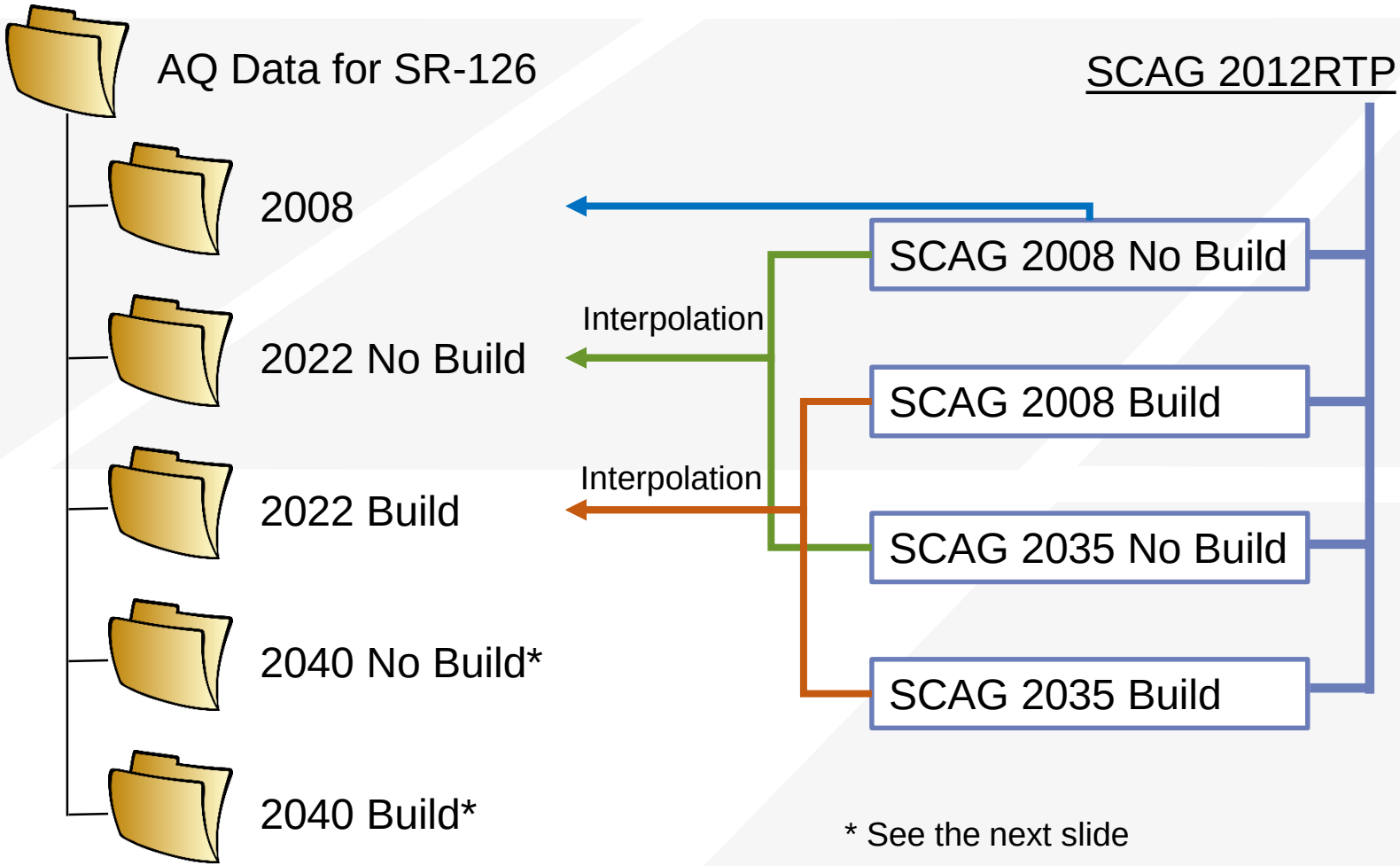


SCAG 2012RTP

- SCAG 2008 No Build
- SCAG 2008 Build
- SCAG 2035 No Build*
- SCAG 2035 Build*

* For the SR-126 project, the official SCAG 2035 model is the no build scenario, and a SCAG 2035 build scenario model needs to be run (the traffic assignment step only).

Match of AQ Data Needs and SCAG Models



* See the next slide

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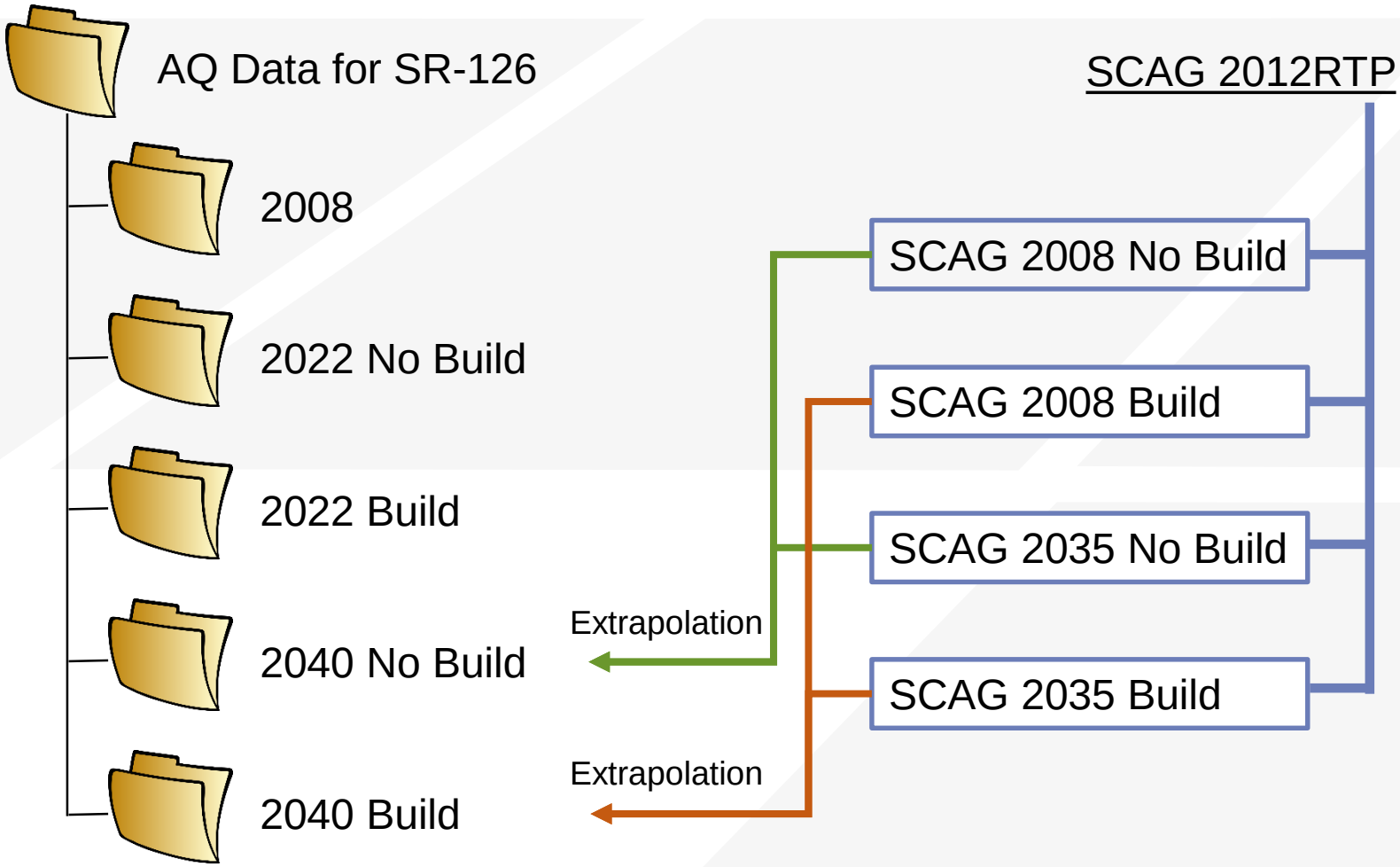
Match of AQ Data Needs and SCAG Models



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Procedures of Data Preparation for AQ Analysis

- Re-run SCAG models
  - Code the project in the network
  - Re-run the traffic assignment step only in most cases
- Extract data from SCAG models (Practice 1)
- Interpolate/extrapolate traffic volumes for opening year or future year (Practice 2)
- Update congested speeds for the interpolated / extrapolated traffic volumes (Practice 3)
- Format to generate the final output (Practice 4)

Data Extraction Directly from the SCAG Model

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Steps to Extract Data Directly from the SCAG Model

- Step 1: Navigate to the Project Location
  - Purpose: Open the highway network and display project links
  - TransCAD operations:
    - Open a geographic file
    - Navigate a map
    - Show the node layer
- Step 2: Assign and review project link IDs
  - Purpose: Assign project link IDs to each link to be included in the AQ analysis
  - TransCAD operations:
    - Add a new field in the link attribute table
    - Use the “info” tool to enter new link attributes
    - Create a selection set by condition
    - Create labels

Steps to Extract Data Directly from the SCAG Model (continued)

- Step 3: Copy link attributes to the AQ Excel file
  - Purpose: Clean and organize the highway network dataview to show only what will be copied to the AQ Excel file
  - TransCAD operations:
    - Show only records of interest
    - Show only fields of interest
    - Sort records in TransCAD
    - Copy and paste
- Step 4: Copy project link IDs to traffic assignment tables
  - Purpose: Copy project link IDs from the highway network dataview to traffic assignment tables, which will be used in Step 5
  - TransCAD operations:
    - Open a *.bin file
    - Create a joint view
    - Fill a field using “Formula”

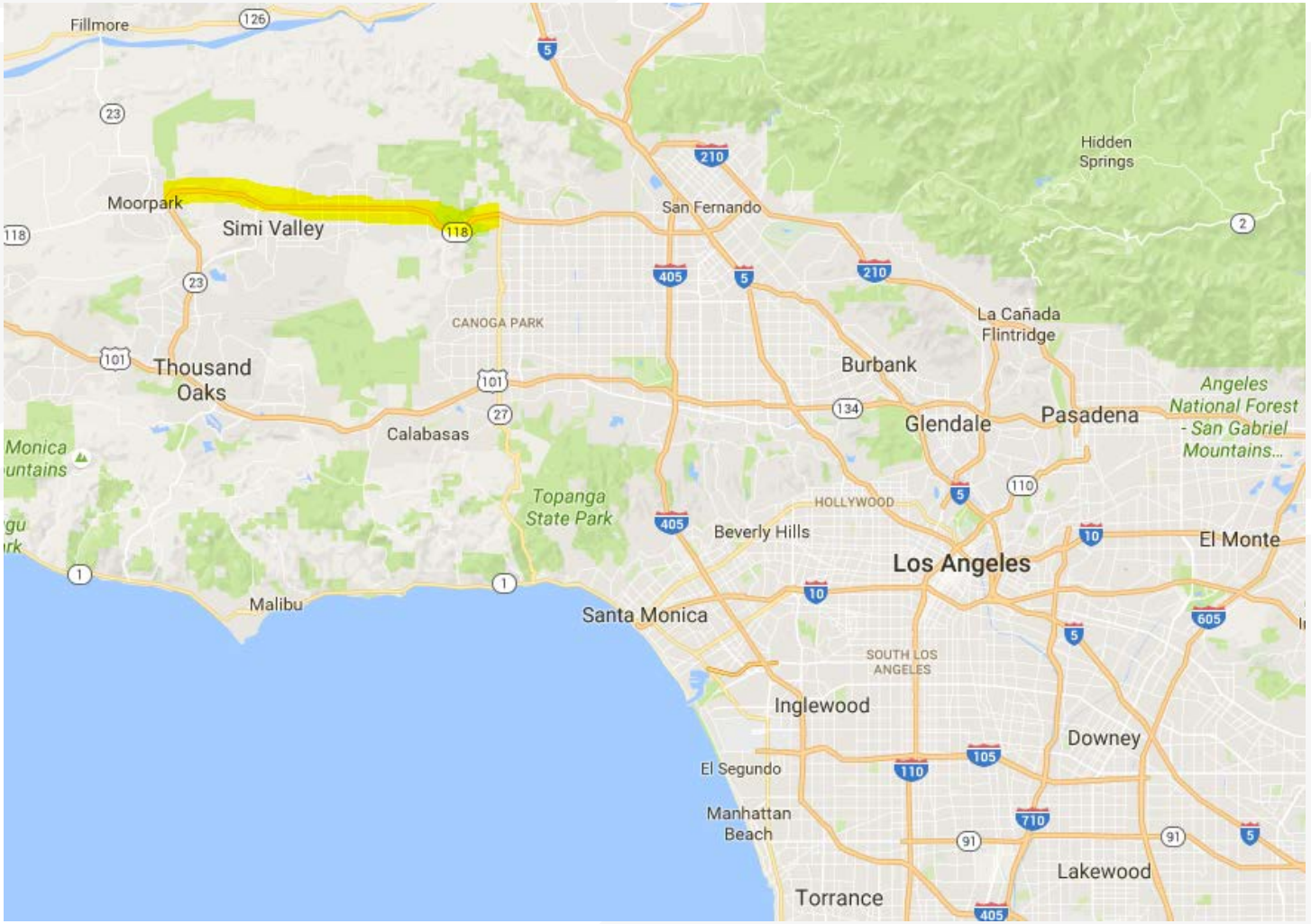
Steps to Extract Data Directly from the SCAG Model (continued)

- Step 5: Copy traffic assignment results to the AQ Excel file
  - Purpose: Clean and organize traffic assignment tables to show only what will be copied to the AQ Excel file
  - TransCAD operations
    - Show only records of interest
    - Show only fields of interest
    - Sort records in TransCAD
    - Copy and paste

Review of the AQ Procedure based on the SR-118 Project

- Project limit
  - SR-118 from SR-23 to SR-27
- Project
  - Four alternatives
- Opening Year
  - 2020 (for this practice)
- Future Year
  - 2035 (for this practice)

SR - 118



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Step 1 : Navigate to the Project Location

- Purpose: Open the highway network and display project links
- TransCAD operations:
  - Open the geographic file

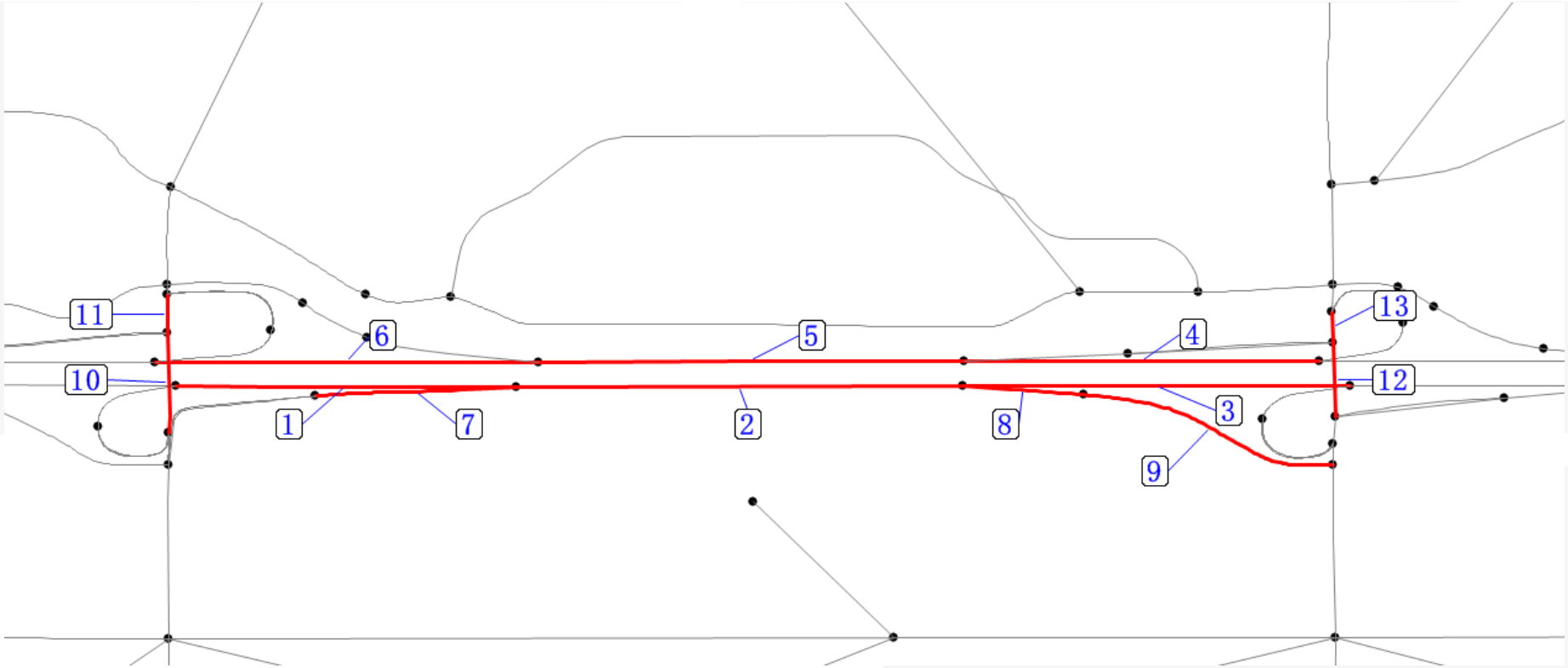
    \AQ Training Material\SCAG 2012RTP 2008 BY Scenario\networks\Outputs\ scag_network_working.dbd

  - Navigate the map
  - Show the node layer

Step 2: Assign and review project link IDs

- Purpose: Assign project link IDs to each link to be included in the AQ analysis
- Detailed Steps:
  1. Add a new field “Proj_Link_ID” in the link attribute table
  2. Select the 13 project links by pointing on each link
  3. Use the “info” tool to enter “Proj_Link_ID” for each of the 13 links
  4. Label “Proj_Link_ID” on the 13 links
- Hints:
  1. Dataview → Modify Table
  2. Selection Toolbox →
  3. Main Toolbox →
  4. Selection Toolbox → →

Project Link IDs used in the Practice



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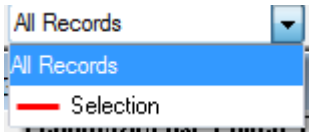
Step 3: Copy link attributes to the AQ Excel file

- Purpose: Clean and organize the highway network dataview to show only what will be copied to the AQ Excel file
- Detailed Steps:
  1. Show only records of interest
  2. Show only fields of interest (refer to “SR-118 Air Quality V1.xlsx” Column E to P to know what fields to show and the order of fields)
  3. Sort records in TransCAD
  4. Copy and paste (to “\ AQ Training Material\AQ Data\SR-118 Air Quality V1.xlsx”)
- Hints:
  1. 

  2. Dataview →Fields / Fields Sets, please include “Proj_Link_ID”, filter
  3. Right Click → Sort Increasing
  4. Ctrl + C, then Ctrl + V

Step 4: Copy project link IDs to traffic assignment tables

- Purpose: Clean and organize the highway network dataview to show only what will be copied to the AQ Excel file
- Detailed Steps:
  1. Open the Traffic Assignment File (pm_flow.bin) in TransCAD
  2. Add “Proj_Link_ID” in the traffic assignment table
  3. Create a joint dataview
  4. Fill the “Proj_Link_ID” field in the traffic assignment table
- Hints:
  1. “AQ Training Material\SCAG 2012RTP 2008 BY Scenario\Assign\Outputs”
  2. Dataview → Modify Table, join from “ID” to “ID1”
  3. Dataview → Join
  4. Right Click → Fill →Formula

Step 5: Copy traffic assignment results to the AQ Excel file

- Purpose: Clean and organize traffic assignment tables to show only what will be copied to the AQ Excel file
- Detailed Steps:
  1. Show only records of interest
  2. Show only fields of interest (refer to “SR-118 Air Quality V1.xlsx” Column Q to AF to know what fields to show and the order of fields)
  3. Sort records in TransCAD
  4. Copy and paste (to “\ AQ Training Material\AQ Data\SR-118 Air Quality V1.xlsx”)
  5. Calculate the “Truck Percent” and “Vehicle Miles Traveled”
- Hints:
  1. Selection → Select by Condition, the condition is Proj_Link_ID > 0

Work with Traffic Volumes not directly from SCAG Models

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Work with Traffic Volumes not directly from SCAG Models

- When the traffic volumes from SCAG models need to be adjusted
  - Example: SCAG models consistently underestimate the traffic volumes on a corridor
  - Solution: to apply a factor to traffic volumes from SCAG models
- When the opening year or future year of a project is not modeled by SCAG.
  - Example: the opening year of SR-126 is 2022, and a 2022 SCAG model does not exist
  - Solution: to interpolate or extrapolate based on existing SCAG models.

Examples of Applying a Factor to SCAG Traffic Volumes

$$V_i^{2035_postprocessed} = \text{Adjustment_Factor} \times V_i^{2035_SCAG}$$

- $V_i^{2035_postprocessed}$ is the post processed 2035 traffic volume on Link i.
- $V_i^{2035_SCAG}$ is the 2035 traffic volume directly from SCAG models on Link i.
- Traffic volumes could be
  - Total Vehicles
  - Total PCE
  - Light Heavy Duty Vehicles
  - Medium Heavy Duty Vehicles
  - Heavy Heavy Duty Vehicles

Examples of Interpolation of Traffic Volumes

$$V_i^{2022} = V_i^{2008} + \frac{2022-2008}{2035-2008} \times (V_i^{2035} - V_i^{2008})$$

- V_i^n is the traffic volume for Year n on Link i. It could be
  - Total Vehicles
  - Total PCE
  - Light Heavy Duty Vehicles
  - Medium Heavy Duty Vehicles
  - Heavy Heavy Duty Vehicles

Examples of Extrapolation of Traffic Volumes

$$V_i^{2022} = V_i^{2008} + \frac{2040 - 2008}{2035 - 2008} \times (V_i^{2035} - V_i^{2008})$$

- V_i^n is the traffic volume for Year n on Link i. It could be
  - Total Vehicles
  - Total PCE
  - Light Heavy Duty Vehicles
  - Medium Heavy Duty Vehicles
  - Heavy Heavy Duty Vehicles

Overview of Practice 2

- Practice 2 is to calculate the 2020 No Build traffic volumes by interpolating
  - the 2008 No Build traffic volumes
  - the 2035 No Build traffic volumes
- Practice 1 generated the 2008 No Build traffic volumes
- Repeat Practice 1 on the 2035 working network and the 2035 traffic assignment results to get the 2035 No Build traffic volumes (we have done this for you)
- All work is done in Excel

Steps of Practice 2

- Detailed Steps:
  1. Open “\ AQ Training Material\AQ Data\SR-118 Air Quality V2.xlsx”
  2. Fill Columns Q to U, and Columns Y to AC in Sheet “2020 NB” by interpolating traffic volumes from “2008 NB” and “2035 NB”
  3. Calculate the Columns V, X, AD and AF (“Truck Percent” and “Vehicle Miles Traveled”) in Sheet “2020 NB”
- Hints:
  2. $$V_i^{2020} = V_i^{2008} + \frac{2020-2008}{2035-2008} \times (V_i^{2035} - V_i^{2008})$$

Update Congested Speed

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Update Congested Speeds

- Congested speed is calculated based on volume-delay function

$$Congested\ Speed = \frac{Free\ Flow\ Speed}{1 + \alpha \times (\frac{Volume}{Capacity})^{\beta}}$$

Where:

α and β are parameters

$Volume$: total **PCE volume** for a time period

$\mathrm{Capacity}$: total capacity on all lanes for a time period

Parameters for the Volume-Delay Function

From the SCAG model documentation:

Should be 4.0

If $\frac{x_i}{C_i}$ <= 1 then β is set to the specific value of 5.0. If $\frac{x_i}{C_i}$ > 1, then α and β are set to values that vary by link facility type, posted speed, and area type according to the values in Table 8-3.

Table 8-3: Volume-Delay Function Parameters

Facility Type	Posted Speed	Area Type	Alpha	Beta
Freeways and HOV	All	All	0.60	8.0
Expressways	<=45mph	1-5	0.60	5.0
Expressways	<=45mph	6-7	0.60	6.0
Expressways	>45mph	All	0.60	8.0
All Others	All	1-5	0.60	5.0
All Others	All	6-7	0.60	6.0

Steps of Practice 3

- Detailed Steps:
  1. Open "\ AQ Training Material\AQ Data\SR-118 Air Quality V3.xlsx"
  2. Calculate the VOC and fill Columns AG and AJ in Sheet "2020 NB"
  3. Fill Alpha and Beta in Columns AH, AI, AK and AL in Sheet "2020 NB"
  4. Calculate the congested speeds and fill Columns W and AE in Sheet "2020NB"
- Hints:
  2. Use the total PCE, instead of total vehicles in VOC
  4. $$Congested\ Speed = \frac{Free\ Flow\ Speed}{1 + \alpha \times (\frac{Volume}{Capacity})^{\beta}}$$

Format results to Generate the Final Output

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Review of the Procedures to Prepare Data for AQ Analysis

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Procedures of Data Preparation for AQ Analysis

- Re-run SCAG models
  - Code the project in the network
  - Re-run the traffic assignment step only in most cases
- Extract data from SCAG models (Practice 1)
  - Define project links
  - Extract data from traffic assignment results

In previous version of the AQ Tool

- Apply a factor to adjust modeled traffic volumes, and update the congested speed (Practice 3)

New function added to the AQ Tool

- Interpolate/extrapolate traffic volumes for opening year or future year (Practice 2), and update the congested speed (Practice 3)

New function added to the AQ Tool

CAMBRIDGE SYSTEMATICS

Think Forward

Memorandum

TO: Caltrans District 7

FROM: Chao Wang, Sean McAtee

DATE: April 7, 2017

RE: SR-118 Air Quality Data Preparation

At your request, CS has been providing training and assistance with extraction of air quality data for the SR-118 corridor in Ventura County. We have prepared an analysis of this corridor consistent with the specifications discussed previously. This updated SR-118 AQ data analysis is based on the most recently adopted SCAG travel model, the SCAG 2016 Regional Transportation Plan (RTP) model.

Project Limits

The SR-118 project is in Ventura County in Moorpark and Simi Valley on SR-23 from 0.8 mile north of Tierra Rejada Road undercrossing to New Los Angeles Avenue undercrossing, and on SR-118 from New Los Angeles Avenue undercrossing to 0.4 mile west of Tapo Canyon Road undercrossing. The SR-118 project limits are shown in Figure 1.

Figure 1: SR-118 Project Limits

515 S. Figueroa Street, Suite 1975
Los Angeles, CA 90071
tel 213-372-3009 www.camsys.com **fax** 213-372-3010

Project Alternatives

The SR-118 project has three alternatives, as described below:

- **Alternative 1:** No-Build Alternative.
- **Alternative 2:** Alternative proposes the following improvements:
  - Add one mixed flow lane from New Los Angeles Ave. to Collins Dr. in each direction.
  - Add two mixed flow lane from Collins Dr. to Madera Rd. in each direction.
  - Add one mixed flow lane from Madera Rd. to Tapo Canyon Rd in each direction.
  - Construct soundwall and median barrier.
  - Widen 11 structures: Arroyo Simi Bridge and overhead (OH); Princeton Ave. undercrossing (UC); Alamos Cyn Rd UC; Madera Rd. UC; Caldwell Ave. UC; Erringer Rd. UC; Dry Cyn. Channel; Sycamore Dr. UC; Galena Ave. UC; Sequoia Ave. UC; Arroyo Del Tapo Channel.
- **Alternative 3:** Alternative proposes the following improvements
  - Add one mixed flcow lane from Arroyo Simi Bridge to Tapo Canyon Rd. in each direction.
  - Restripe the Arroyo Simi Bridge from two to three non-standard lanes in each direction.
  - Reconstruct the inside shoulder and median of SR-23/SR-118 connectors from two to three non-standard lanes in each direction
  - Construct soundwall and median barrier.
  - Widen 10 structures. Same proposed structures in Alternative 2, excluding Arroyo Simi Bridge.

Model Analysis Years and Phases

The model analysis years and phases for the SR-118 project are summarized below.

- **Existing Year:** 2014
- **Opening Year 1:** 2025
  - In Year 2025, the **Phase 1** of the project will be completed
  - In Phase 1, only the east bound of SR-118 will be widen.
- **Opening Year 2:** 2030

  - In Year 2030, the **Phase 2** of the project will be completed
  - In Phase 2, both the east bound and the west bound of SR-118 will be widen.
- **Horizon Year:** 2040

Model Alternatives for the Air Quality Analysis

Ten model alternatives are required for the Air Quality (AQ) Analysis, as listed below.

- Existing 2014 No Build
- Opening 2025 No Build
- Opening 2025 Build Alternative 2 Phase 1
- Opening 2025 Build Alternative 3 Phase 1
- Opening 2030 No Build
- Opening 2030 Build Alternative 2 Phase 2
- Opening 2030 Build Alternative 3 Phase 2
- Horizon 2040 No Build
- Horizon 2040 Build Alternative 2 Phase 2
- Horizon 2040 Build Alternative 3 Phase 2

The official SCAG 2016 RTP model provides the 2012 model, the 2016 model, and the 2040 model. The results for all immediate years are interpolated or extrapolated based on these three model years. Table 1 summaries how the ten model alternatives listed above are obtained based on the 2012, 2016 and 2040 models. For example, the first row in Table 1 shows that the results for Existing 2014 No Build (2014 NB) are interpolated based on the results for the 2012 NB and the 2016 NB.

Table 1: Model Runs to Obtain the Ten Model Alternatives for the AQ Analysis[1]

	2012 Models	2016 Models					2040 Models				
	NB	NB	A2P1	A2P2	A3P1	A3P2	NB	A2P1	A2P2	A3P1	A3P2
2014NB	X	X									
2025NB		X					X				
2025A2P1			X					X			
2025A3P1					X					X	
2030NB		X					X				
2030A2P2				X					X		
2030A3P2						X					X
2040NB							X				
2040A2P2									X		
2040A3P2											X

Table 1 shows that eleven SCAG model runs (scenarios) are needed. They are:

- 2012 No Build
- 2016 No Build
- 2016 Build Alternative 2 Phase 1
- 2016 Build Alternative 2 Phase 2
- 2016 Build Alternative 3 Phase 1
- 2016 Build Alternative 3 Phase 2
- 2040 No Build
- 2040 Build Alternative 2 Phase 1
- 2040 Build Alternative 2 Phase 2
- 2040 Build Alternative 3 Phase 1
- 2040 Build Alternative 3 Phase 2

SCAG Model Runs

Since the SR-118 project will not affect the regional travel pattern and the mode choice pattern, only traffic assignment was run for each scenario.

[1] In Table 1, A means Alternative and P means Phase. For example, A2P1 means Alternative 2 Phase 1.

The procedures for each SCAG model run are:

- Code the highway network
  - Alternative 1 (No Build): no changes are needed.
  - Alternative 2 Phase 1: Starting from the No Build highway network, add one lane to the east bound of the freeway for all freeway links in the project limit, plus add one additional lane (two lanes in total) to the east bound of the freeway between Collins Dr. to Madera Rd.
  - Alternative 2 Phase 2: Starting from the No Build highway network, add one lane to both bounds of the freeway for all freeway links in the project limit, plus add one additional lane (two lanes in total) to both bounds of the freeway between Collins Dr. to Madera Rd.
  - Alternative 3 Phase 1: Starting from the No Build highway network, add one lane to the east bound of the freeway for all freeway links in the project limit.
  - Alternative 3 Phase 2: Starting from the No Build highway network, add one lane to both bounds of the freeway for all freeway links in the project limit.

- Run network initialization on the SCAG model user interface to re-calculate the freeway speeds and capacities

- Run traffic assignment with turn penalties
  - The official SCAG model does not implement any turn penalties. However, turn penalties are needed for many ramps in the SR-118 project to make sure these ramps are represented correctly in the highway network. Figure 2 shows examples of prohibited turns. The curved arrows in Figure 2 are turn movements that were prohibited.

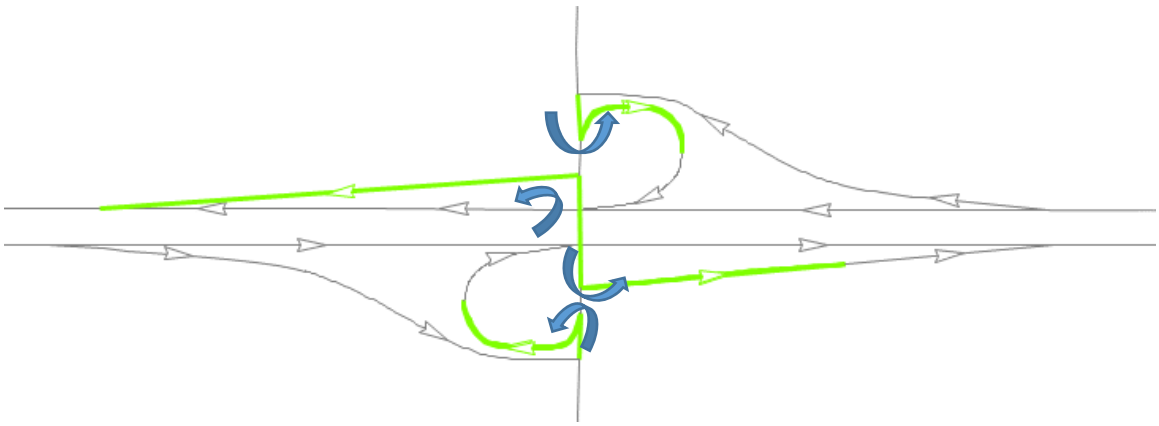

Figure 2: Example of Prohibited Turns

- Caltrans D7 provided the turn penalty table they have been using to CS. CS reviewed and revised this table.
- Turn penalties were added to the TransCAD network file (*.net file), and traffic assignment for all five time periods was run.

The highway network for the official 2012 SCAG model is the same as the highway network for the 2012 No Build scenario, and the traffic assignment results for the official 2012 SCAG model are ready. However, the traffic assignment for the 2012 No Build scenario still needs to run because turn penalties needs to be applied in traffic assignment, to be consistent with results from other scenarios. Based on the same reason, the 2016 No Build scenario and the 2040 No Build scenario were also run. In total, eleven scenarios were run.

Data Extraction and Interpolation

The AQ data extraction tool was used to extract and interpolate data from the raw SCAG traffic assignment results. An important input file to this tool is the project link file, which contains the TransCAD link IDs for all links that should be included in the analysis of the SR-118 project. It also contains some other link attributes, such as road names, facility types, begin of link descriptions, and end of link descriptions.

Caltrans D7 provided the SR-118 project link file. CS reviewed this file and made some modifications, including,

- Updated the TransCAD link ID to be consistent with the SCAG 2016 RTP. The SR-118 project link file provided by Caltrans D7 was based on the SCAG 2012 RTP model, which has different highway network from that for the SCAG 2016 RTP. So the project link ID list has been updated to be consistent with the SCAG 2016 RTP.
- Added more links to facilitate the study of intersections. Caltrans D7 wants to study major intersections close to the SR-118 project. All intersection legs (including Tier 1 Centroid Connectors) for these major intersections have been added to the project link ID list to facilitate this study.
- Added more links from parallel local roads. Adding more lanes on SR-118 attracts trips from parallel local roads, therefore reducing their traffic. More links from these parallel local road have been added to the project link ID list to reflect the impact of the SR-118 project.
- Corrected begin of link descriptions and end of link descriptions on some links.

The new project link ID list includes the 263 links demonstrated in Figure 3 (the previous list included 229 links).

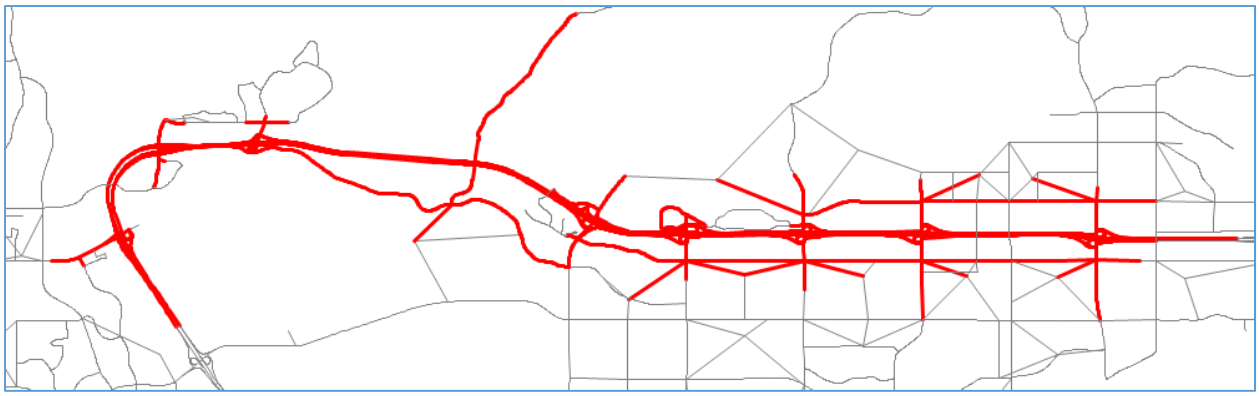

Figure 3: Links defining the SR-118 Project

At Caltrans D7's request, CS modified the AQ data extraction tool to report the link Volume Over Capacity (VOC). The Excel template file was modified accordingly.

Final Output

The CSV files generated from the AQ data extraction tool were copied to the Excel template file to create the final output files. The final output files are attached as the ten files shown below.

- SR-118 Air Quality 2014NoBuild.xlsx
- SR-118 Air Quality 2025Build_Alt2_Pha1.xlsx
- SR-118 Air Quality 2025Build_Alt3_Pha1.xlsx
- SR-118 Air Quality 2025NoBuild.xlsx
- SR-118 Air Quality 2030Build_Alt2_Pha2.xlsx
- SR-118 Air Quality 2030Build_Alt3_Pha2.xlsx
- SR-118 Air Quality 2030NoBuild.xlsx
- SR-118 Air Quality 2040Build_Alt2_Pha2.xlsx
- SR-118 Air Quality 2040Build_Alt3_Pha2.xlsx
- SR-118 Air Quality 2040NoBuild.xlsx