Agenda

District 7 TransCAD Training – Part 3

Day 1 (December 13, 2016):

- A brief refresher on basic TransCAD topics already covered in the first session,
- Group practice creating a complete map
- Detailed review of assignment results
- **SR-126 Air Quality Step-by-Step (full manual process)**

Day 2 (December 14, 2016):

- Placing the map on a layout and printing or saving it
- Editing networks (adding/dropping lanes including HOV lanes, and ramp/interchange edits)
- Running Traffic Assignment with a modified network (full step by step process – example)
- Working with trip tables (TAZ aggregation, desire lines, small county to county comparisons, TLFDs) *[As time permits]*
- Select Link/Zone Analysis *[As time permits]*
- Subarea extraction *[Likely to be in a future session]*

CAMBRIDGE SYSTEMATICS

Think Forward

TransCAD and the SCAG Model

presented to

Caltrans District 7

presented by

Cambridge Systematics, Inc.

Chao Wang, Sean McAtee

December 13th and 14th, 2016

Review: TransCAD and SCAG Model Basics

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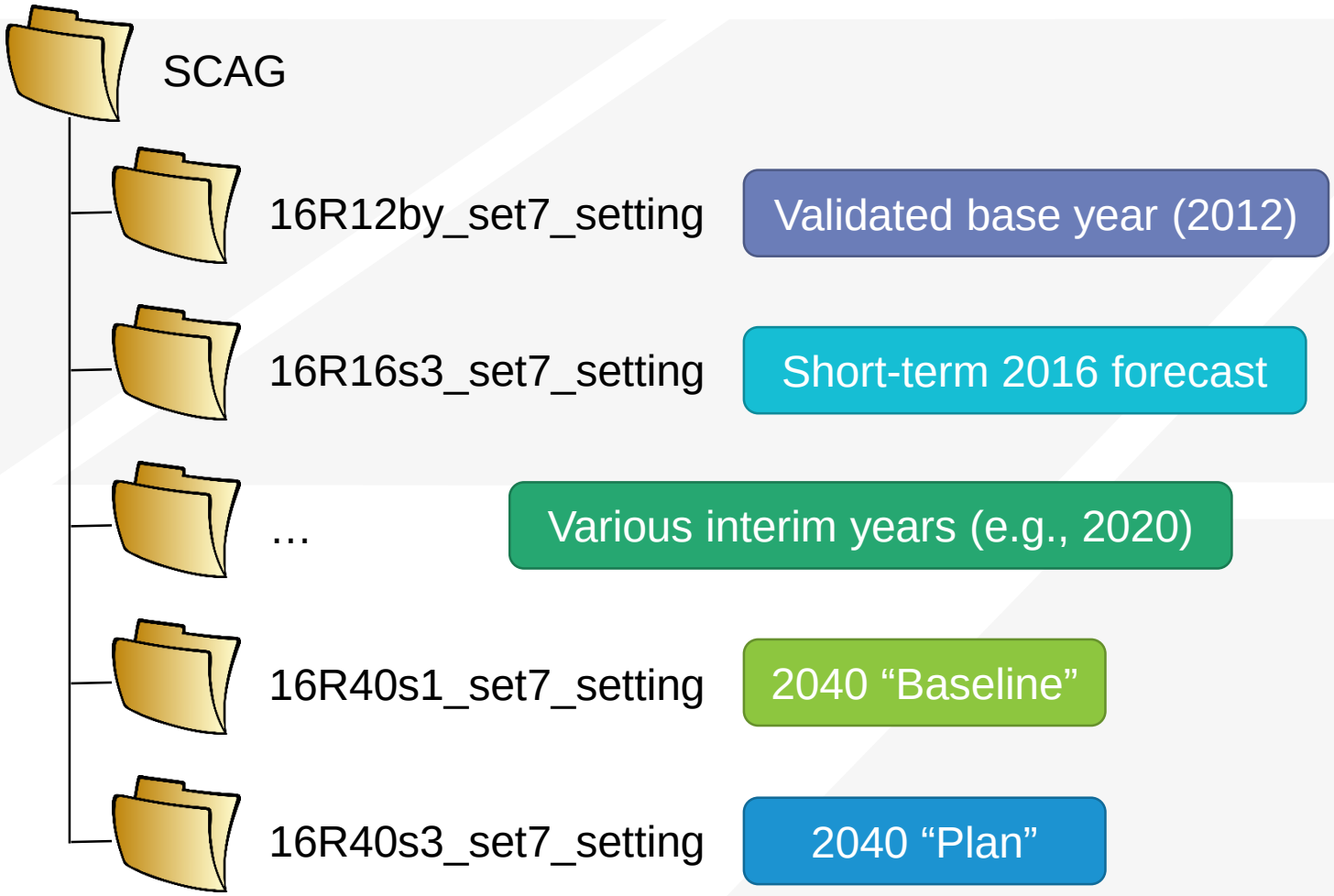
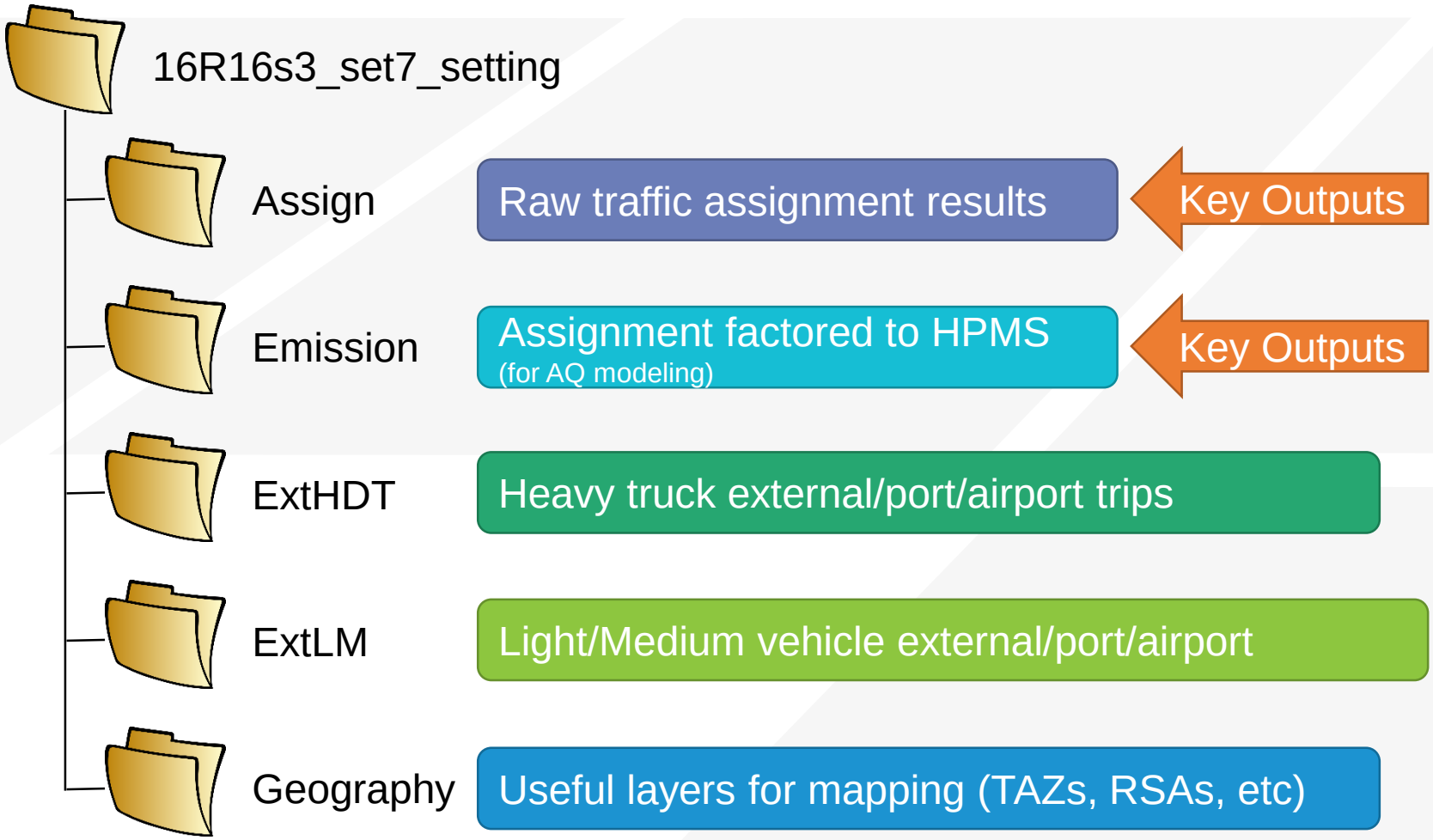
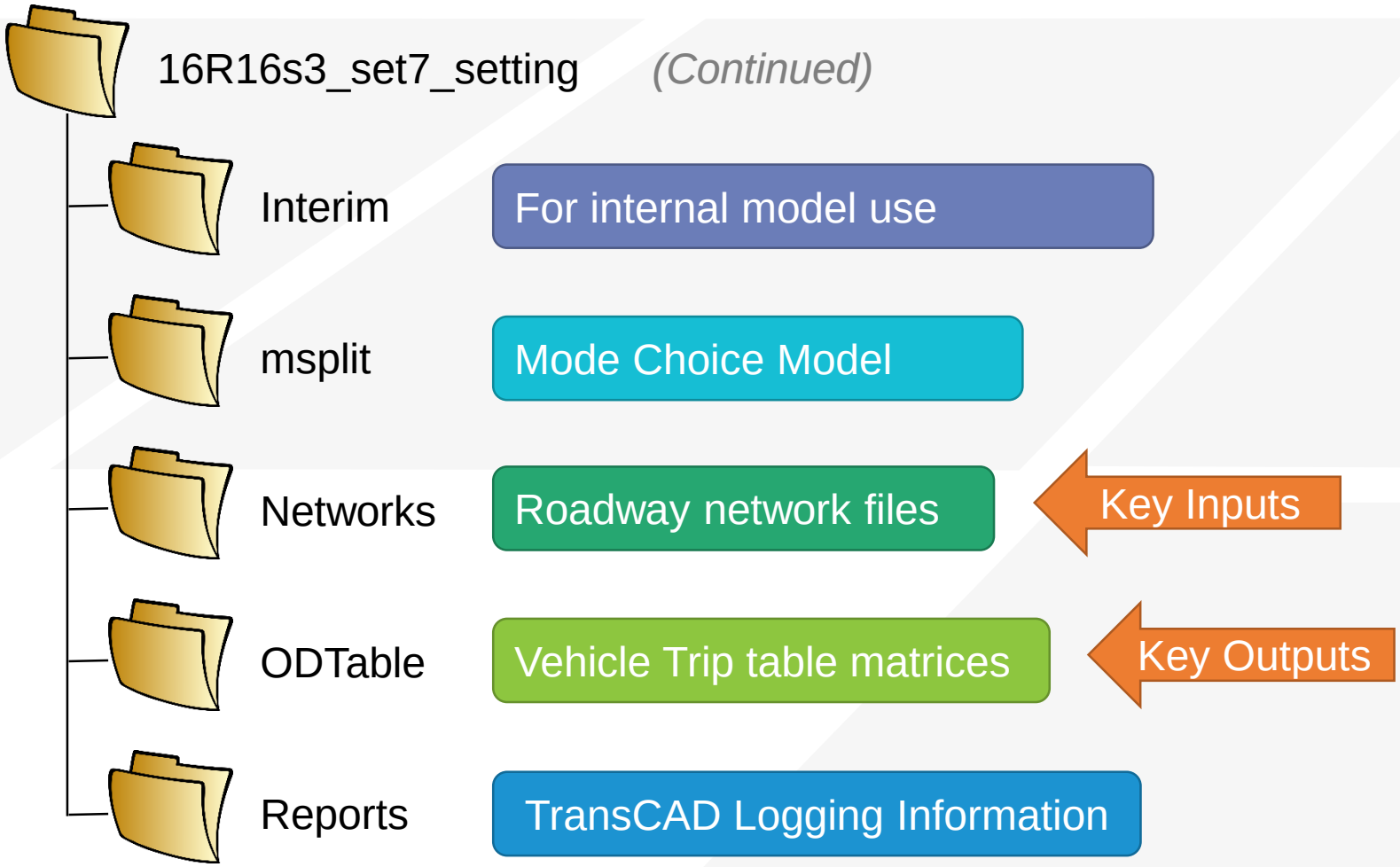
SCAG Model File Structure



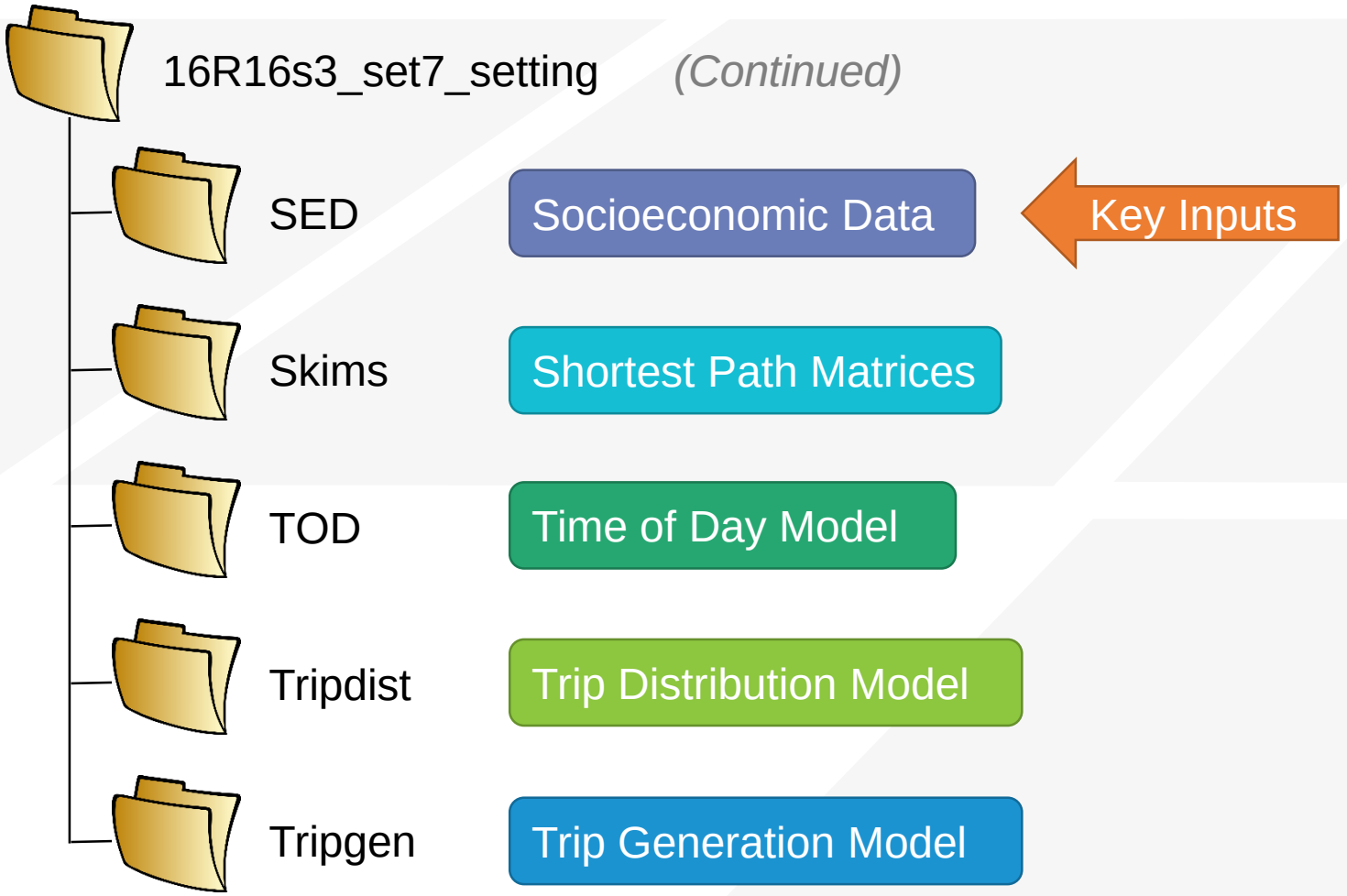
SCAG Model File Structure



SCAG Model File Structure

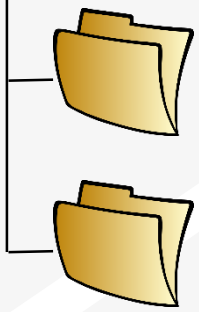


SCAG Model File Structure



SCAG Model File Structure

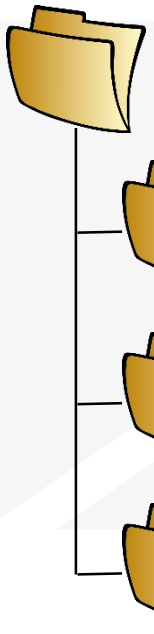
16R16s3_set7_setting *(Continued)*



Truck — Internal Heavy Duty Truck Model

User — For troubleshooting / SCAG use

SCAG Model File Structure



All folders have a the same structure

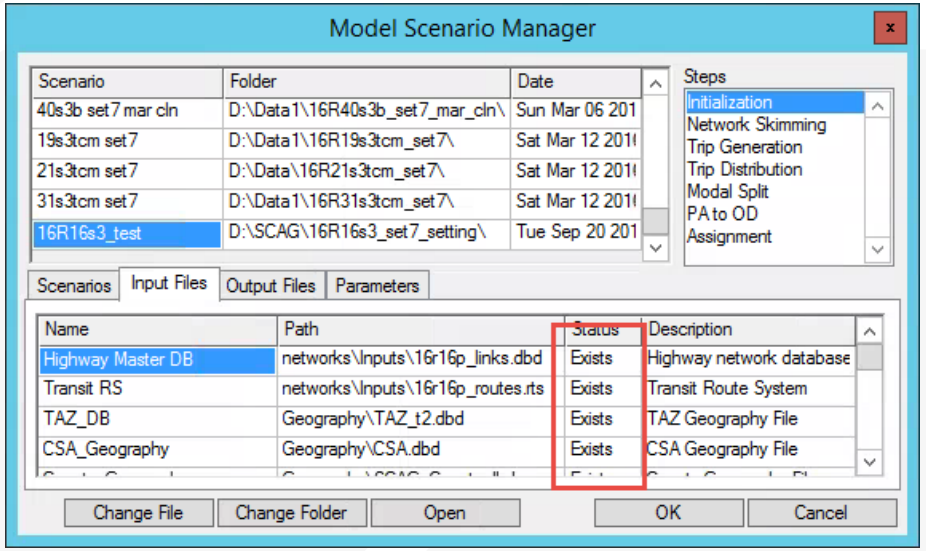
Files provided by SCAG. Changes made here

Files generated by the model. Do not change.

Model result summary tables

SCAG Model Scenarios

- Start the Add-In
  - Tools → Add-Ins → SCAG Model v 6.3
- Setup a Scenario
  - Click “Setup”
  - Find the scenario to run
    - Example: 16R16s3
    - Make a copy or work in place – But **KEEP TRACK**
  - Set the correct directory on your system
    - Check to make sure Input files are shown as “Exists”
  - Click ‘OK’ (be patient while the system responds)



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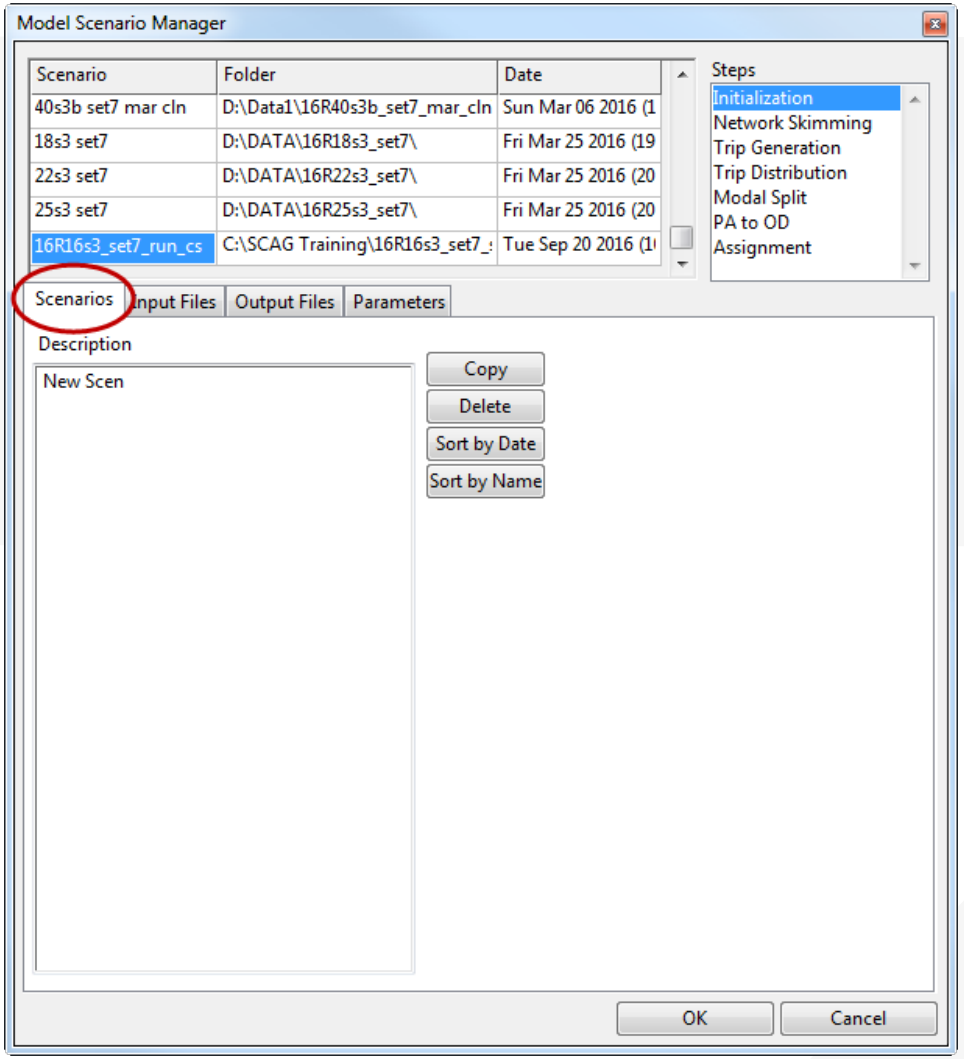
SCAG Model Scenarios



- Scenarios
  - Manage scenario list
  - Enter a description
- Input, Output, Parameters
  - Check/modify filenames and parameters

Different Run Types

	Feedback	One Loop	Assignment
Run Time	7-10 Days	1-2 Days	< 1 Day
When to Run	• To generate original SCAG model results • To test large system wide network changes • To test any SED changes • To produce a final model dataset after alternatives analysis	• To test the impacts of small to moderate changes **on mode choice** • This method will reduce but not eliminate oscillation noise Usually only run when we need to understand transit changes	• To test the impacts of small to moderate changes on roadway volumes • This method will nearly eliminate oscillation noise

Example: When to run a full 5-loop run

- Receive new model inputs from SCAG
  - We have input files from SCAG, but no outputs
  - We want to generate outputs for further use
- **Run when people could change their decisions on:**
  - Where to work or shop
  - Where to make typical daily trips
- Example: High Desert Corridor
  - Creates a **large new freeway**
  - People could choose to make different trips

Example: When to run a full 1-loop run

- Network alternatives that include transit, HOV, or HOT
  - **AND:** You are interested in the effect on mode share
- Change in SED assumptions
  - SED = Socioeconomic data
  - Change HH or employment numbers by TAZ

Example: When to run assignment only

- Network alternatives that include general purpose roadway changes
- Initial screening and alternatives comparison
- **This is the most common way the SCAG model is currently run**

Review: Mapping Basics

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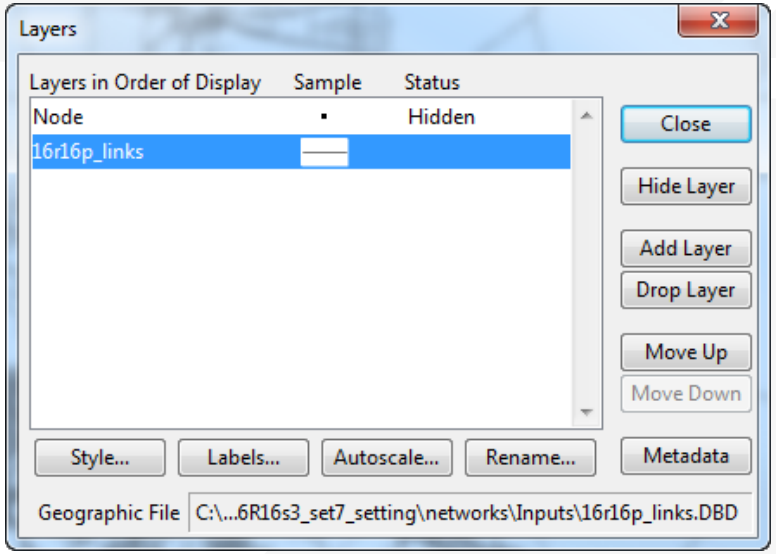
Working with Layers

- Start by opening a map **or** a geographic (dbd) layer file
  - » Opening a layer will create a new map and add the layer
  - » Opening a map will load all saved layers, settings, etc.
- Access layers with the **layers dialog** box ()

Top layer (drawn first)

Bottom layer (drawn last)



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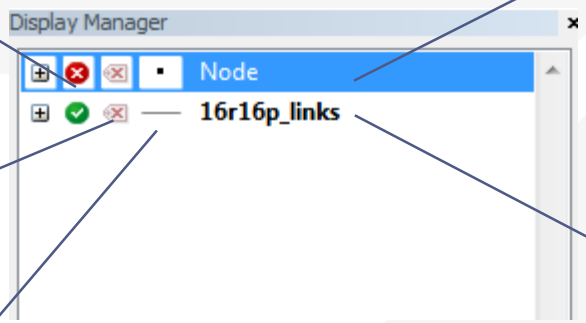
Display Manager

- Activate from Map → Display Manager
- Quick access to layers, settings, etc.
  - Right-click for more settings, including *make working layer*

Hide/show a layer

Add/edit labels

Change a layer style



Node layer is **NOT** active

Bold text: links layer is active

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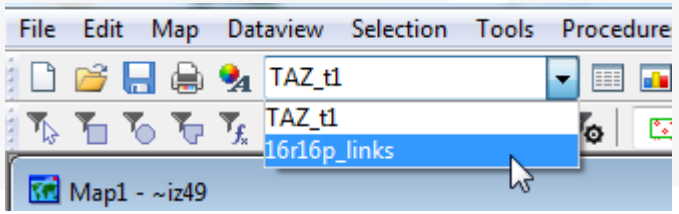
Creating Maps

- Create a new map by opening a Geographic File (*.dbd)
- Add more layers if desired
  - »  then 
- Choose the active layer
  - » Use the dropdown selector
  - » Or use the display manager



- Change the “default” styles for the layers
  - »  then  , or  , or use the display manager
- Hide or show layers
  - »  or the display manager

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Color and Pattern Themes

- Set feature colors and styles based on attributes
  - Color Themes () are often used to display facility type on a roadway network
  - Pattern Themes (Map → Pattern Theme…) is sometimes used to display number of lanes on a roadway network

Functional Class

Primary Facility Type		Secondary Facility Type	
1	Freeways	10	Freeway
2	HOV	20	HOV 2
		21	HOV 3+
		22	HOV - HOV Connector
3	Expressway / Parkway	30	Undivided
		31	Divided, Interrupted
		32	Divided, Uninterrupted
4	Principal Arterial	20	Undivided
		41	Divided
		42	Continuous Left Turn
5	Minor Arterial	50	Undivided
		51	Divided
		52	Continuous Left Turn
6	Major Col lector	60	Undivided
		61	Divided
		62	Continuous Left Turn

Primary Facility Type		Secondary Facility Type	
7	Minor Collector	70	Undivided
		71	Divided
		72	Continuous Left Turn
		73	Posted Speed 25
		74	Posted Speed 15
8	Ramps	80	Freeway to Freeway Connector
		81	Freeway to arterial
		82	Arterial to freeway
		83	Ramp Distributor
		84	Ramp from Arterial to HOV
		85	Ramp from HOV to Arterial
		86	Collector distributor
		87	Shared HOV Ramps to MF
		88	Truck only
9	Trucks	90	Truck only
100		100	Centroid Connector - Tier 1
200		200	Centroid Connector - Tier 2

Source: SCAG Model Documentation, Appendix A

Speed and Capacity

- See Lookup tables in SCAG Validation Report
  - Chapter 4
  - Defines speed and capacity

Functional Class

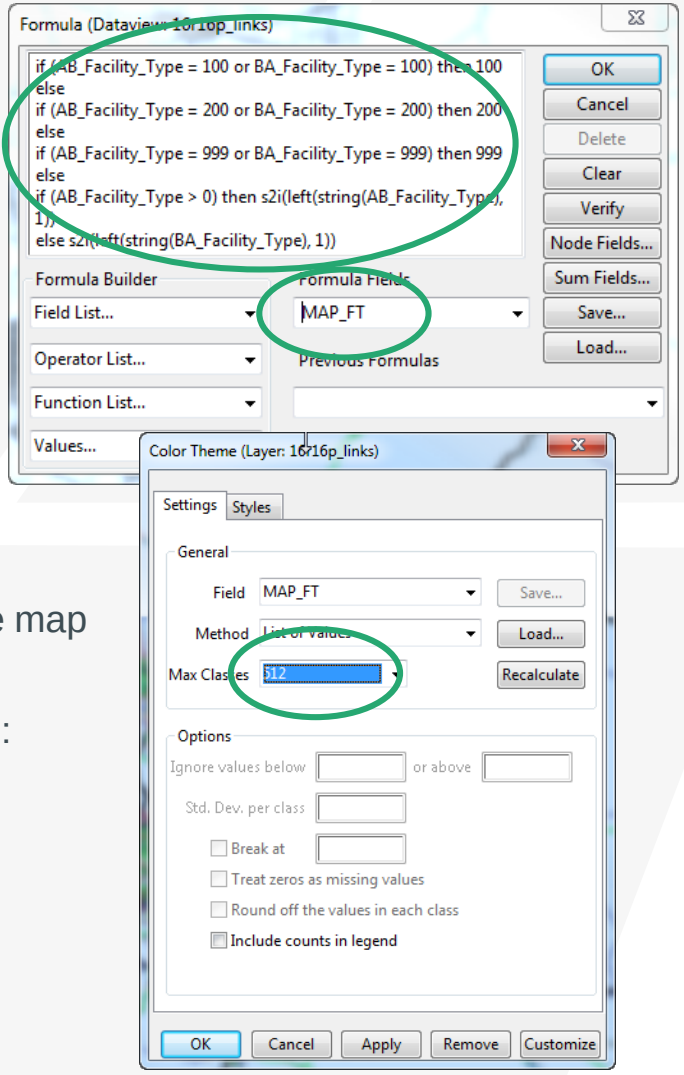
- Two Digit FT Codes
  - Contained in AB_Facility_Type and BA_Facility_Type
  - Difficult to use for map editing setup (too many details)
- One Digit FT Codes
  - Not stored on the network
  - Can be computed

TransCAD Formulas.txt

```
MAP_FT:
-------
if (AB_Facility_Type = 100 or BA_Facility_Type = 100) then 100 else
if (AB_Facility_Type = 200 or BA_Facility_Type = 200) then 200 else
if (AB_Facility_Type = 999 or BA_Facility_Type = 999) then 999 else
if (AB_Facility_Type > 0) then s2i(left(string(AB_Facility_Type), 1))
else s2i(left(string(BA_Facility_Type), 1))
```

Review 1a: Create a color theme for line layer using MAP_FT field

1. Open the **SCAG Loaded Network File**
   - ✓ File→Open, then in the file type dropdown next to 'File name:' select Geographic File(*.cdf,.*dbd) option
   - ✓ Browse to **C:\SCAG Training\assign\Outputs\scag_network_loaded.dbd**
2. Add the MAP_FT Formula Field
   - ✓ In TransCAD, go to Dataview→Formula Fields
   - ✓ Open **C:\SCAG Training\TransCAD Formuals.txt** in notepad (double-click from Windows Explorer)
   - ✓ Copy the MAP_FT formula
   - ✓ Paste the formula into the TransCAD formula field window
   - ✓ Name the formula MAP_FT
   - ✓ Click OK
3. On the top ribbon in TransCAD, click  it is called 'color theme map wizard'
4. It opens up a dialog box with two tabs. In the first tab 'Settings' tab:
   - ✓ Click Load…
   - ✓ Choose From Settings File
   - ✓ Browse to and select SCAG Training\Settings.stg
   - ✓ Choose MAP_FT and click OK,
   - ✓ Click OK again to complete the color theme dialog box



Review 1b: Save your Map

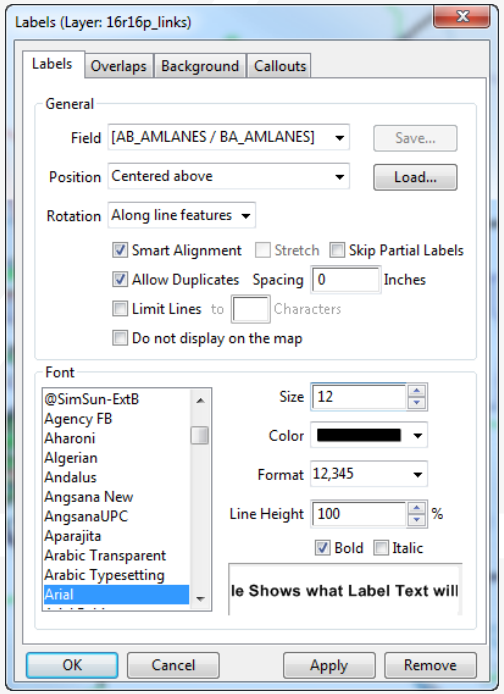
1. Go to File → Save
   - ✓ Browse to C:\SCAG Training
   - ✓ Save the map as **SR126 AQ.map**
2. We will continue to modify our work and save this map

Other Map Tools

- Labels () can be used to show attributes
- Scaled Symbol Themes () can be used to visualize data
- Selection Sets can be used to:
  - View/edit only selected data
  - Change map formatting
  - Show/Hide features

Review 2: Add number of lanes labels

1. Start with the results from Review 1
   - ✓ Open the saved map if needed
2. Use the and zoom-in tool ( ) to zoom in to the area of interest
3. On the top ribbon, click the labels icon ( )
   - ✓ Select the [AB_AMLANES/BA_AMLANES] field
   - ✓ Change the size and color to match your preference
   - ✓ Change the format to have numbers by comma separated
   - ✓ Click ‘OK’ button
4. Save your changes in the map



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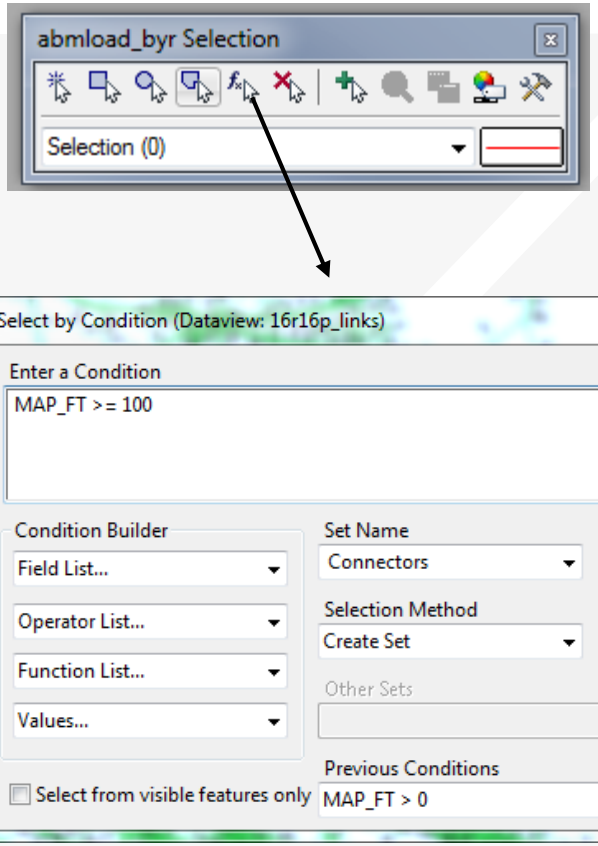
Review 3: Select and hide centroid connectors

1. Start with the results from Review 2
   - ✓ Open the saved map if needed
2. In TransCAD, choose **Tools→ Selection** or hit F9
   - ✓ This will toggle the selection toolbox shown to the right
   - ✓ Click select by condition ( ) to open the query builder
   - ✓ Type in condition: **MAP_FT >= 100**
   - ✓ Type the Set Name: **Connectors**
3. Hide Centroid Connectors
   - ✓ Open selection settings (Selection → Settings or)
   - ✓ Click on **Connectors**,
   - ✓ Click on **Status** until **Connectors** is **Invisible**
   - ✓ Click **Apply** then **Close**
4. Save your changes in the map



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Data Tables (“Dataviews”)

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Working with dataviews

- Open a dataview for any existing layer ()
- Open a standalone table with File → Open
- Add/Remove fields with Dataview → Modify Table
  - (or )
  - Be careful: Changes are permanent once you click “OK”
- Data can be edited directly in the dataview
  - Be careful: Changes are saved as you go
- Create formula fields with 
- Right-Click on a column header for more options
  - Including a formula Fill

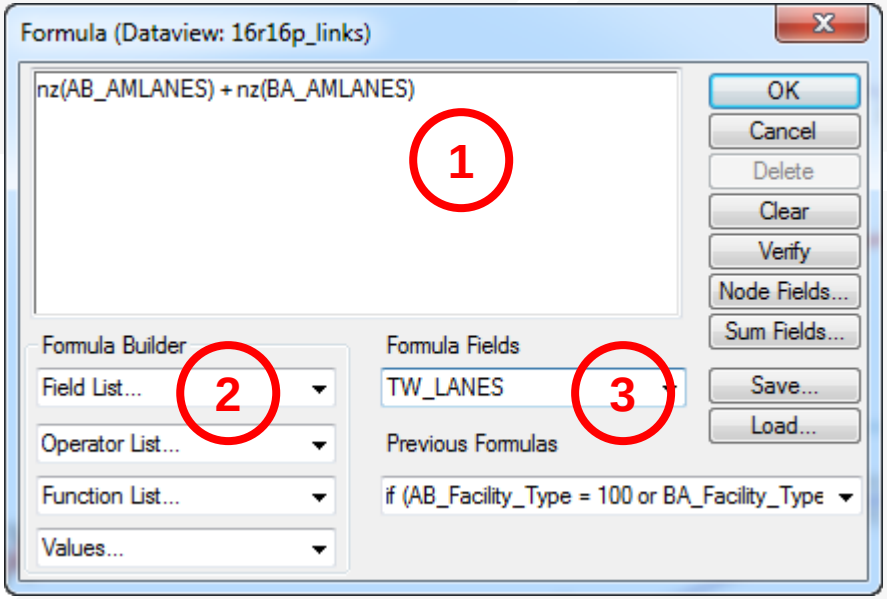
Working with Dataviews

- Formula ***Field*** ***vs.*** Add Field & Formula ***Fill***

Discussion: What is the difference between a formula field and fill?

1. Enter a formula
2. Use the Field List to find field names
3. Name the formula field

Tip: nz([Field]) converts null values to zero values



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Joining Data

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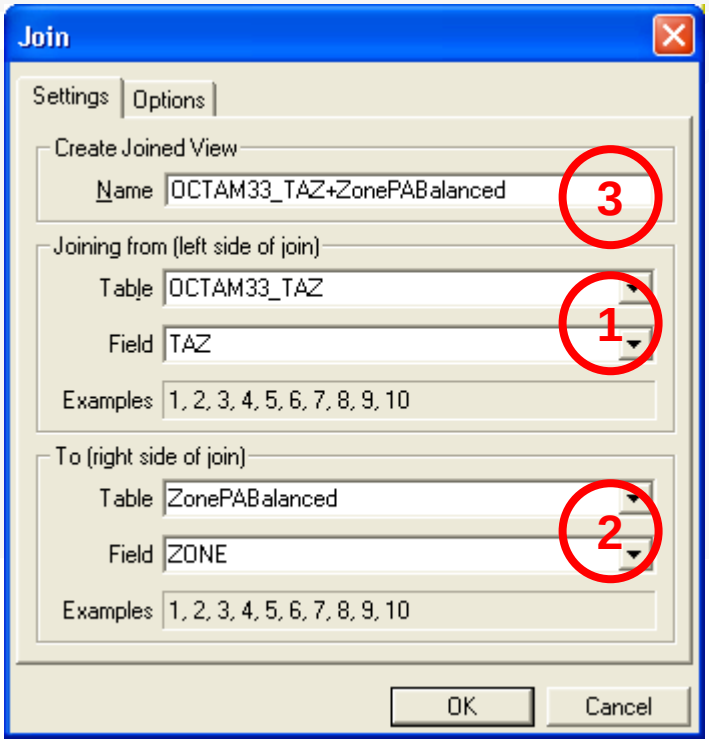
Joining Data

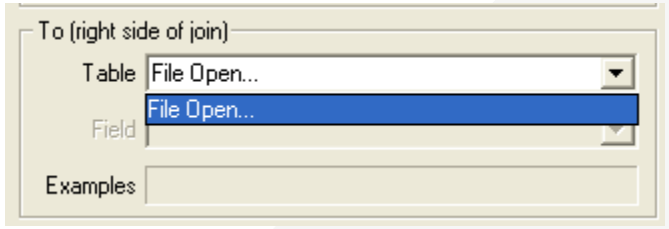
- Layers have an associated data table ()
- Data can be joined () to other tables
  - Roadway Network + Traffic Assignment results
  - TAZ layer + Land Use Data
  - Roadway Network + Lookup Table
  - More…
- This is how traffic assignment results are viewed in TransCAD
- Fields cannot be added/removed from a joined view

Joining Data



1. Select the Primary join table
   - » *Be careful: Check the Field*
2. Select the secondary join table
   - » *Be careful: Check the Field*
3. Create a name for the view, or use the default (do this last)

Tip: You can open a file from the join dialog box



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Highway Assignment

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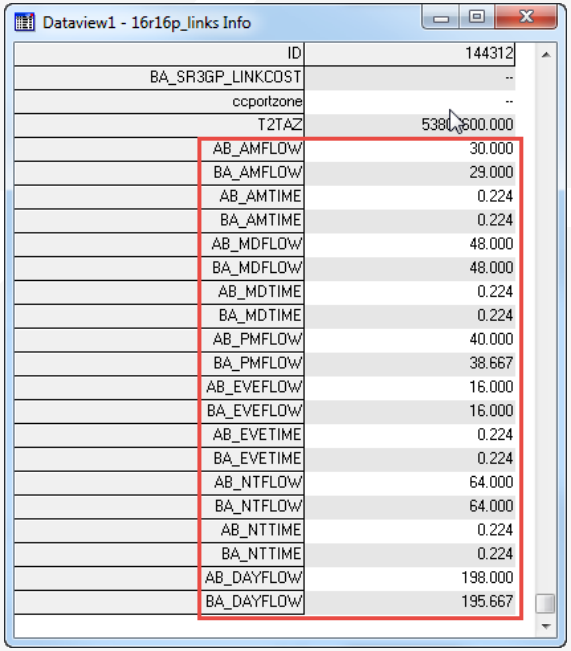
Assignment Results

- Basic Volumes
  - Located on the **Loaded Network**
  - Assign\Output\scag_network_loaded.dbd
- Volume and Travel Time for:
  - Each Period
    (AM, MD, PM, NT, EVE)
  - Total daily



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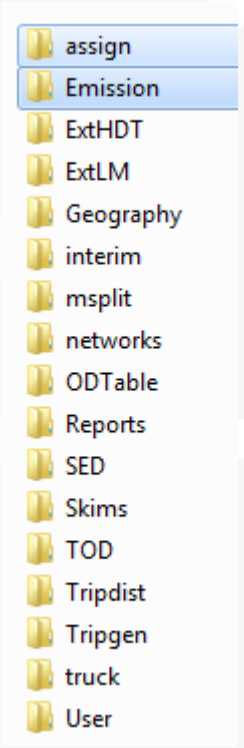
Assignment Results

- Detailed Results in a separate table
  - Join to the network using ID & ID1
  - By time period or daily
  - In the assign\Outputs folder
- Processed version in ‘emission’
  - Adjusted as part of SCAG’s air quality modeling process
  - Can be used if desired, but be consistent within a project!

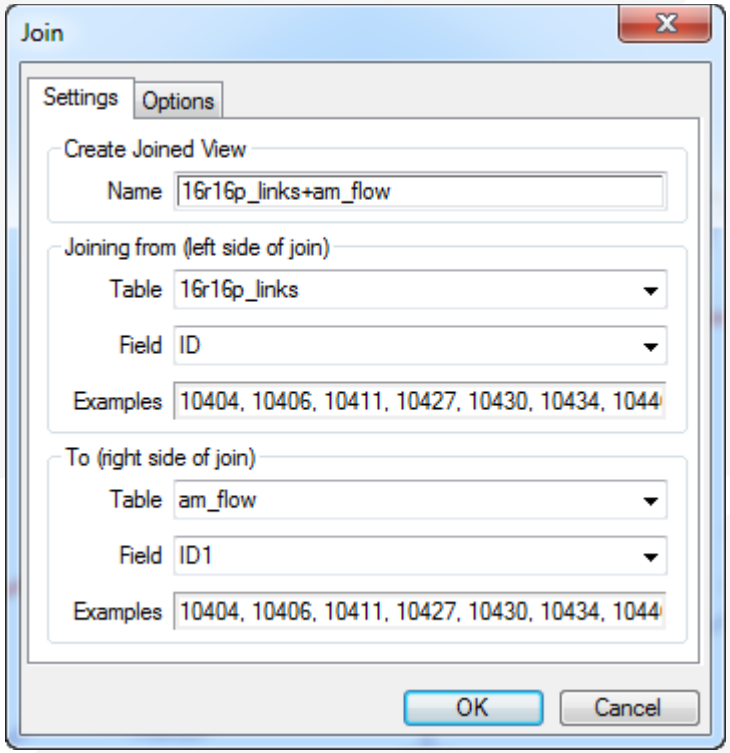


Assignment Results

- Detailed Results include:
  - Basics:
    - Total Flow
    - Flow by class (e.g., drive alone, shared ride, truck)
    - Travel time and speed (congested time by period)
  - Extras / Statistics:
    - VMT (called V_Dist_T)
    - VHT
    - Volume to Capacity Ratio (“VOC”)
    - PCE Values
  - Select Link / Zone Results
    - Only present if mode was run with assign\Inputs\SelectLink.qry

Review 4: Join AM Assignment Results to the Network

1. Start with the results from Review 3
   - ✓ Open the saved map if needed
2. Open the detailed AM assignment results
   - ✓ Use **File → Open**
   - ✓ Browse to **Assign\Outputs\am_flow.bin**
3. Create the join from **Dataview → Join** or 
   - ✓ Left side: **16r16p_links** and **ID**
   - ✓ Right side: **am_flow** and **ID1**
   - ✓ Click **OK**
   - ✓ Remember: Do not close the joined view.
4. Use the **info** tool to review the results



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Assignment: Key Fields

- ***_Flow_PCE:** Passenger Car Equivalent traffic flow.
  - » Different types of vehicles have different PCE Vales
- ***_Time:** Congested travel time (minutes)
- ***_VOC:** Volume to Capacity Ratio (uses PCE)
- ***_V_Dist_T:** Vehicle Miles Traveled
- ***_VHT:** Vehicle Hours Traveled
- ***_Speed:** Contested speed (mph)

Assignment: Key Fields *(continued)*

- ***_VDF:** Volume delay function results
  - Same as time in the SCAG model
  - Some models use different functions
- ***_Flow_[CLASS]:** Flow by vehicle type
  - Truck classes are duplicated (e.g., both **LHDT** and **LIGHT_TRUCKS**)
  - Truck classes also show PCE values
- **AB_Flow / BA_Flow / TOT_Flow:** "Final Answer" total flow values

Review 5: Mapping Challenge

1. Start with the results from Review 4
   - ✓ Open the saved map if needed
2. Change labels to show % Truck on each link
   - ✓ Use a formula field and labels together
3. Create a volume bandwidth theme
4. Change the color theme to reflect V/C Ratio
   - ✓ Make links with >80% orange
   - ✓ Make links with >90% red
5. Create and edit a legend
6. Put this map in a new layout
   - ✓ Remember to add title, legend and date
   - ✓ make this a report-ready layout

Review 5 Solution

- A solution file will be available separately

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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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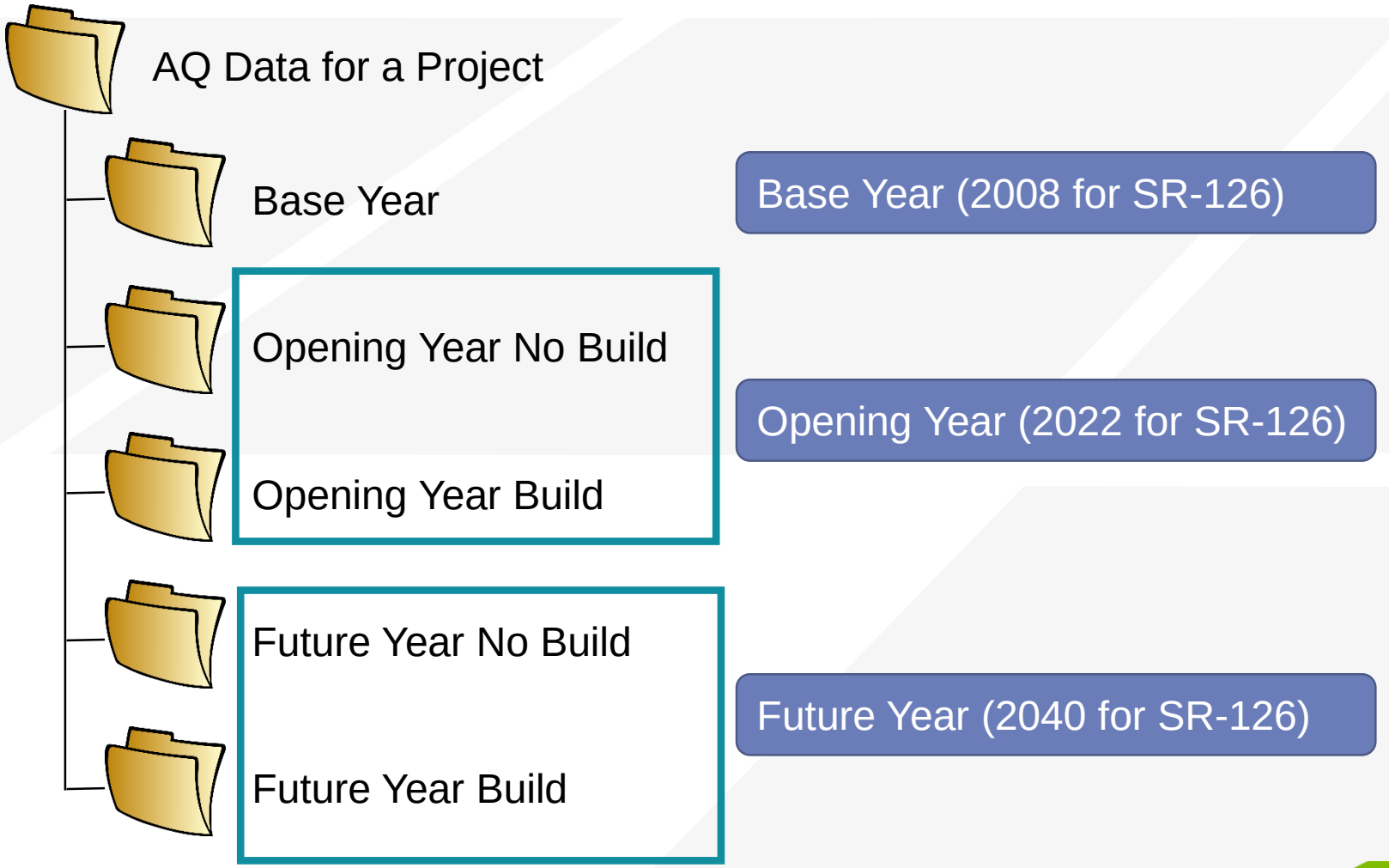
Air Quality Analysis Data Needs

- 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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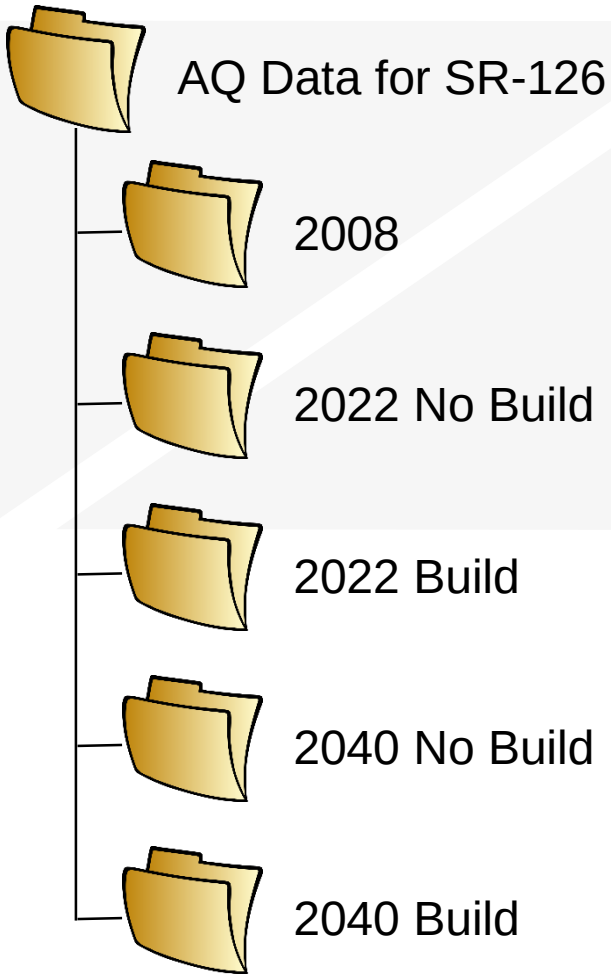
SCAG Model Alternatives

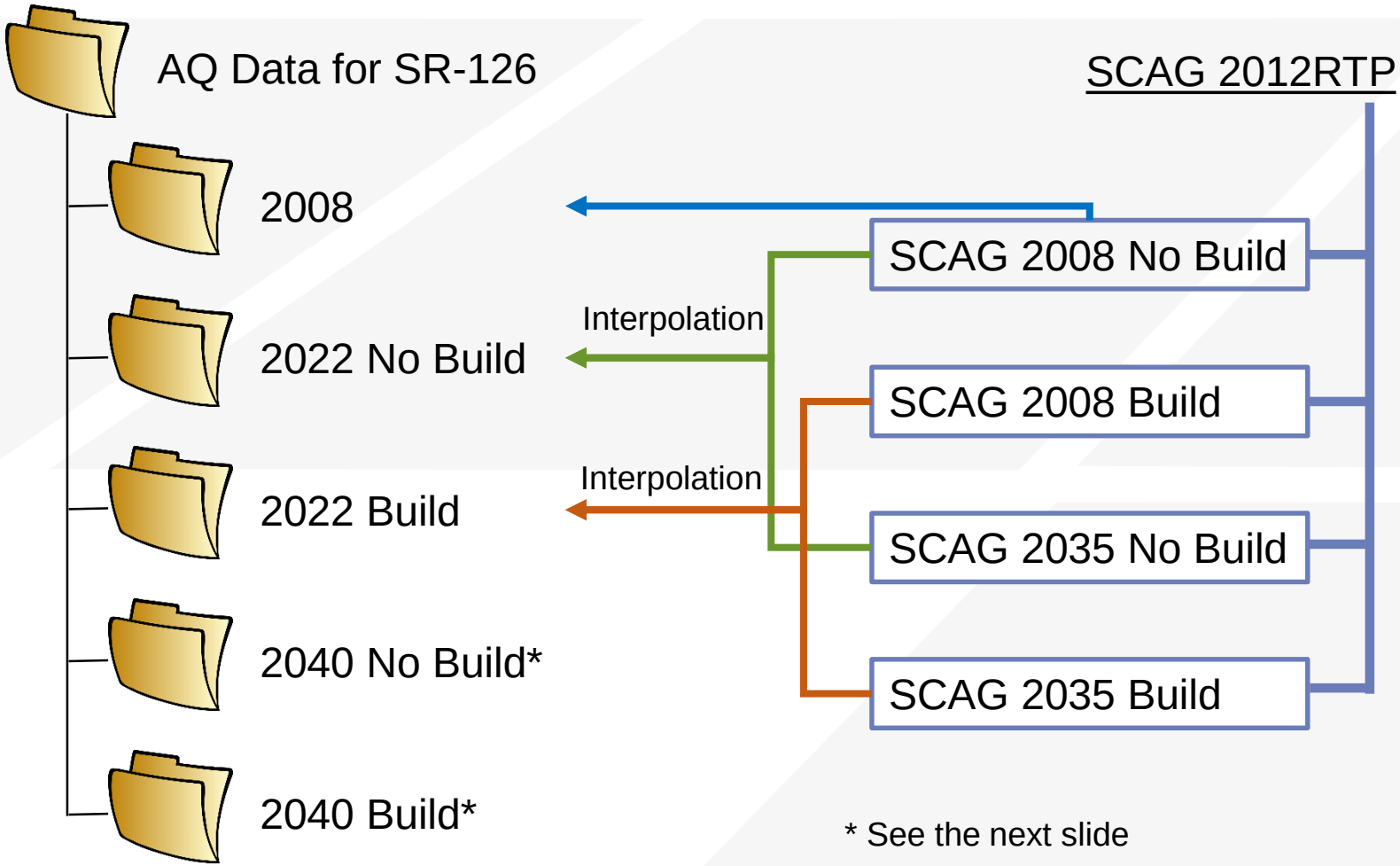


SCAG 2012RTP

- 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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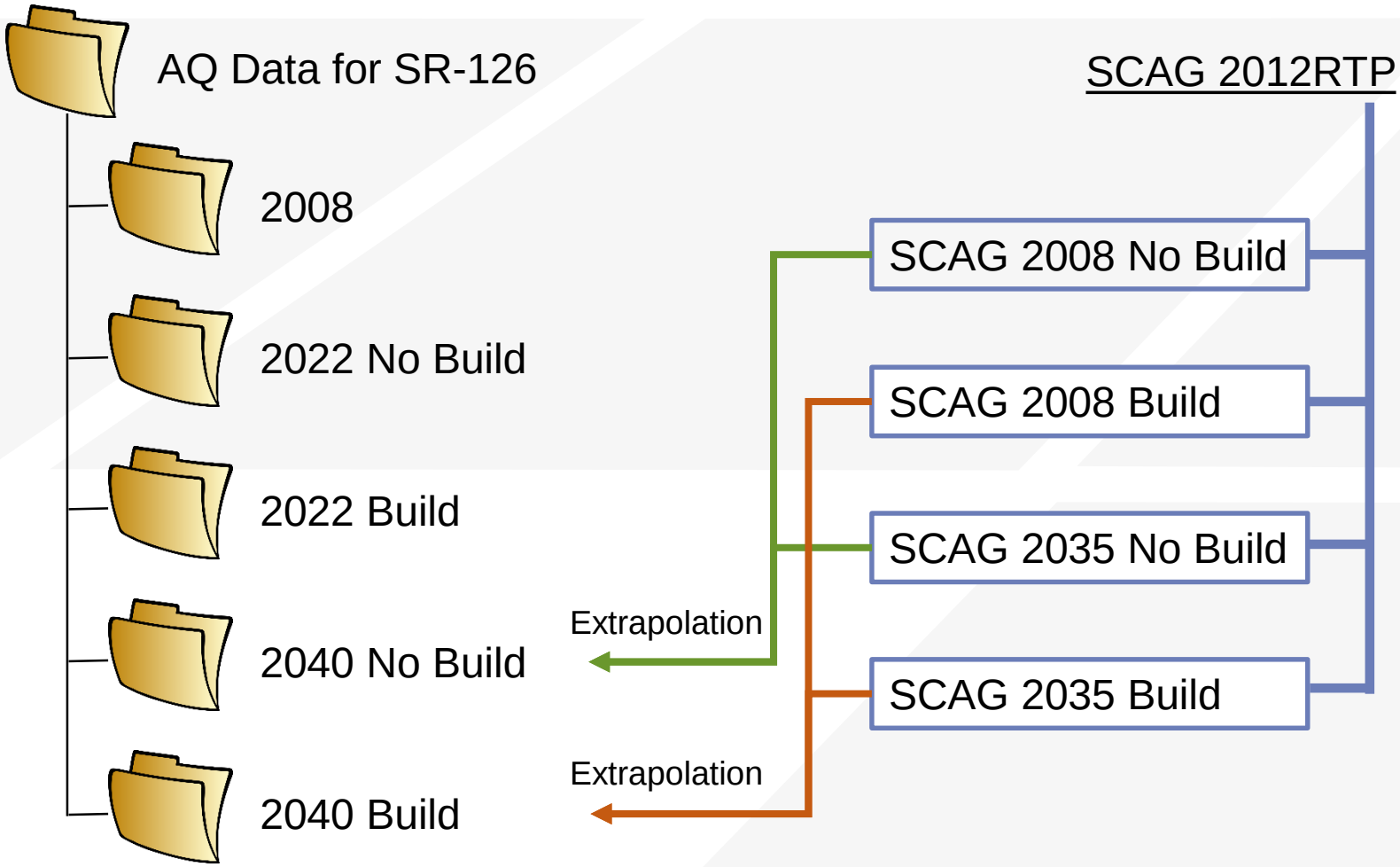
Match of AQ Data Needs and SCAG Models



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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)

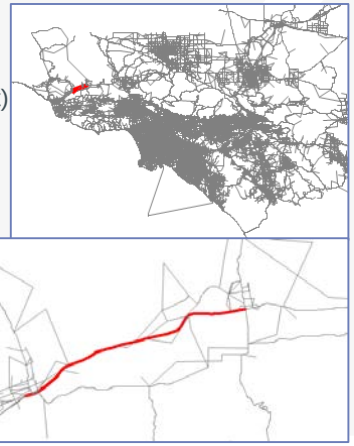
- Step 5: Copy traffic assignment results to the AQ Excel file
  - Purpose: Clean and organize traffic assignment tables to show only what will be copied to the AQ Excel file
  - TransCAD operations
    - Show only records of interest
    - Show only fields of interest
    - Sort records in TransCAD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

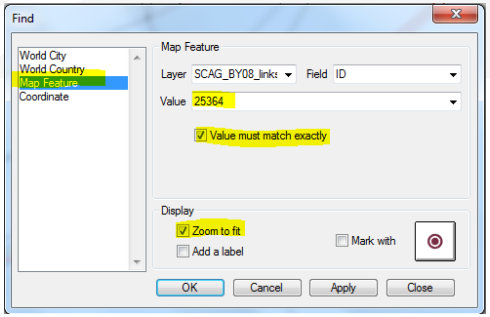
Practice 1: Create and fill the 2008 AQ Excel file

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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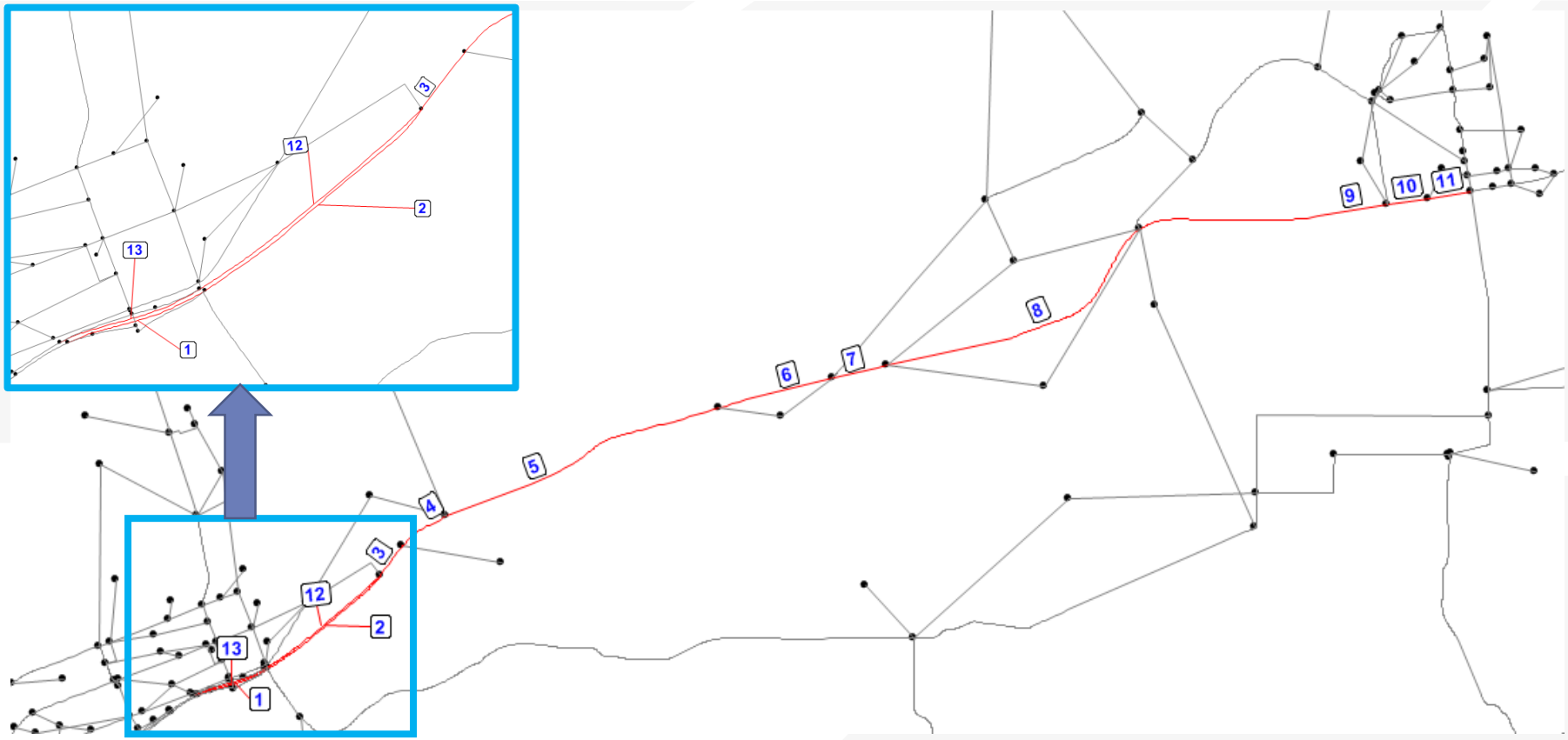
Project Link IDs used in the Practice



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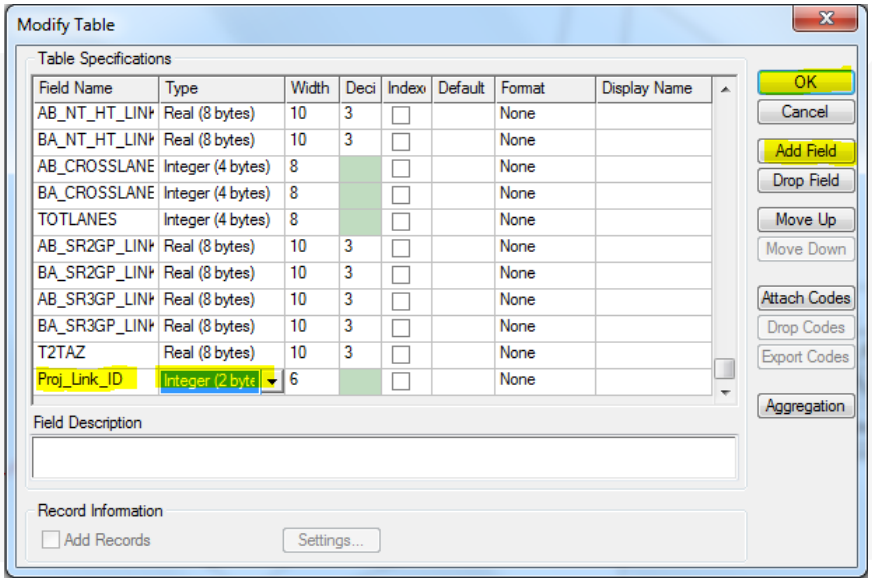
Practice 1: Create and fill the 2008 AQ Excel file

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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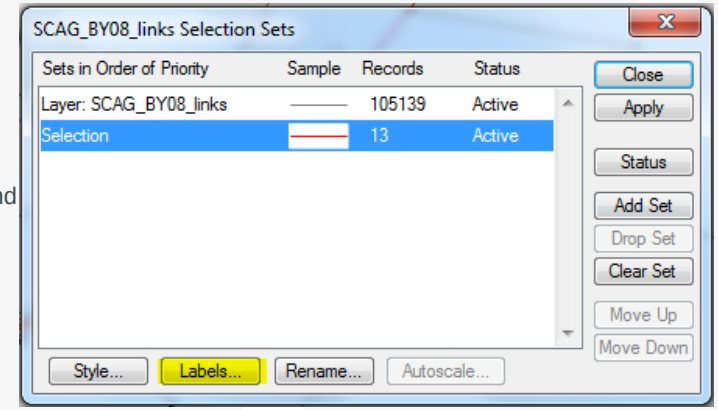
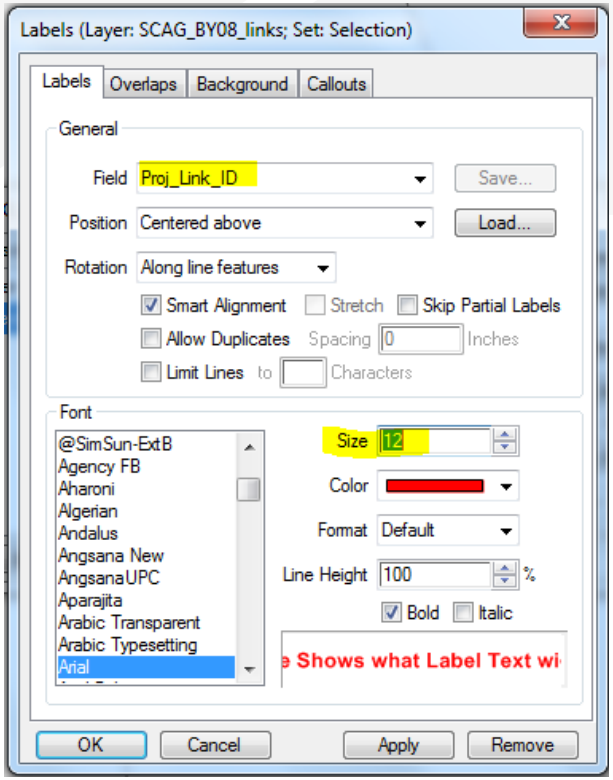
Practice 1: Create and fill the 2008 AQ Excel file

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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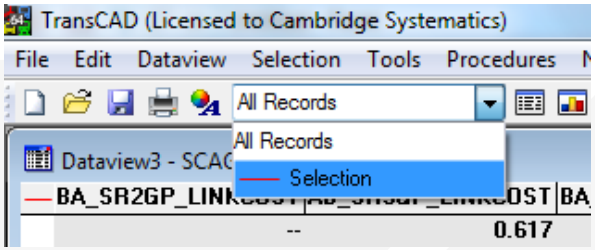
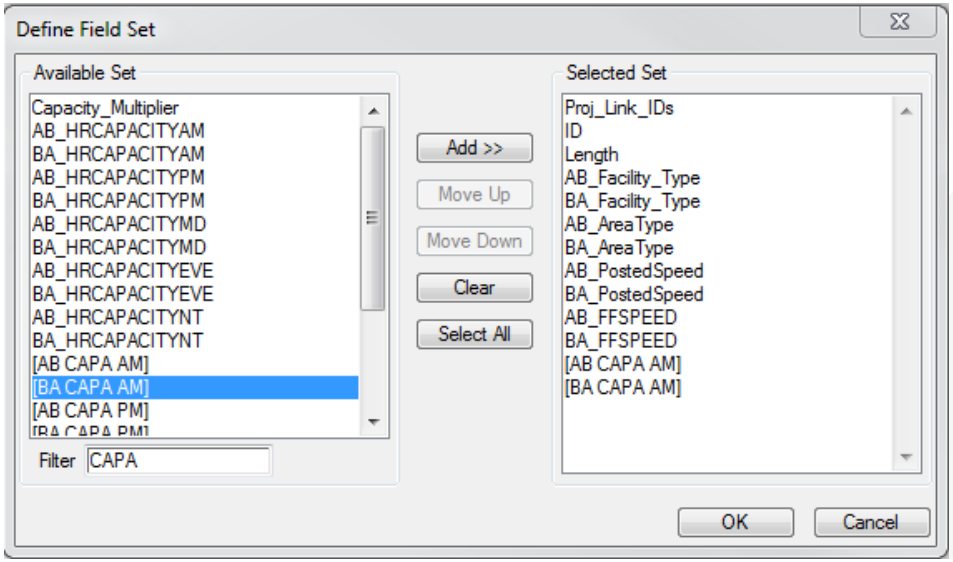
Practice 1: Create and fill the 2008 AQ Excel file

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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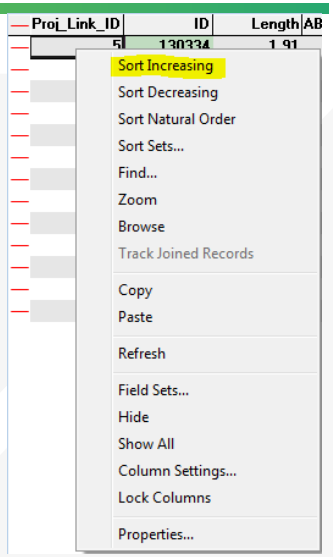
Practice 1: Create and fill the 2008 AQ Excel file

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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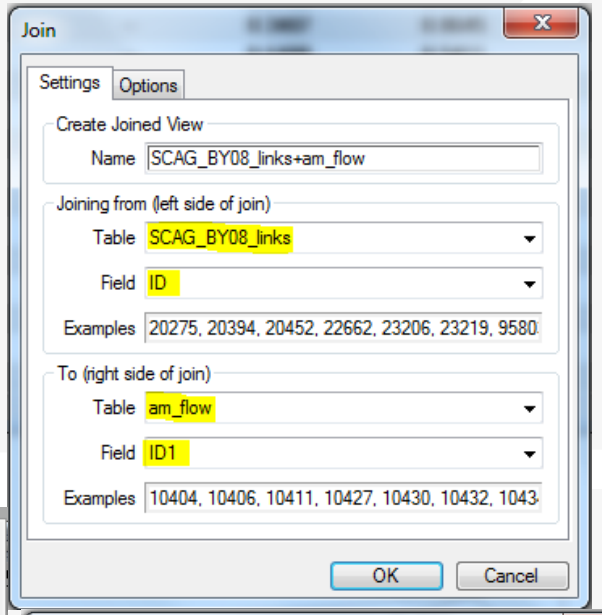
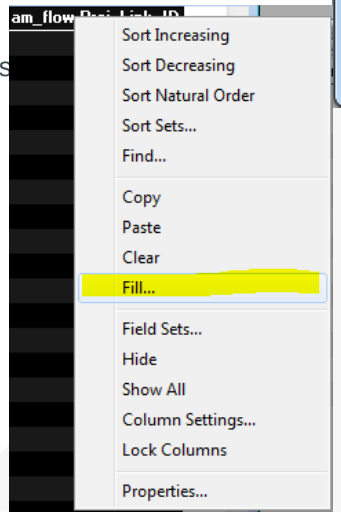
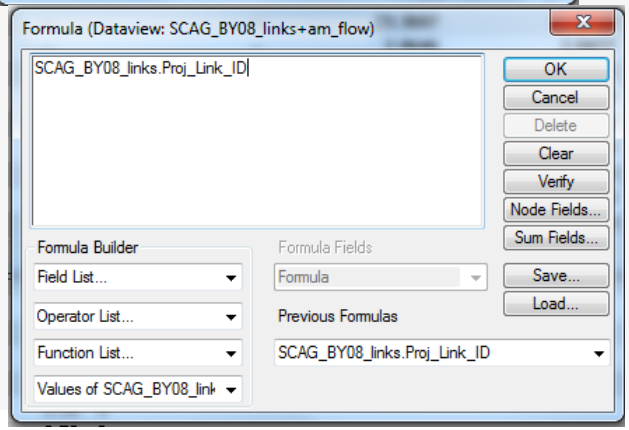
Practice 1: Create and fill the 2008 AQ Excel file

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.



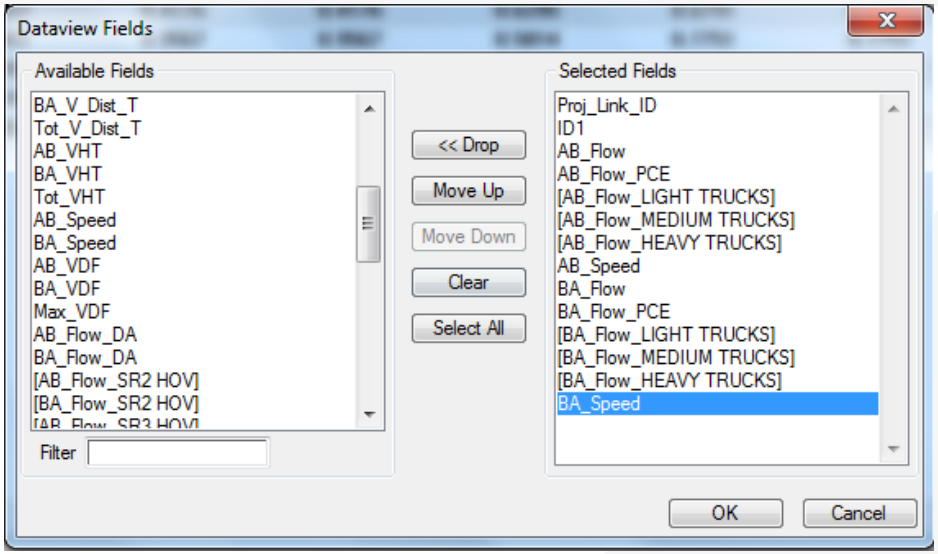




Practice 1: Create and fill the 2008 AQ Excel file

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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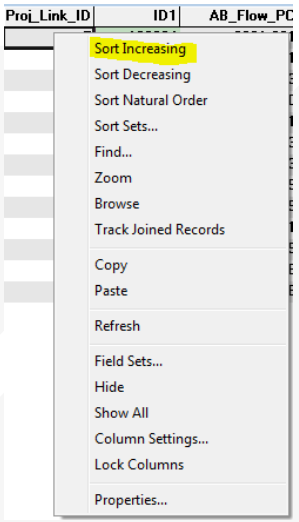
Practice 1: Create and fill the 2008 AQ Excel file

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

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

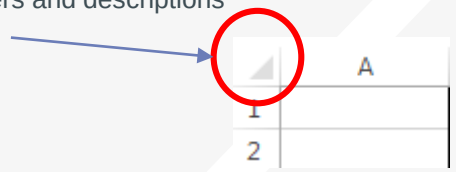
- V_i^n is the traffic volume for Year n on Link i. It could be
  - Total Vehicles
  - Total PCE
  - Light Heavy Duty Vehicles
  - Medium Heavy Duty Vehicles
  - Heavy Heavy Duty Vehicles

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

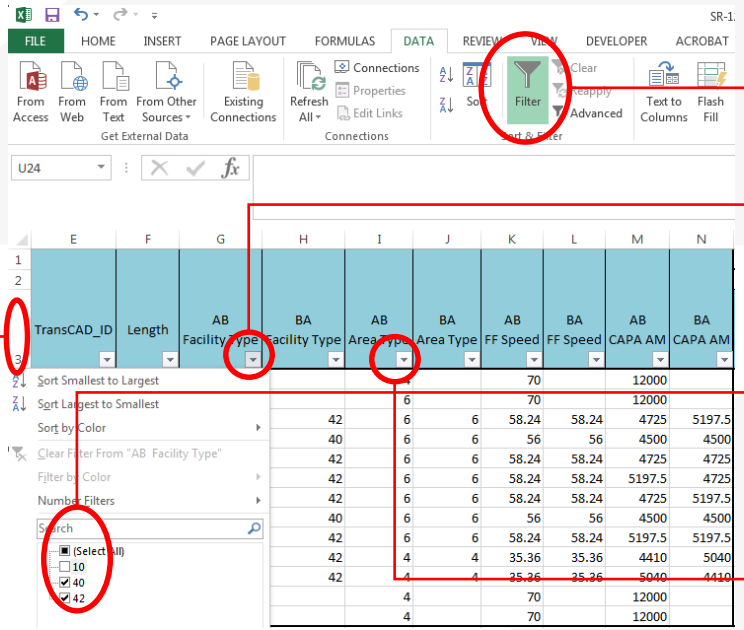
If $\frac{x_i}{C_i}$ <= 1 then β is set to the specific value of 5.0. If $\frac{x_i}{C_i}$ > 1, then α and β are set to values that vary by link facility type, posted speed, and area type according to the values in Table 8-3.

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)