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Think Forward

Data Preparation for AQ Analysis

presented to

Caltrans District 7

presented by

Cambridge Systematics, Inc.

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Motivation

➤ Review the procedures to prepare data for AQ analysis based on a real project, from the beginning to the end

➤ Review the following topics
  » SCAG model
  » Network attribute changes
  » Run SCAG model
  » Data extraction and interpolation based on the customized GISDK tool
  » Basic TransCAD operations

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Agenda

- Overview of the SR-118 Project

- Overview of the Air Quality Analysis Process

- Plan Model Runs

- Run SCAG Models

- Extract and Interpolate Data

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Overview of the SR-118 Project

SR - 118

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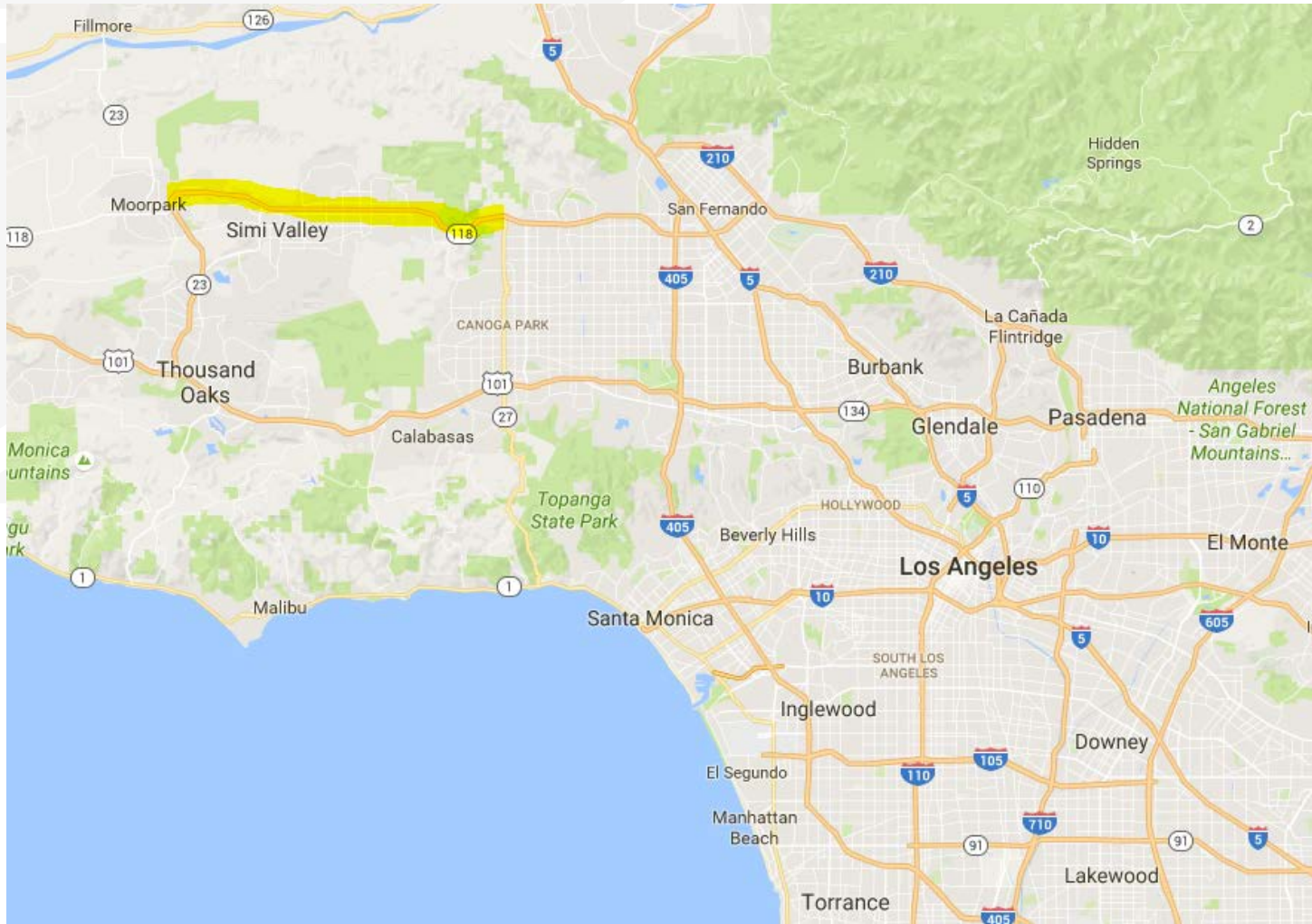
Project Alternatives

➤ **Alternative 1:** No-Build Alternative.

➤ **Alternative 2:**
» Add one lane to each direction
» Add one additional lane from Collins Dr. to Madera Rod. In each direction

➤ **Alternative 3:**
» Add one lane to each direction

Model Analysis Years and Phases

➤ **Existing Year:** 2014

➤ **Opening Year 1:** 2025
  » In Year 2025, the **Phase 1** of the project will be completed
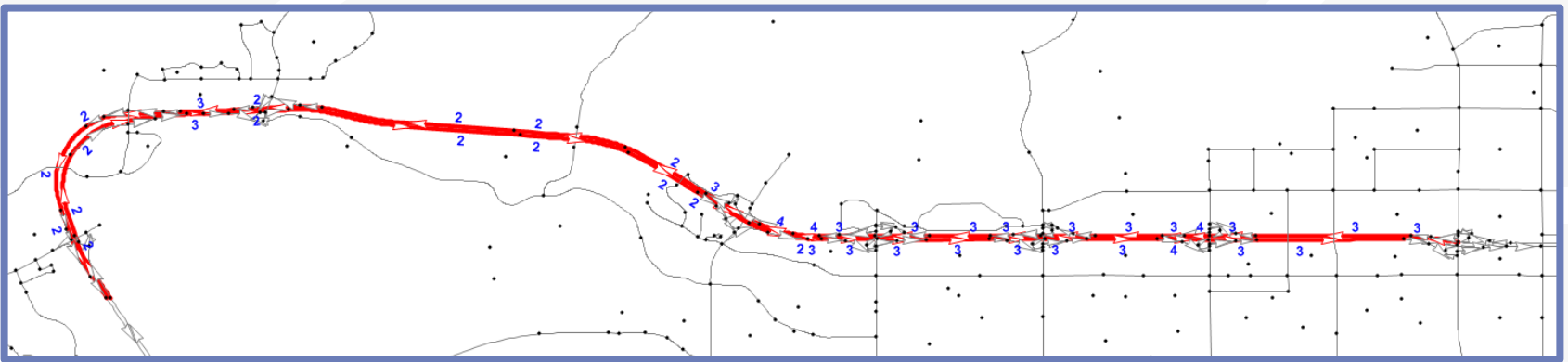 » In Phase 1, only the east bound of SR-118 will be widen.

➤ **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

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Links Affected by the SR-118 Project

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Overview of the Air Quality Analysis Process

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Overview of the Procedures

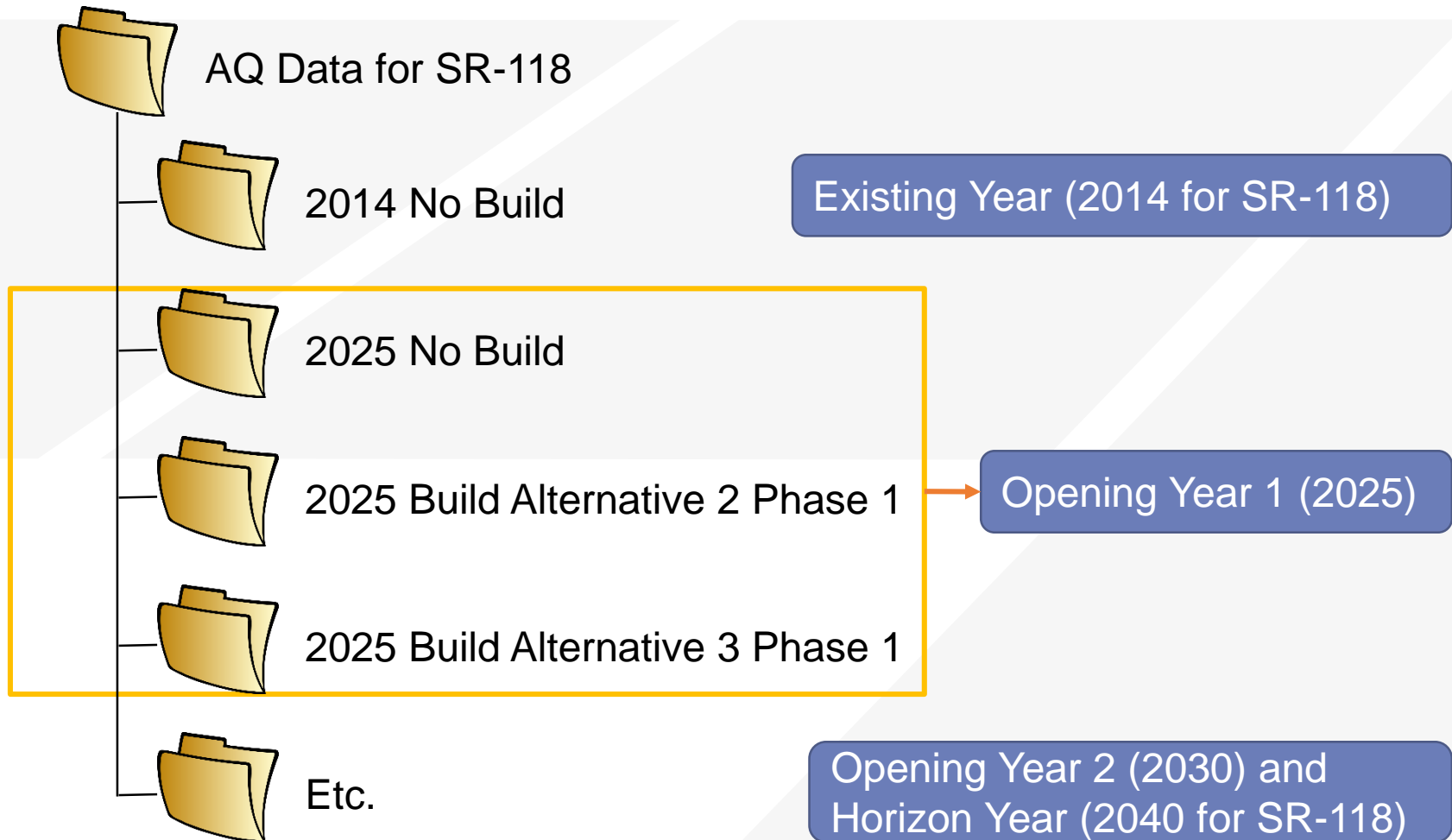Plan model runs → Run SCAG models → Extract and interpolate data
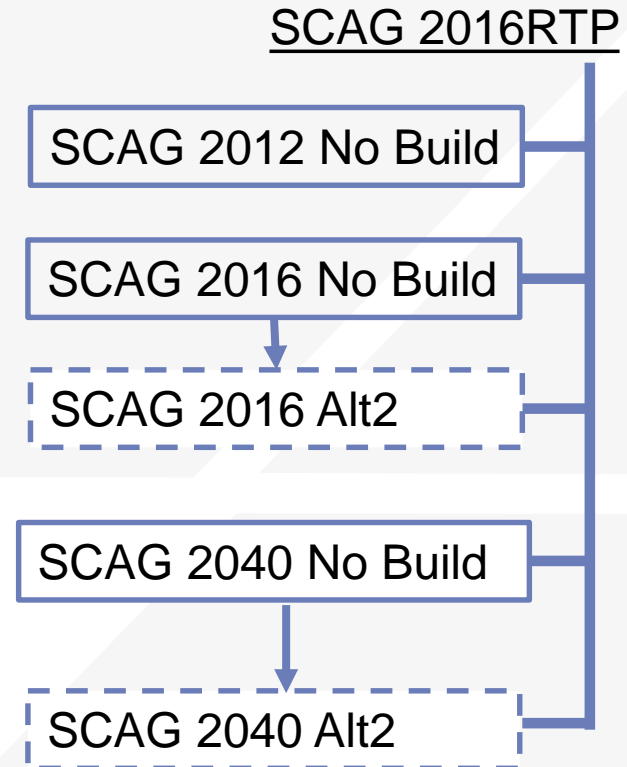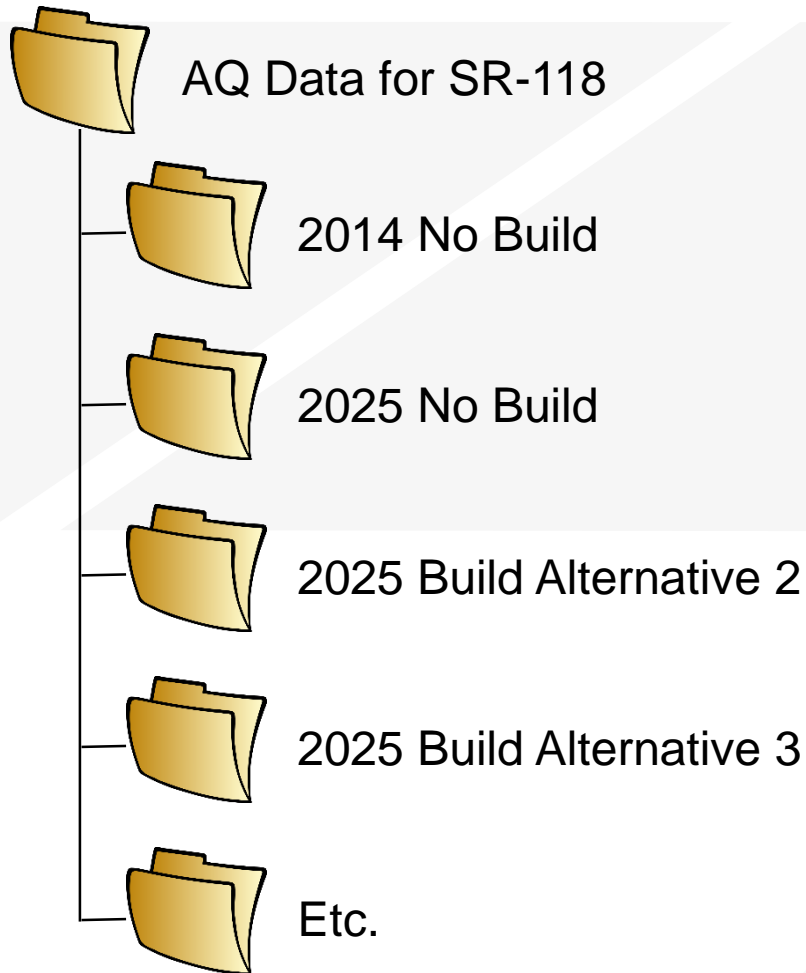
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Air Quality Analysis Data Needs

➤ Key information for an Air Quality (AQ) analysis

» Total Volume

» Truck Percent

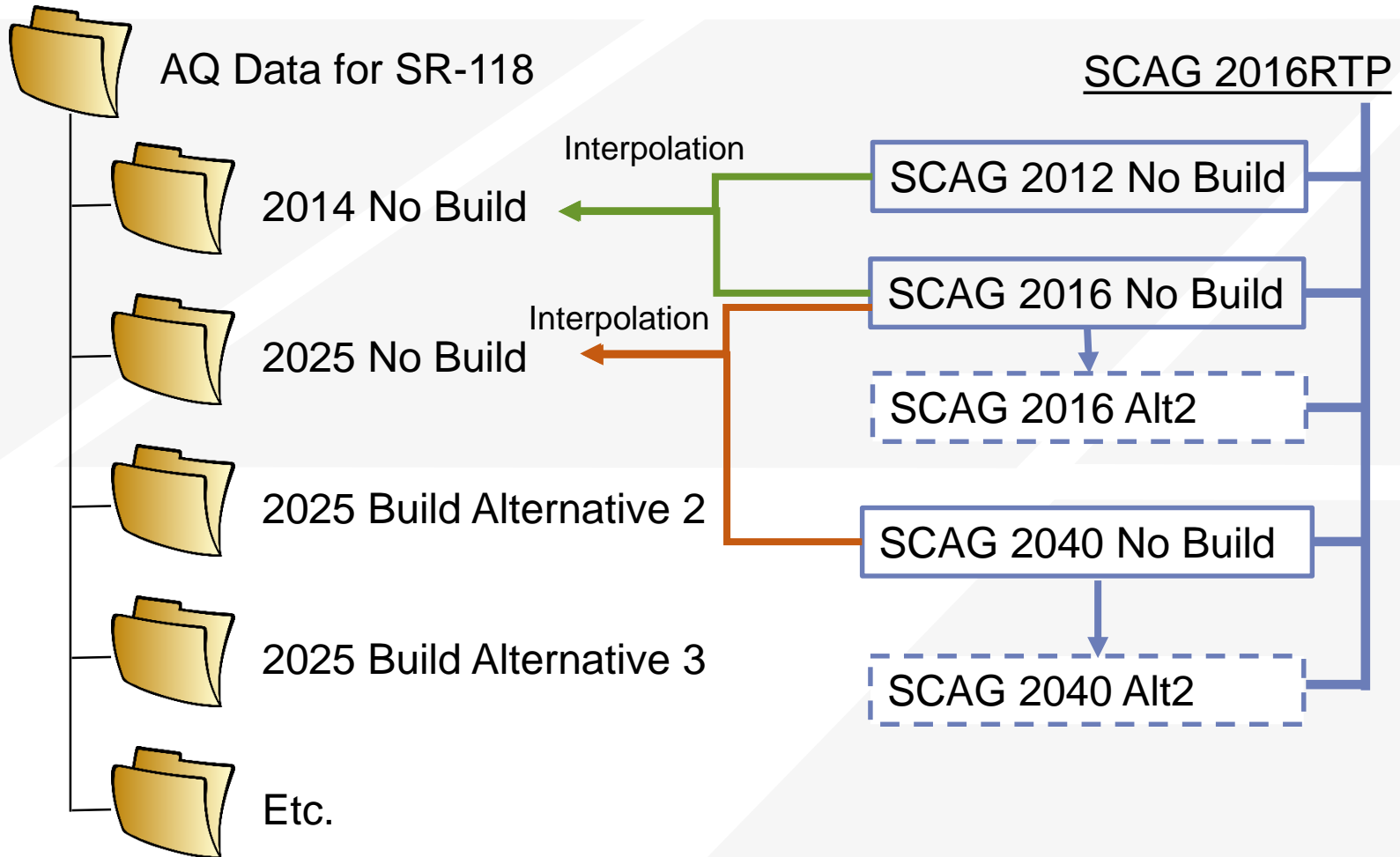» Congested Speed

» Vehicle Miles Traveled (VMT)

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Plan Model Runs

Air Quality Analysis Data Needs

AQ Data for SR-118

2014 No Build

Existing Year (2014 for SR-118)

2025 No Build

2025 Build Alternative 2 Phase 1

Opening Year 1 (2025)

2025 Build Alternative 3 Phase 1

Etc.

Opening Year 2 (2030) and Horizon Year (2040 for SR-118)

SCAG Model Alternatives

AQ Data for SR-118

SCAG 2016RTP

- 2014 No Build
- 2025 No Build
- 2025 Build Alternative 2
- 2025 Build Alternative 3
- Etc.

SCAG 2012 No Build

SCAG 2016 No Build

SCAG 2016 Alt2

SCAG 2040 No Build

SCAG 2040 Alt2

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Match of AQ Data Needs and SCAG Models

AQ Data for SR-118

SCAG 2016RTP

- 2014 No Build
- 2025 No Build
- 2025 Build Alternative 2
- 2025 Build Alternative 3
- Etc.

Interpolation

Interpolation

SCAG 2012 No Build

SCAG 2016 No Build

SCAG 2016 Alt2

SCAG 2040 No Build

SCAG 2040 Alt2

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Match of AQ Data Needs and SCAG Models

AQ Data for SR-118

- 2014 No Build
- 2025 No Build
- 2025 Build Alternative 2
- 2025 Build Alternative 3
- Etc.

SCAG 2016RTP

SCAG 2012 No Build

SCAG 2016 No Build

SCAG 2016 Alt2

Interpolation

SCAG 2040 No Build

SCAG 2040 Alt2

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Plan Model Runs

- Ten model alternatives are required for the AQ Analysis

- Eleven model runs are needed

- Read Table 1 in the handout

Run SCAG Models

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Steps to Run SCAG Models for AQ Analysis

➤ Code the project in the network

➤ Re-run the traffic assignment step*

  » Run network initialization

  » Run traffic assignment

* Notes: if the project is big enough to change the regional trip distribution or it is a transit project, need to conduct a one-loop run, instead of traffic assignment only.

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Code the Project in the Network

➤ Change number of lanes

➤ 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

  » Add one additional lane (two lanes in total) to the east bound of the freeway between Collins Dr. to Madera Rd.

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Code the Project in the Network

➤ All changes are made to the input highway network

» \networks\Inputs*_links.dbd

➤ Need to change the number of lanes for all time periods

BA_Facility_Type	--
AB_PostedSpeed	65
BA_PostedSpeed	--
AB_AMLANES	3
BA_AMLANES	--
AB_PMLANES	3
BA_PMLANES	--
AB_MDLANES	3
BA_MDLANES	--
AB_EVELANES	3
BA_EVELANES	--
AB_NTLANES	3
BA_NTLANES	--
FWY_Main_Lane	3
FWY_Aux_Lane	--
FWY_Acc_Dec_Lane	--
TRUCK_CLIMB	--

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Exercise 1: Code the number of lanes

➤ Code the number of lanes for 2016 Alternative 2 Phase 1

➤ The following tricks can help you do the work faster:

» Show node layer to help the work

» Show the flow direction on the links

» Use "Selection Set" to select the project links

» Use "Fields Set" to show only the fields that you want to see

» Can show the Google Map layer to help the work

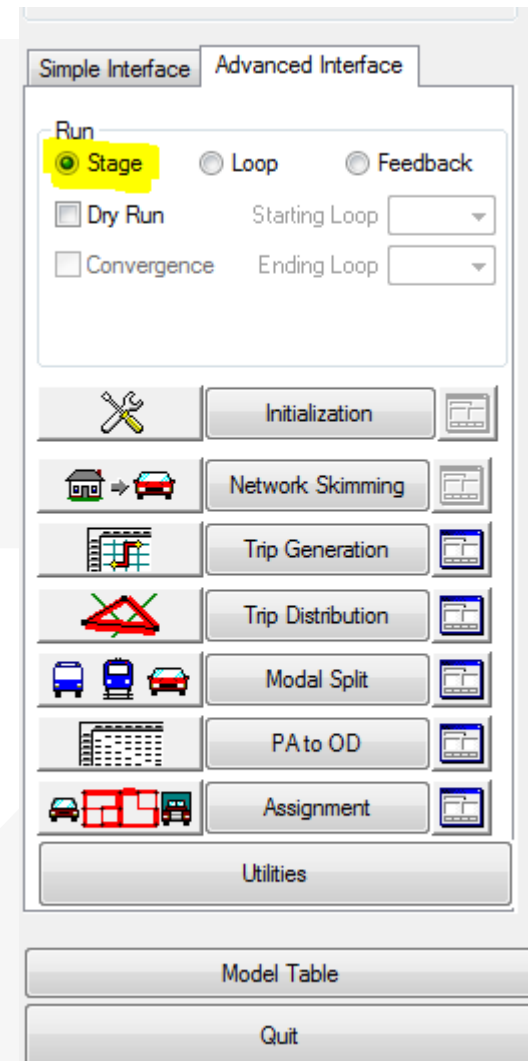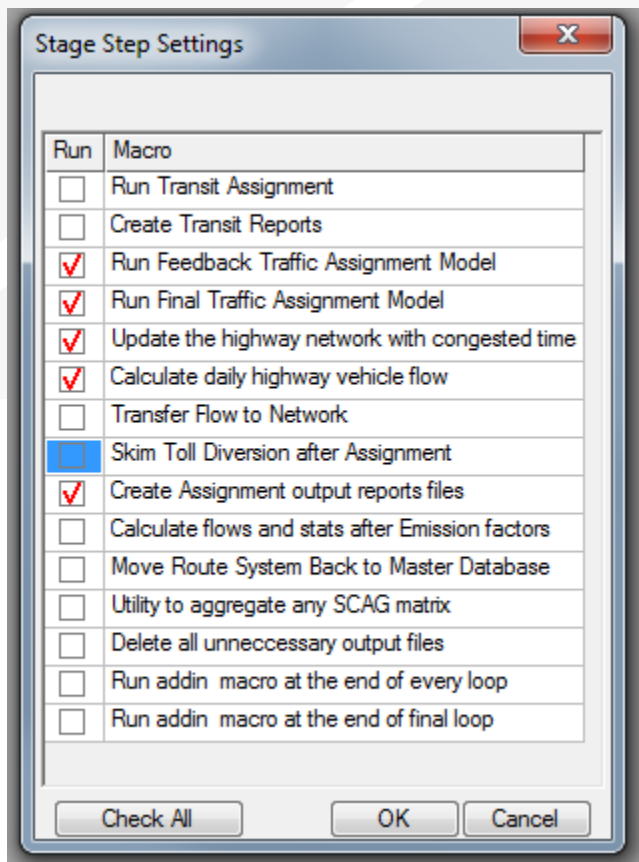CAMBRIDGE SYSTEMATICS

Re-run Traffic Assignment

➤ Run network initialization

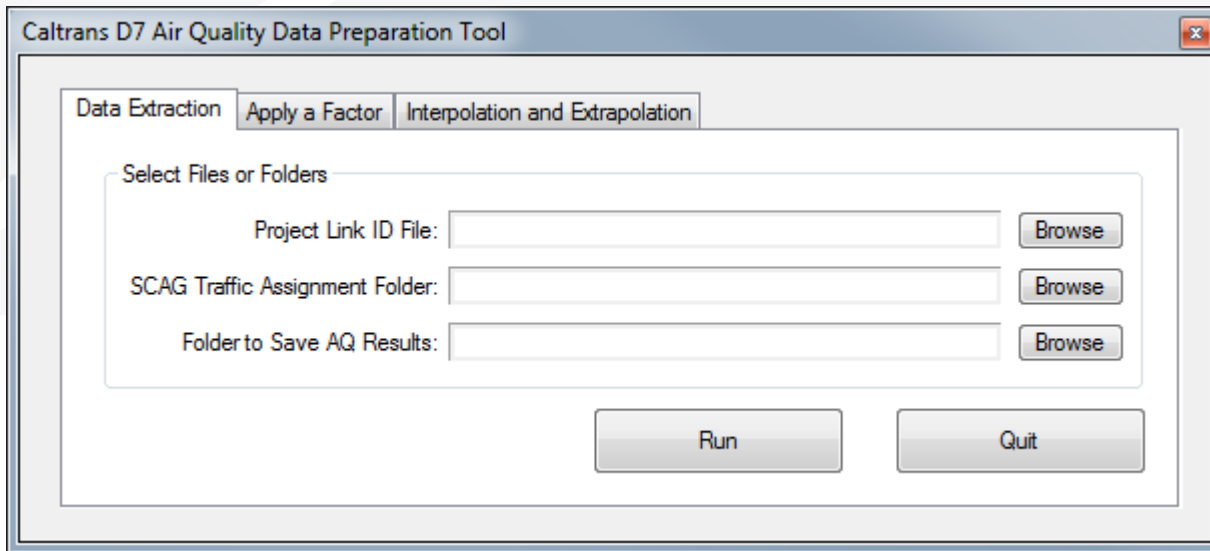CAMBRIDGE SYSTEMATICS
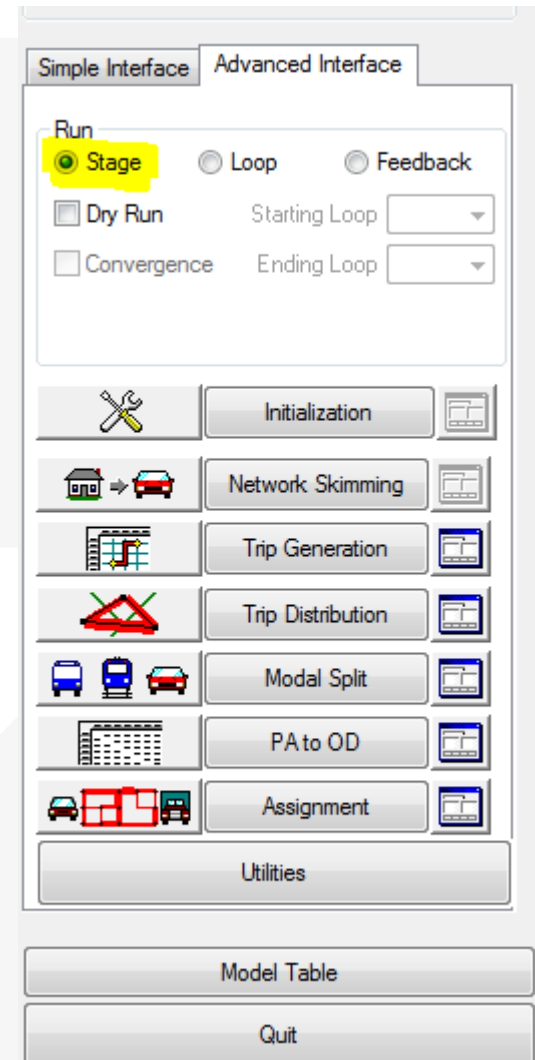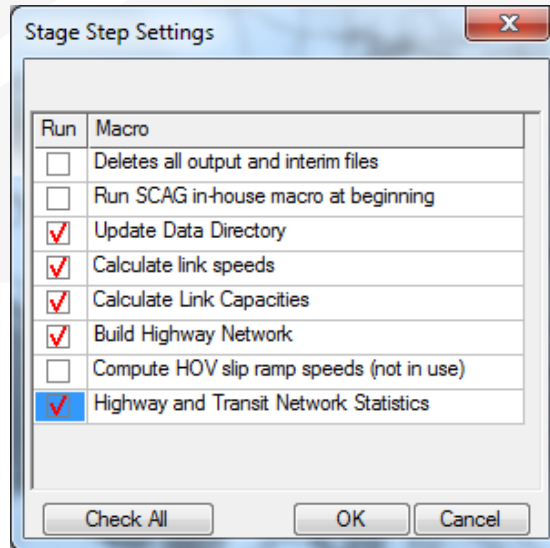
Re-run Traffic Assignment

➤ Run traffic assignment

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Extract and Interpolate Data

Customized Tool to Prepare Data

➤ Caltrans D7 Air Quality Data Preparation Tool

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Flow Chart

Data Extraction for the Air Quality Analysis

Prepare Input Files
(Project links and associated information)

↓ Convert Excel files to Bin files

Extract Traffic Assignment Results
(Using the GISDK script)

↓ Copy CSV files to Excel template files

Formatted AQ Data to be transferred to the AQ Analysis Staff

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Input

➤ The input file contains
- » Project link number
- » TransCAD link ID
- » Topological direction
- » Link length
- » Route number
- » Facility type
- » Post Mile etc.

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.

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What Links should be included for an AQ Analysis

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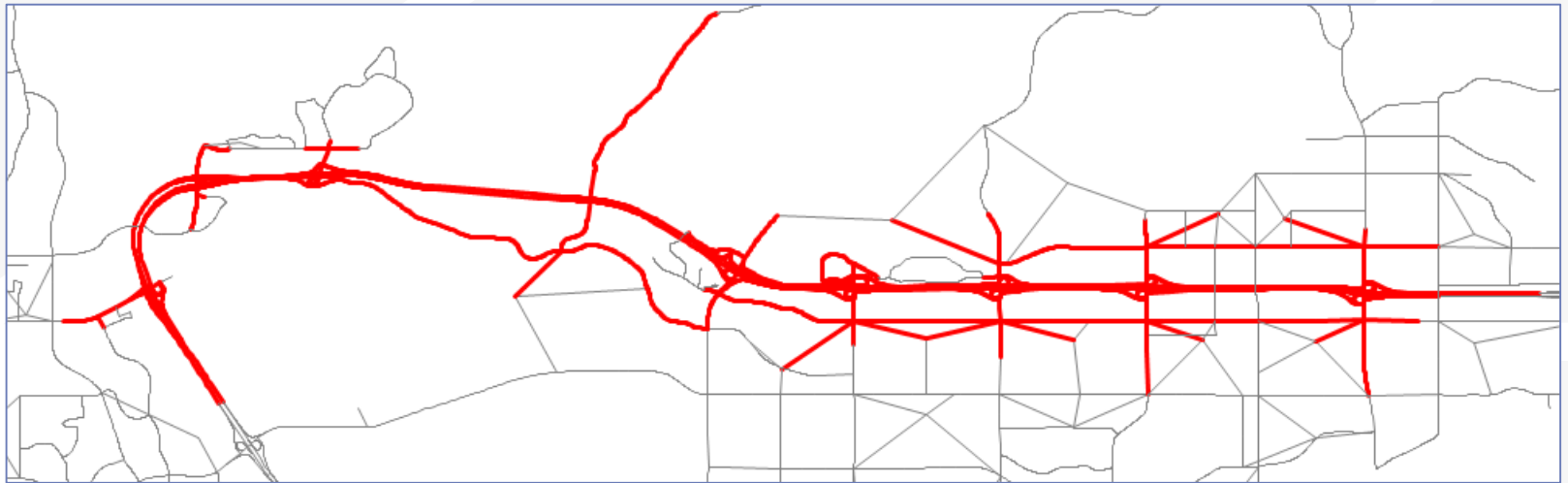
Output

CSV Files

- » Two or four freeway csv files, one for each direction
- » One ramp csv file
- » One arterial csv file

Copy to the Excel Template File

- » Copy values only

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Exercise 2: Run the AQ Tool

➤ Install the AQ Tool (TransCAD Add-ins)

➤ Run the tool

➤ Examine the results

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Exercise 2-1: 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 "\D7_AQ_Tool".

» Click the "OK" button to close the window.
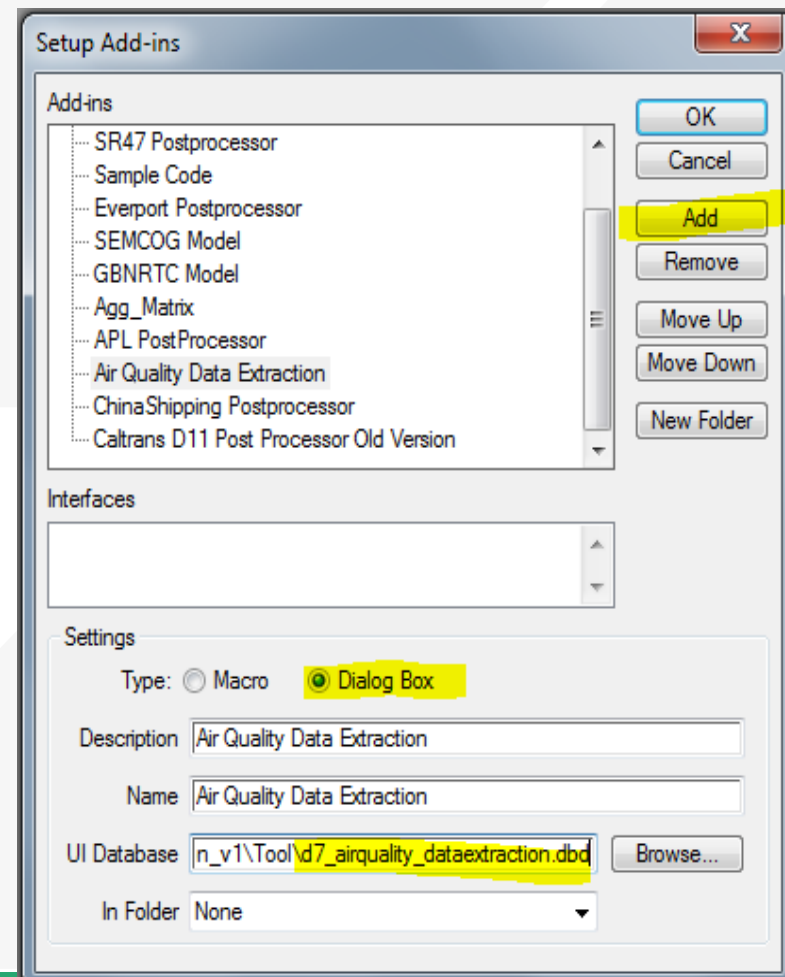
Exercise 2-2: Run Data Extraction

➤ Step 3: Select the tool from Tools→ Add-Ins

➤ Step 4: On the "Data Extraction" tab, specify the inputs and output folder, and click "Run" to run the data extraction

» Project Link ID file is "\SR-118_AQ_Input\Project_List_SR-118_04062017.bin"

» SCAG Traffic Assignment Folder is "\SCAG_Model_Run\2016Build_Alt2_Pha1\Assign_Output\"

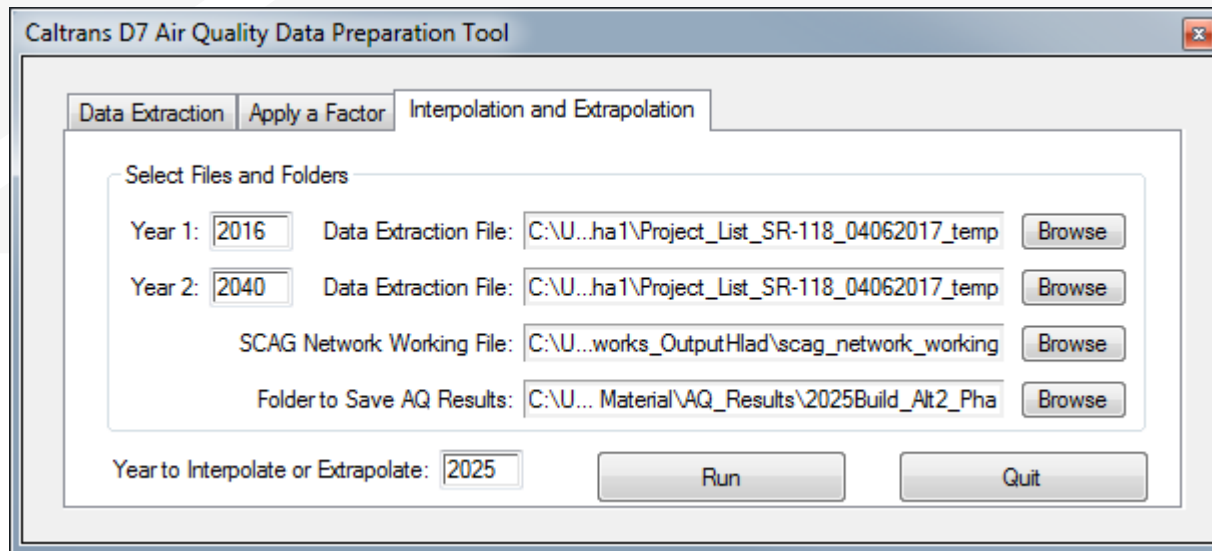» Folder to Save AQ Results is "\AQ_Results\2016Build_Alt2_Pha1\"

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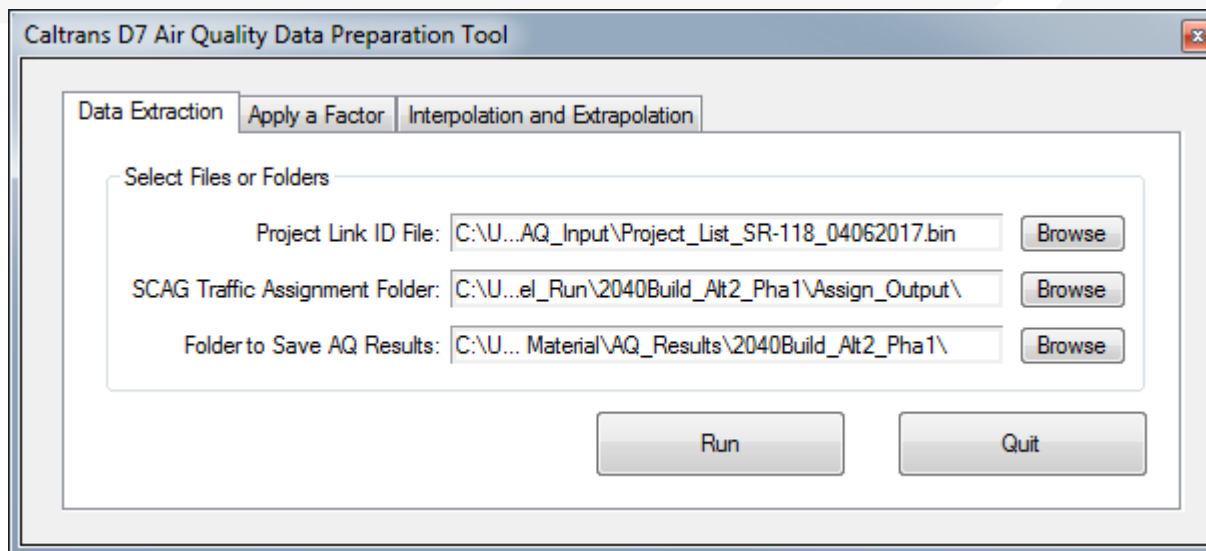
Exercise 2-3: Run Data Extraction

➤ Step 5: Repeat Step 4 for 2040Build_Alt2_Pha1

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Exercise 2-4: Run Data Interpolation

➤ Step 6: Interpolate the results for 2025Build_Alt2_Pha1 based on

» 2016Build_Alt2_Pha1

» 2040Build_Alt2_Pha1

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Exercise 3: Create the Final Output

➤ Copy the results to the template

➤ Check the results

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Exercise 3: Create the Final Output

➤ Step 1: Make a copy of the template and rename it

   » The template file is \SR-118_AQ_Input\SR-118 Air Quality Template v2.xlsx

➤ Step 2: Open the csv files* in Excel and copy **values** to the corresponding spreadsheet in the Excel file from Step 1

   » E.g. copy the content (without the first row) in "Project_List_SR-118_04062017_Route118_East.csv" to the spreadsheet of "Freeways East" in the Excel file from Step 1

   » When copy from the CSV file, use the following tips to select the content faster

      ▪ Click on Cell A2 (first column second row to leave out the title row), then use Ctrl + Shift + → (pressing three keys together) on the keyboard to select all columns, then use Ctrl + Shift + ↓ to select all rows from Row 2.

   » 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.

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