CAMBRIDGE SYSTEMATICS

Think Forward

TransCAD and the SCAG Model

presented to

Caltrans District 7

presented by

Cambridge Systematics, Inc.

Chao Wang, Sean McAtee

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Installing & Running the SCAG Model

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Preparing a Computer

- TransCAD 6.0,
  - build 9215 or later
  - 64-bit version required
  - TransCAD 7 not supported (yet)

Also install 32-bit for GIS and Office compatibility!

- Minimum System Requirements
  - 24 GB RAM
  - 12 CPU cores
  - 500 GB free on system drive (C:\ Drive)
  - 800 GB free on model run drive (e.g., D:\ Drive)
  - 360 GB for model run storage

Requesting the SCAG Model

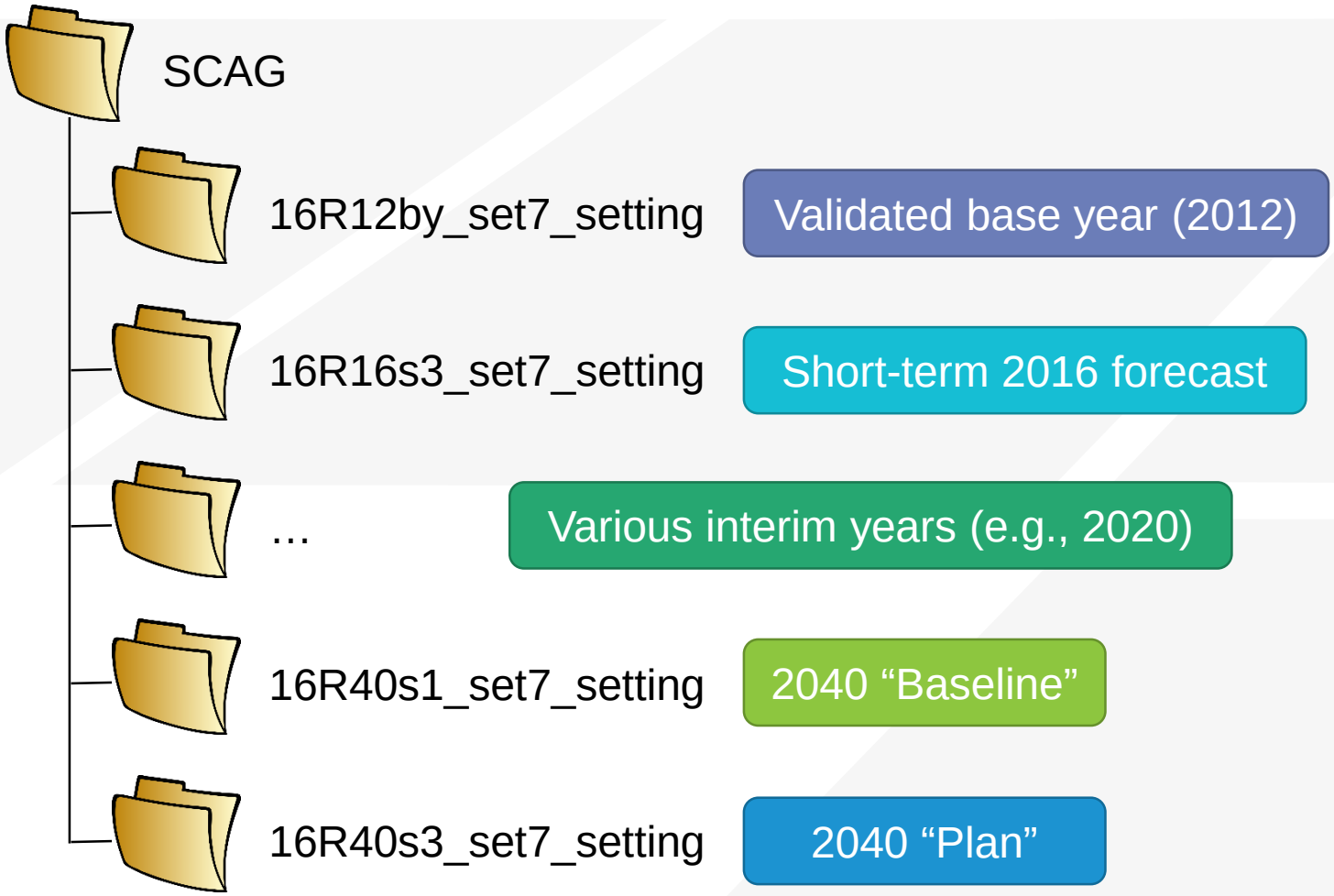
- Request the model from SCAG
  - Go to: http://www.scag.ca.gov/DataAndTools/Pages/Documents.aspx
  - Download the Model Data Request Form
  - Fill out and submit as instructed
- Cheryl Leising may be able to provide a Word version that is easier to fill out

Installing the SCAG Model

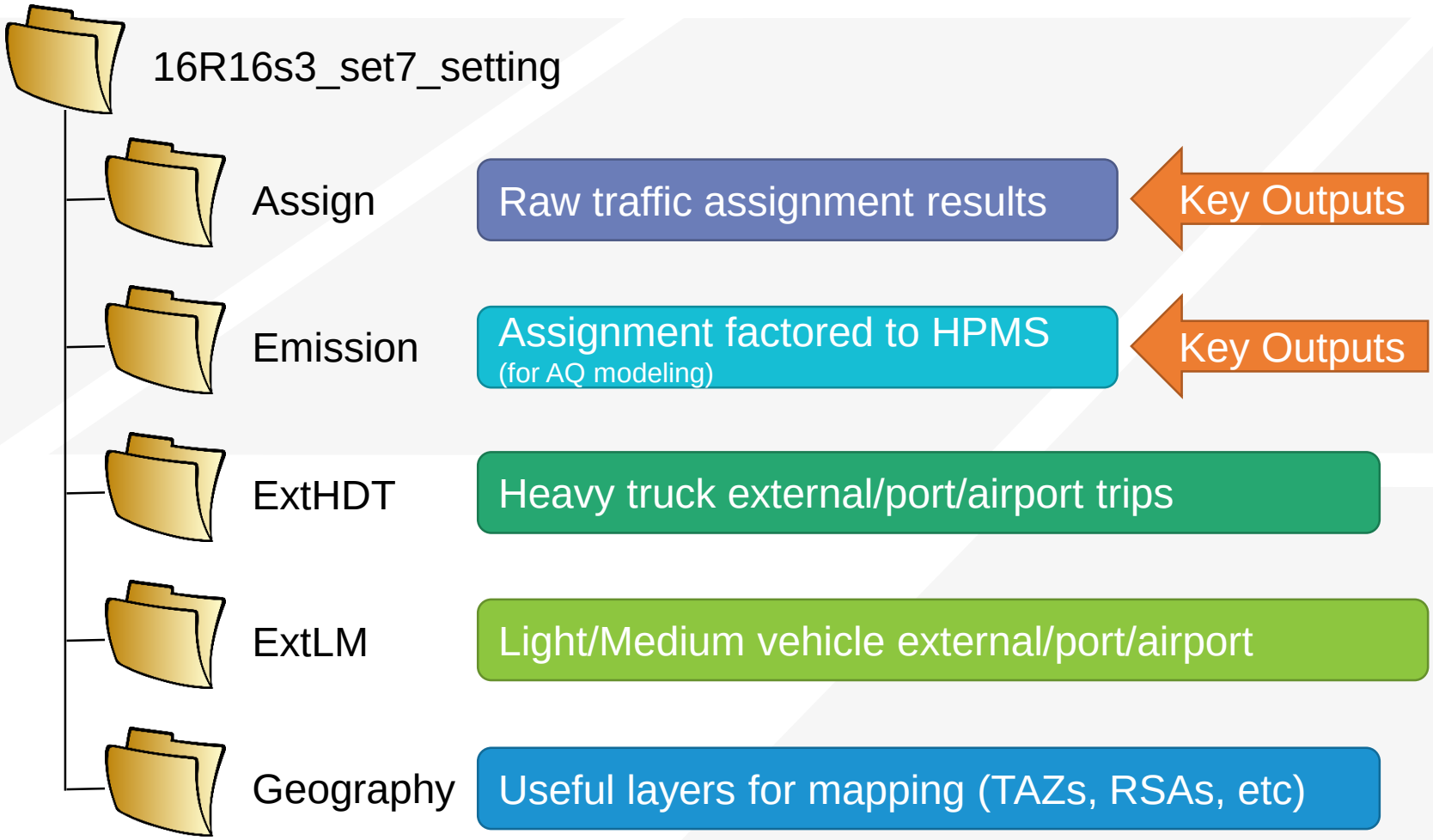
- Install the User Interface (UI)
  - Follow Instructions provide by SCAG
    - **memo model installation v6.3.doc**
  - You may need administrator privileges
- Copy the model data and model table
  - Place in a user-specified location
    - Example: D:\SCAG
  - One directory for each scenario
    - Example: 16R16s3_set7_setting
  - Model table with scenario information
    - Example: SCAGModelv63q.bin

See Handout

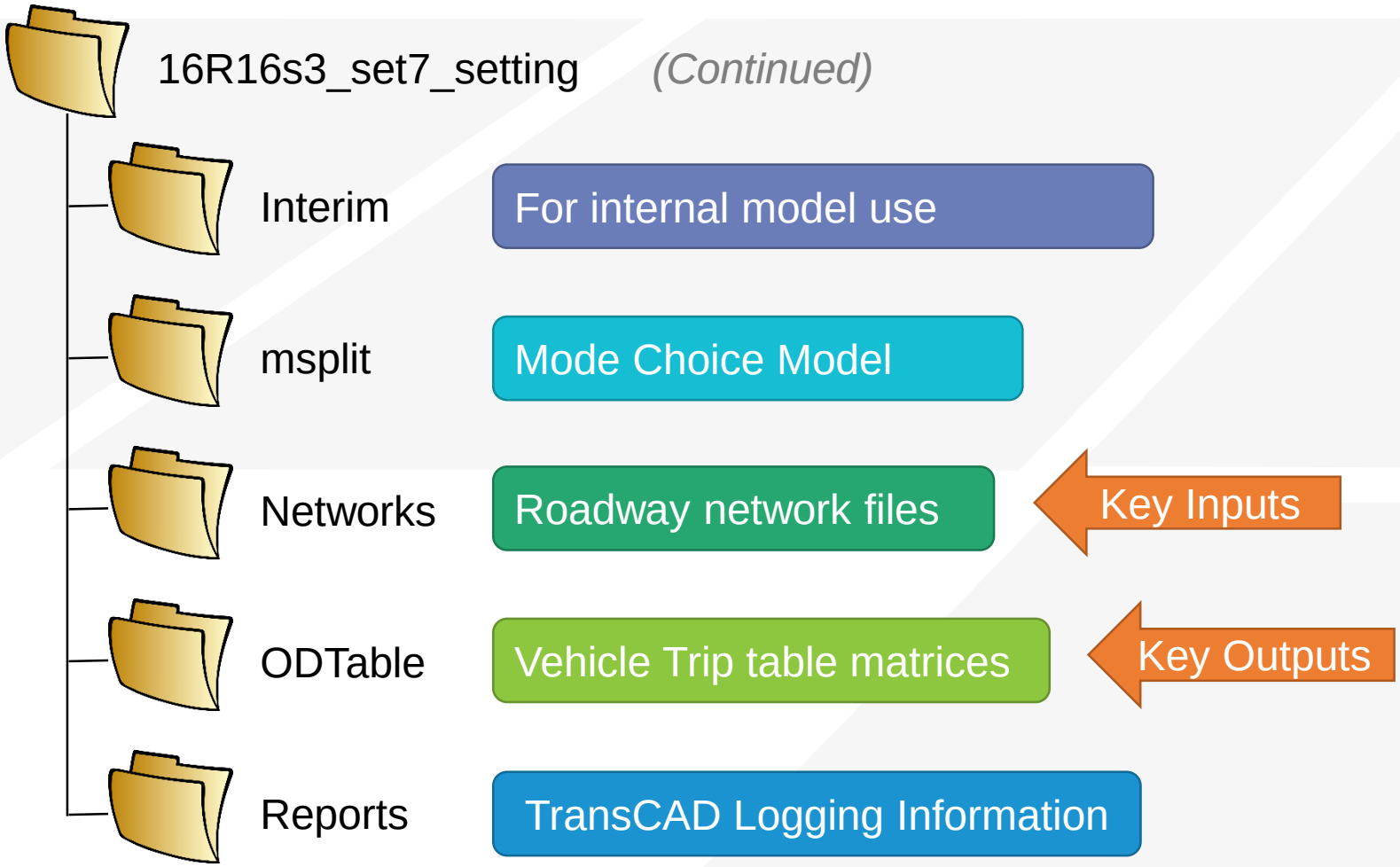
SCAG Model File Structure



SCAG Model File Structure



SCAG Model File Structure



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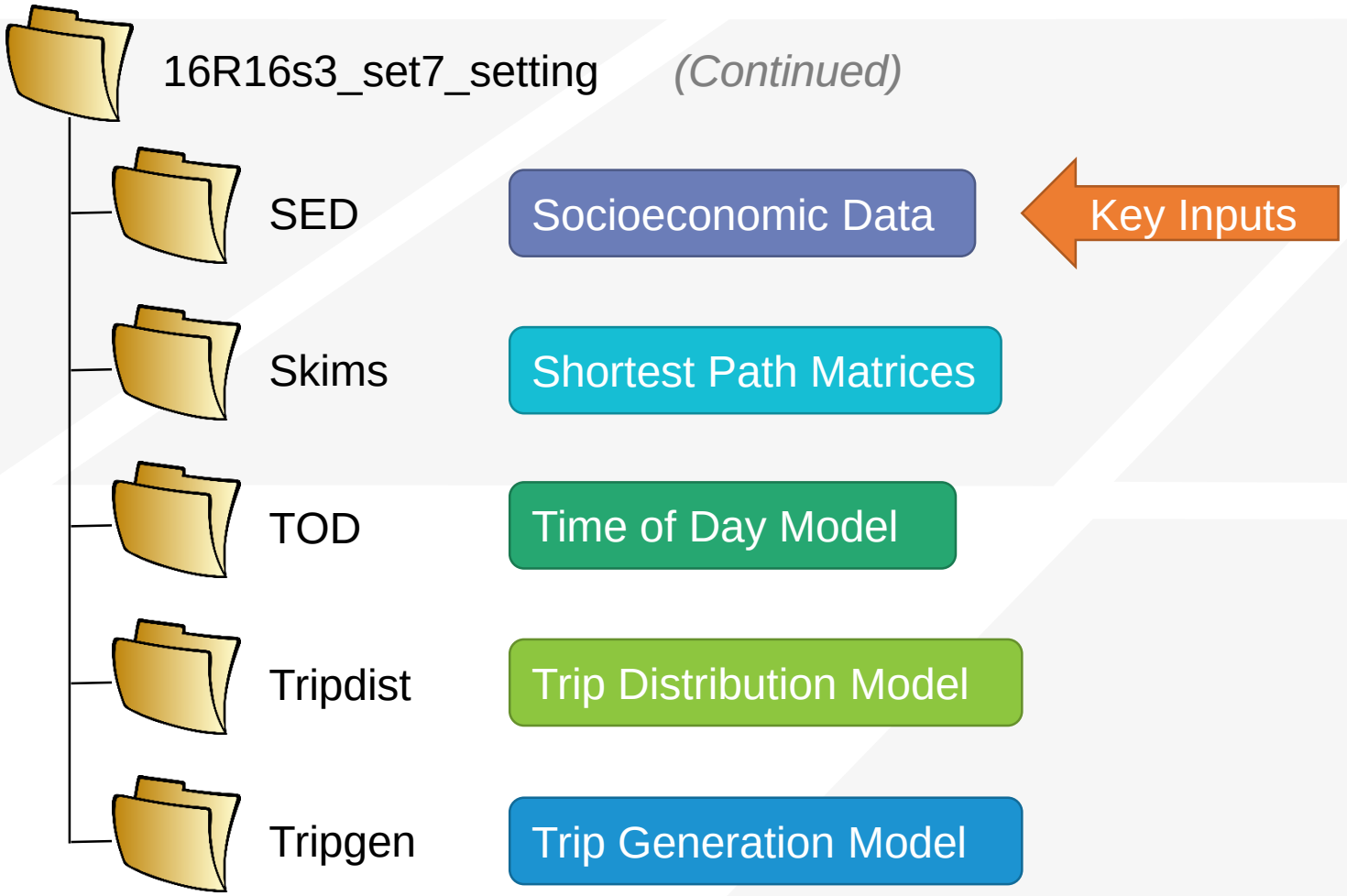
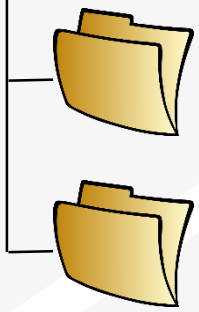
SCAG Model File Structure



SCAG Model File Structure

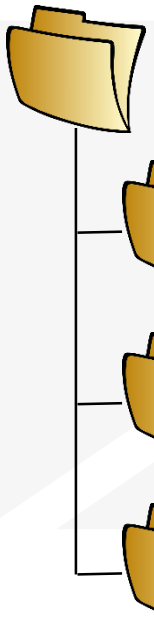
16R16s3_set7_setting *(Continued)*



Truck — Internal Heavy Duty Truck Model

User — For troubleshooting / SCAG use

SCAG Model File Structure



Networks

All folders have a the same structure

Inputs

Files provided by SCAG. Changes made here

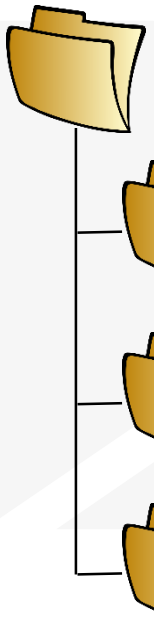
Outputs

Files generated by the model. Do not change.

Reports

Model result summary tables

SCAG Model File Structure



All folders have a similar structure

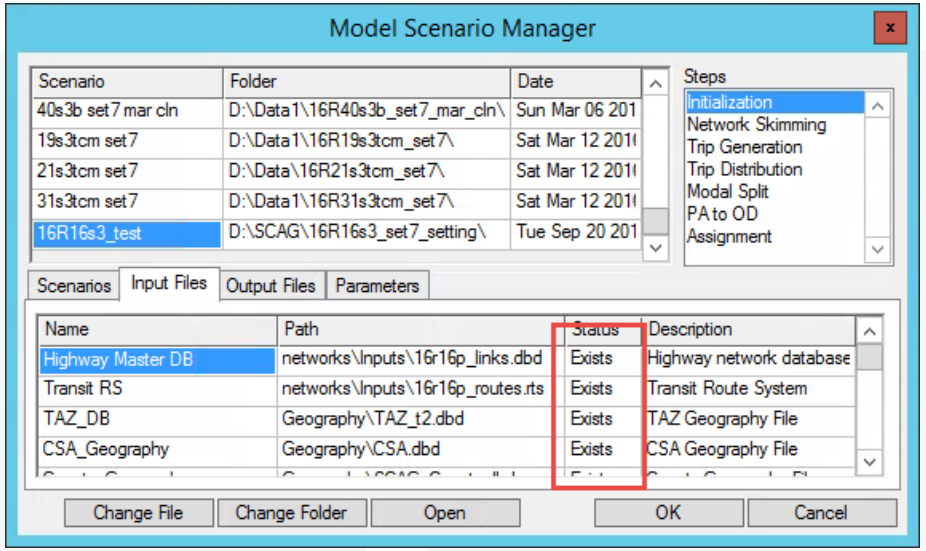
Files provided by SCAG. Changes made here

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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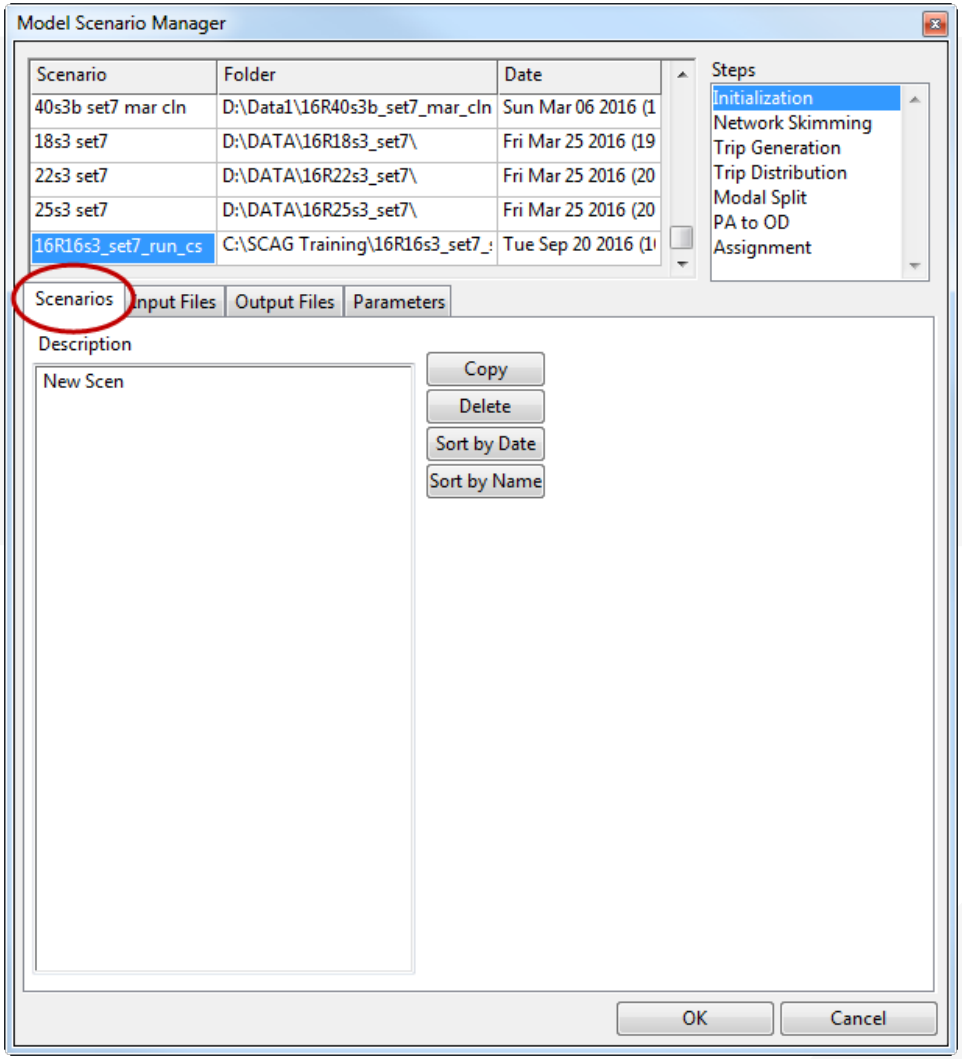
SCAG Model Scenarios



- Scenarios
  - Manage scenario list
  - Enter a description

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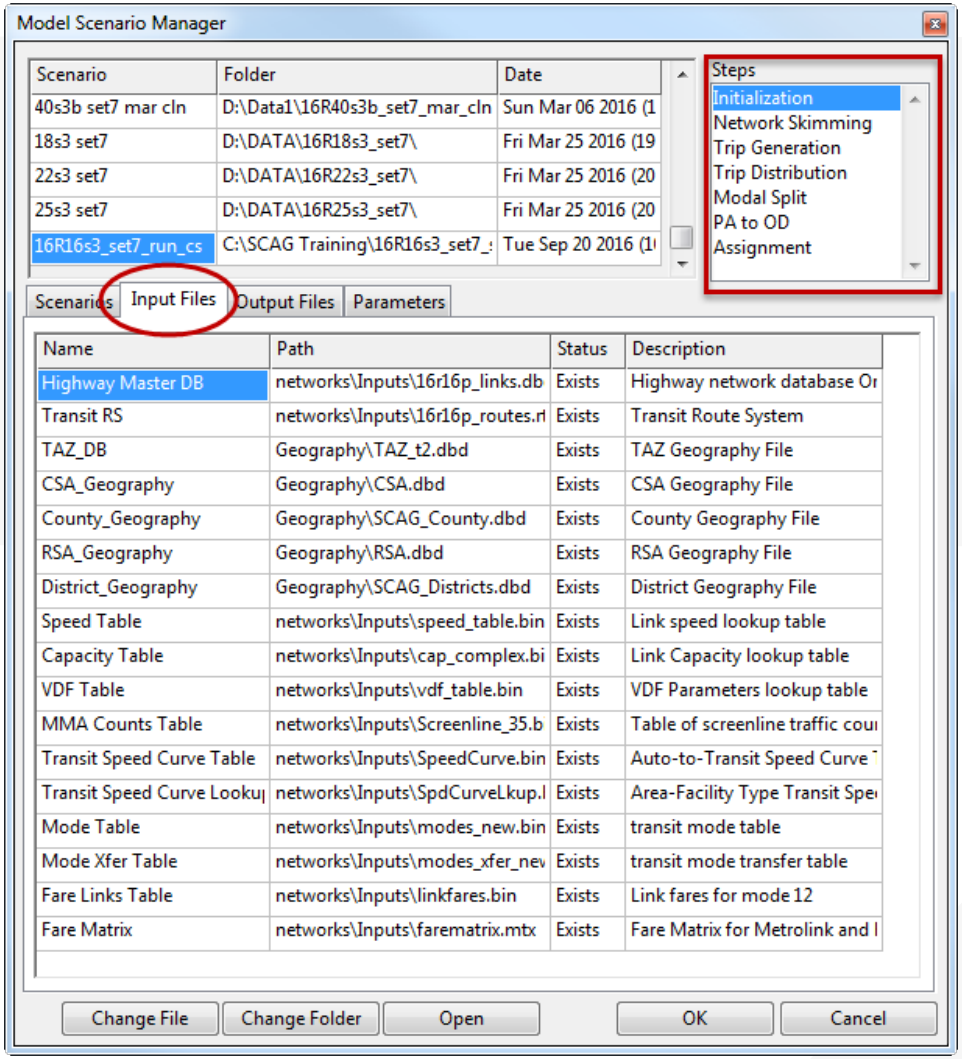
SCAG Model Scenarios



- Input Files
  - Varies by step
  - List input files
  - Rarely changed, but serves as a good reference
  - You ***could*** change filenames, but need to make sure valid files exist

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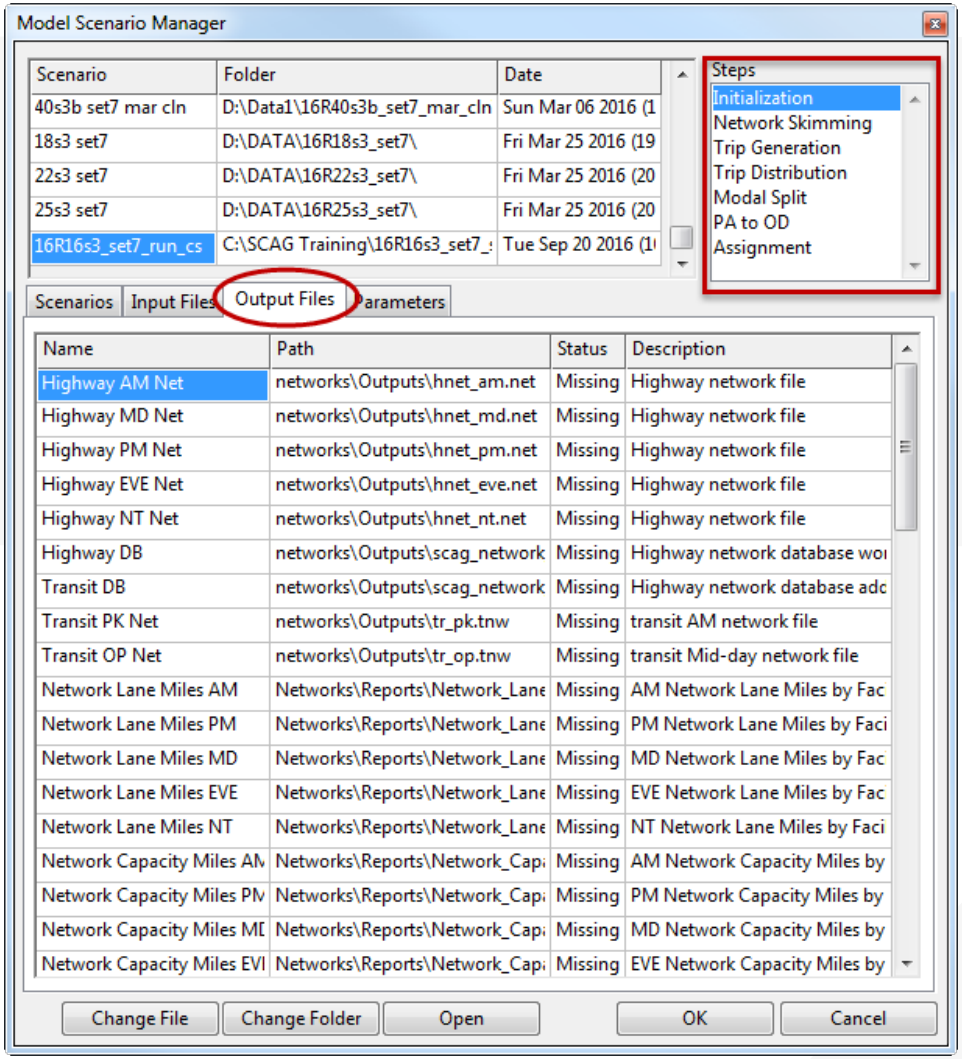
SCAG Model Scenarios



- Output Files
  - Varies by step
  - List output files
  - **Never** changed, but serves as a good reference
  - Status changes from **Missing** to **Exists** when the model is run

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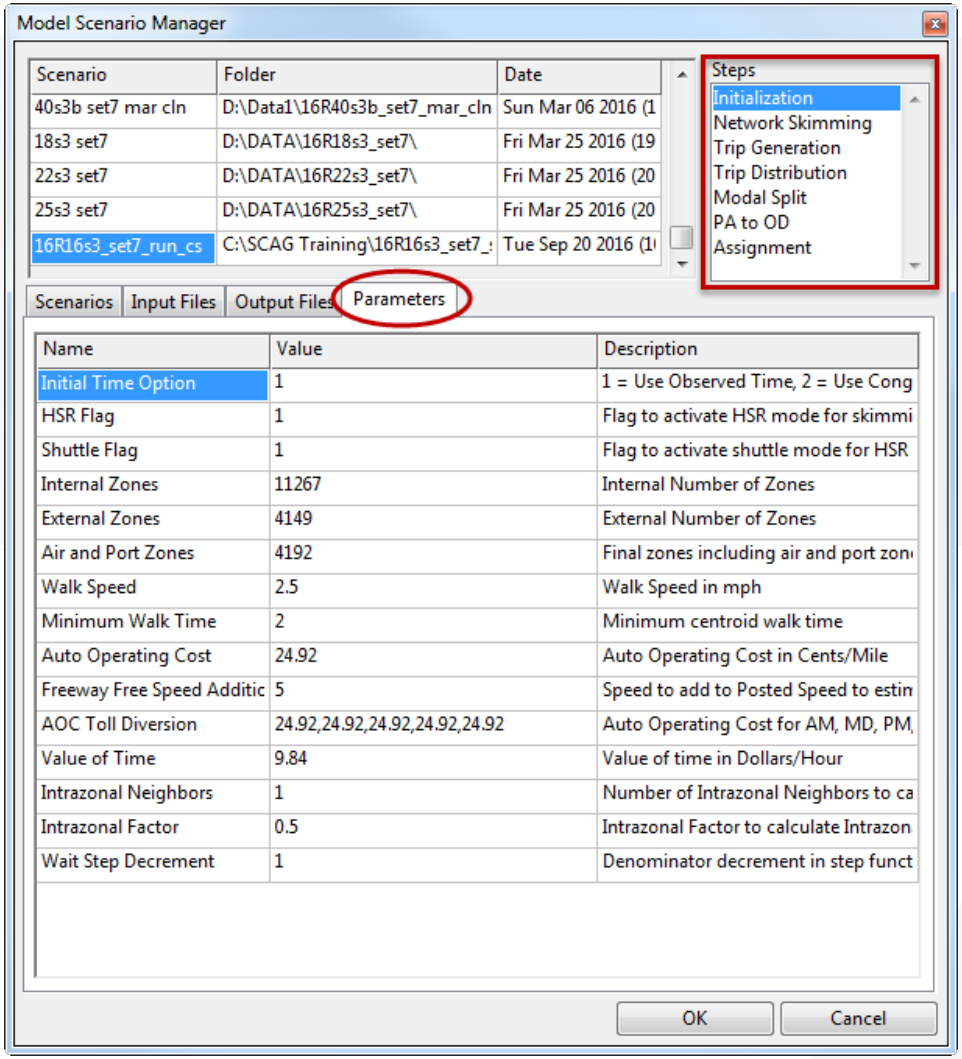
SCAG Model Scenarios



- Parameters
  - Varies by step
  - List output files
  - **Rarely** changed – and always with ***extreme caution***
  - Only change with guidance from the User's Guide, SCAG, or Caliper

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The Model Table

- Stores information from the scenarios
- In-Program Demo

Different Run Types

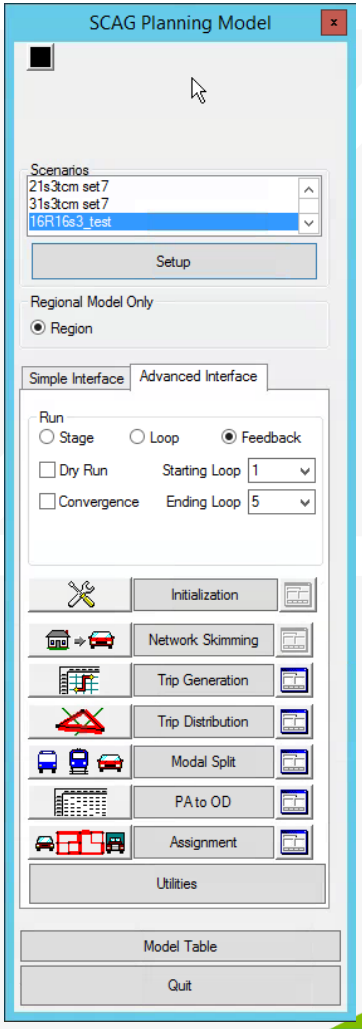
	Feedback	One Loop	Assignment
Run Time	7-10 Days	1-2 Days	< 1 Day
When to Run	• To generate original SCAG model results • To test large system wide network changes • To test any SED changes • To produce a final model dataset after alternatives analysis	• To test the impacts of small to moderate changes **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

Running for Scenarios

- One-Loop Run
  - Run one complete feedback loop, starting with final loop from a full model
  - Can be useful for:
    - Large roadway and/or transit scenarios
  - Comparing directly? Run a 6th loop baseline as well
- Quick Run with network changes only
  - Trip tables and mode choice does not change
  - Can be useful for:
    - Testing roadway network changes
    - Running assignment again with select link / zone analysis

Running the SCAG Model

- Full Feedback Run
  - Set the model to run “Feedback”
  - Leave starting and ending loops at 1 and 5
  - Make sure the computer can run for 6 to 10 days without interruptions
  - Click ‘Initialization’



One Loop Run

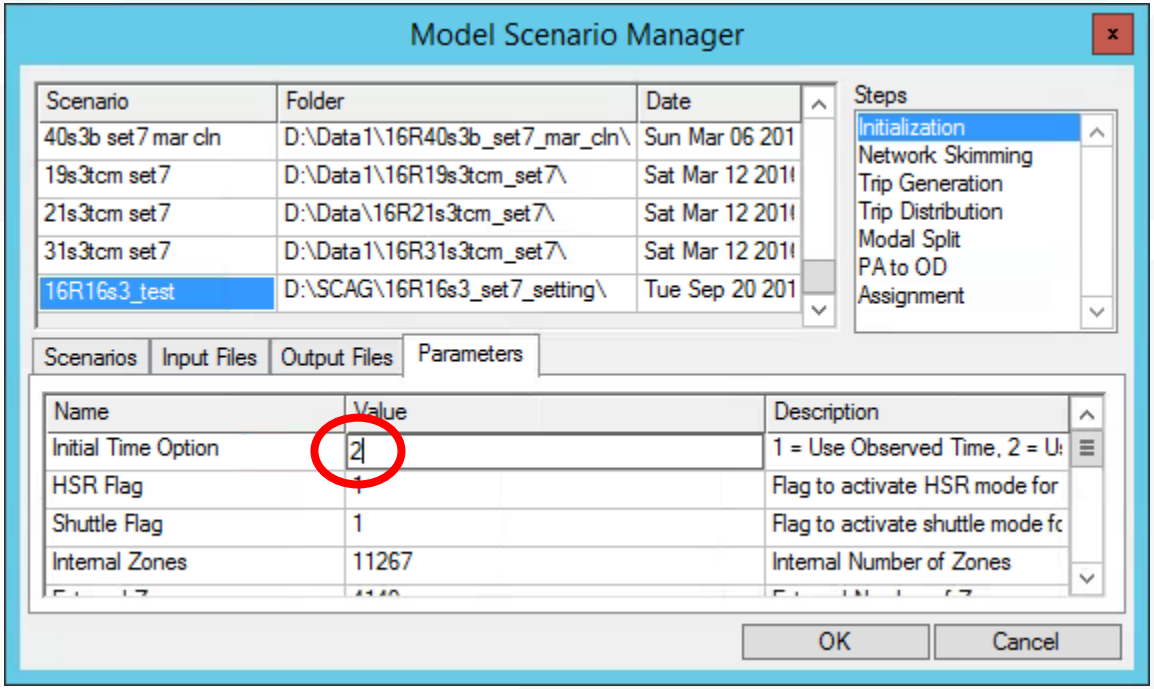
- Copy your entire model scenario folder
  - e.g., 16R40s1_set7_setting → 16R40s1_set7_setting_alt1
- Copy the scenario from the scenario manager and point the new scenario to the new folder
- Modify the **inputs**
  - Highway network file
  - Route system File
  - Socioeconomic Data

See network editing module

- Run the **Check Network Attributes** utility
- Run the **Mergenet Run** utility
  - This merges speed feedback results with the modified network

One-Loop run

- Edit the scenario (click Setup)
  - Set the **Initial Time Option** to a value of 2
  - Click OK



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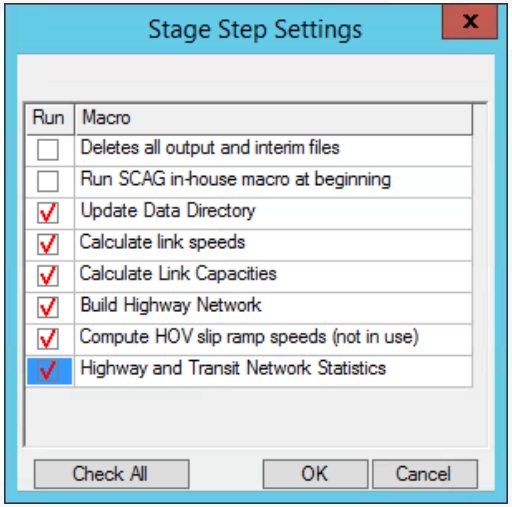
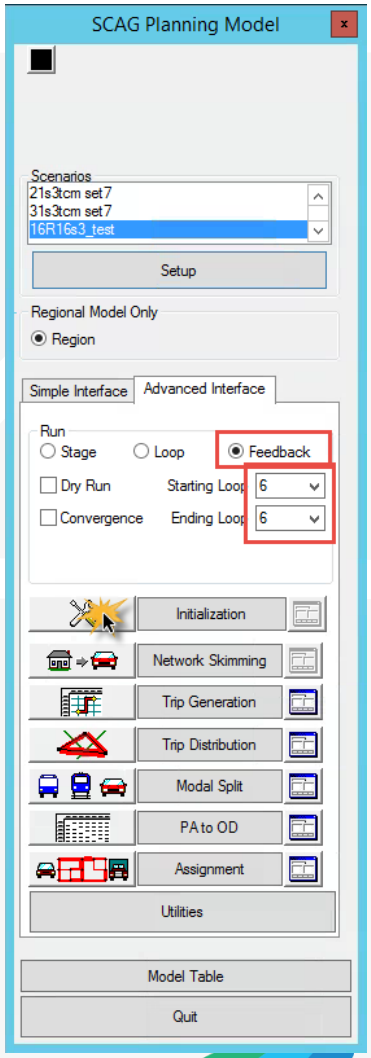
One-Loop run

- Set the dialog box to:
  - Run Feedback
  - Run loop 6 to 6 *(Be careful – the drop-downs can change unexpectedly)*
- Click the  button next to Initialization
  - Set steps as shown
  - Click OK



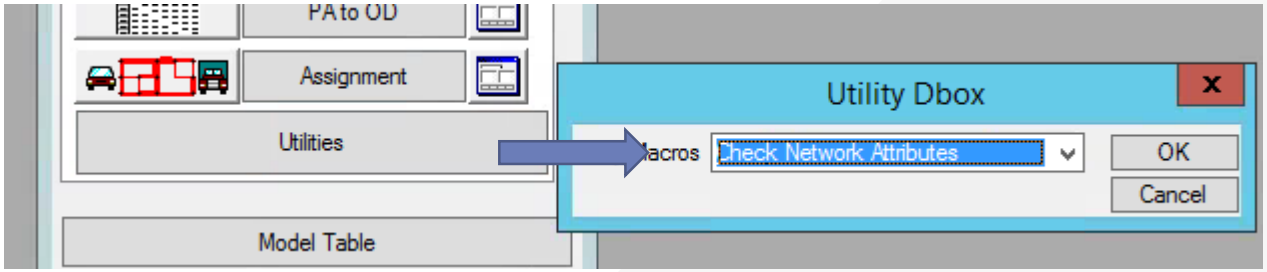


One-Loop run

- Click the **Initialization** button to start the run
  - This should take about a day to complete
- Did you get an error??
  - Try closing and restarting TransCAD, then picking up where you left off.
  - Always double-check feedback settings and active steps before starting a run

Assignment: Network Change

- Copy your entire model scenario folder
  - Alternate: Just backup the original **networks** and **assign** folders
- Modify the **input** highway network file
  - Remember: keep the route system up to date!
- Run the Check Network Attributes utility



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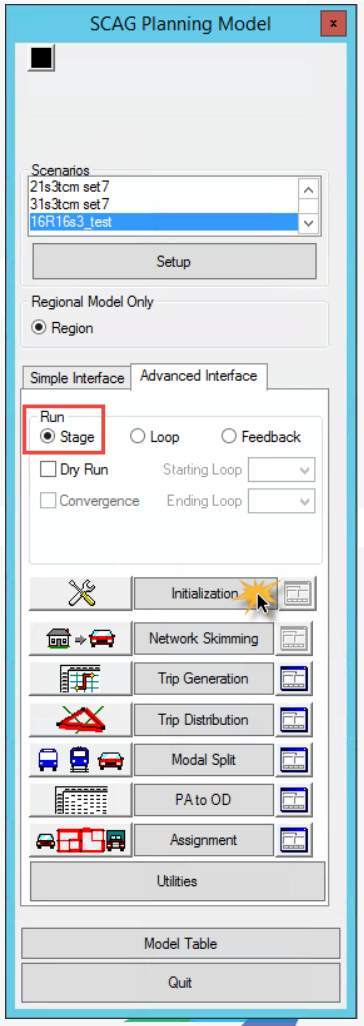
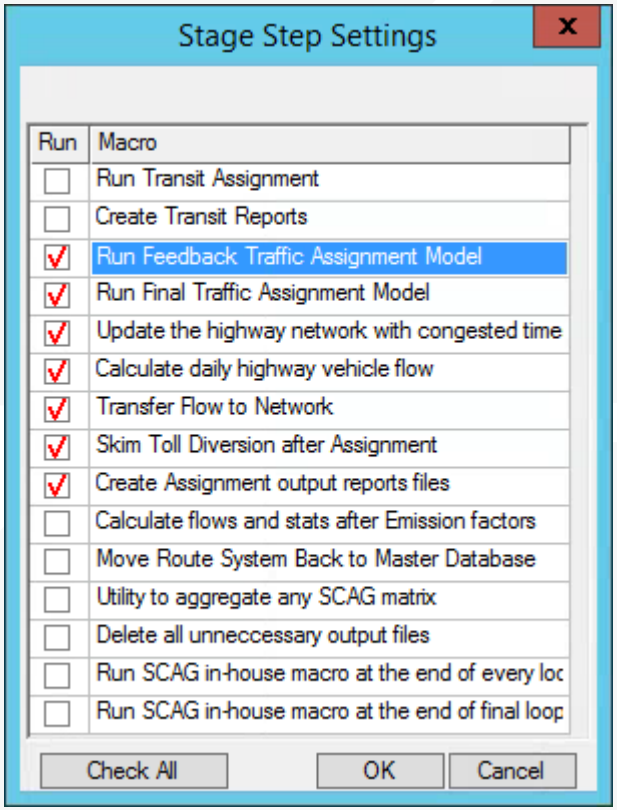
Assignment : Network Change

- Double-check the scenario setup. Change directory or filenames if needed
- Set the model to run only a single stage
- Click ‘Initialization’
- When asked if you want to delete all files, click ‘**No**’



Assignment : Network Change

- When initialization completes, click on the  button next to assignment
  - » Set steps as shown
  - » Click OK
- Click ‘Assignment’ to run traffic assignment
  - » This will take several hours



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Map Basics: Visualizing

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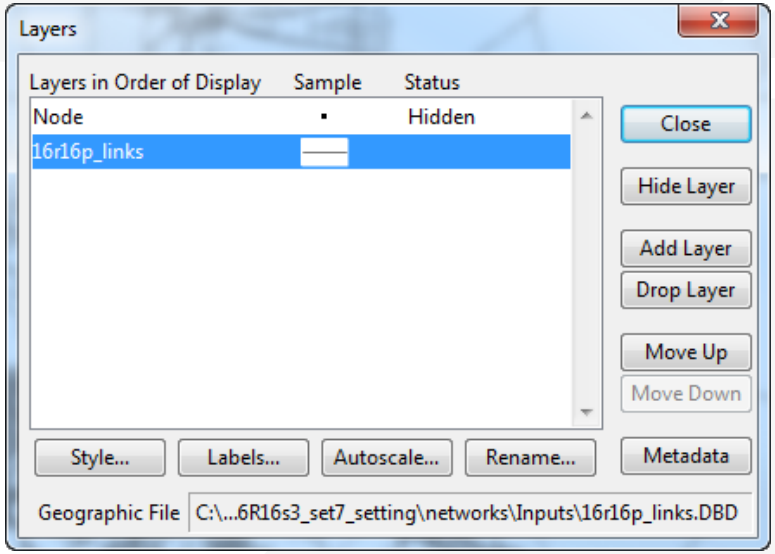
Working with Layers

- 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 ( )



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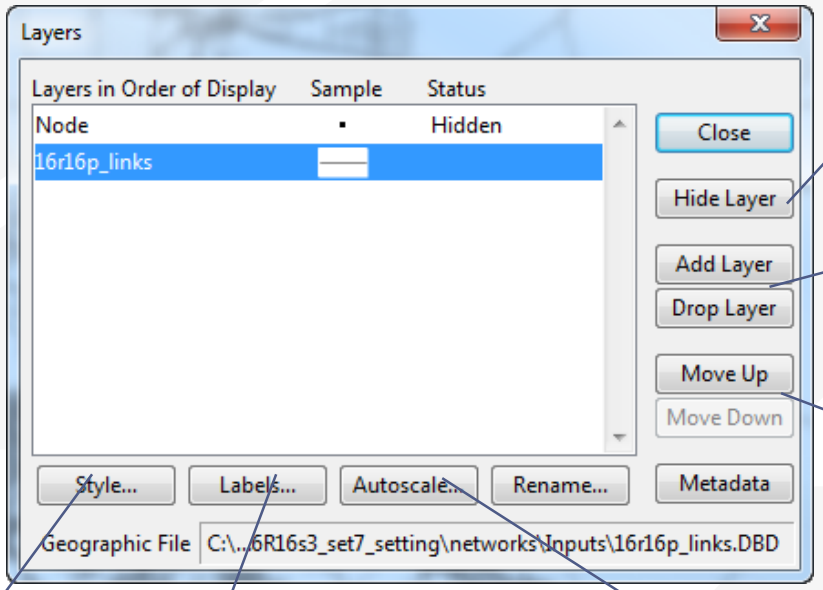
Working with Layers

- **The Layers Dialog ( )**



Hide/show a layer

Add/Drop layers

Re-order layers

Change a layer style

Add/edit labels

Automatically show/hide layers as certain scales

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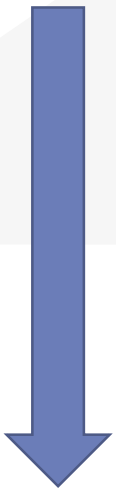
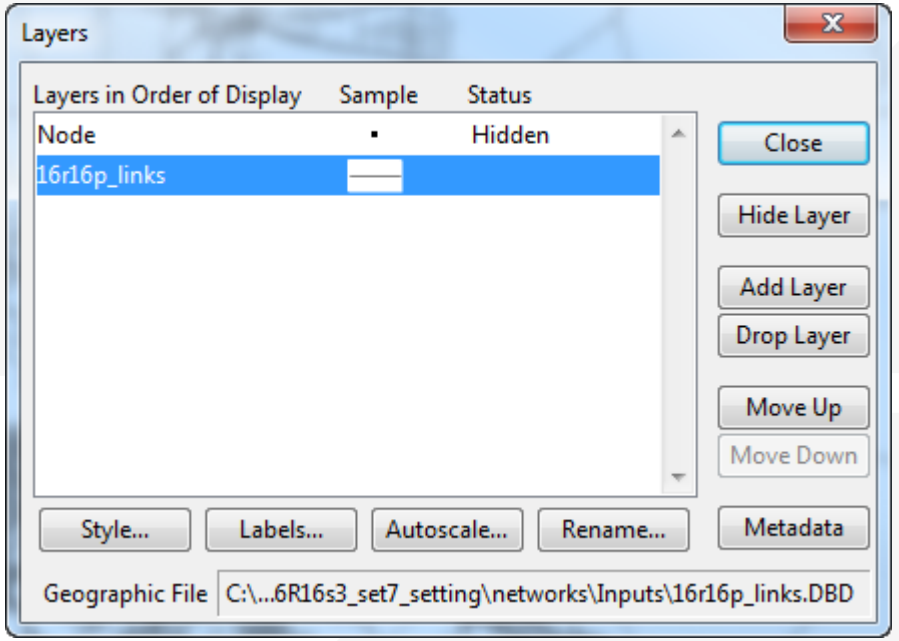
Working with Layers

- **Layers are drawn from TOP to BOTTOM**

Top layer
(drawn first)



Bottom layer
(drawn last)



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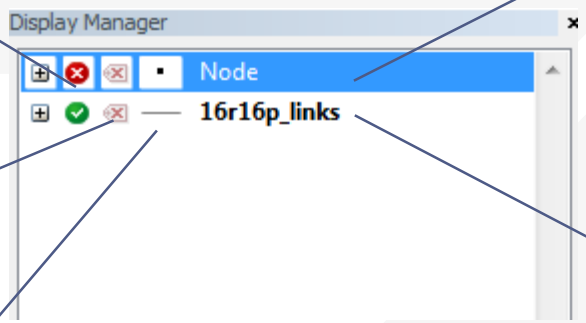
Display Manager

- 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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Color Theme

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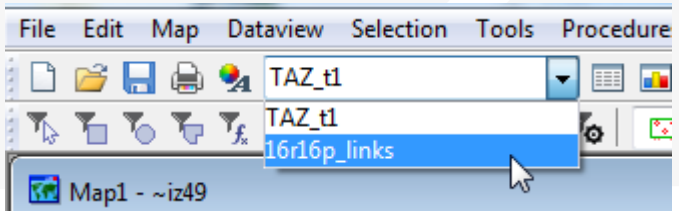
Creating Maps

- 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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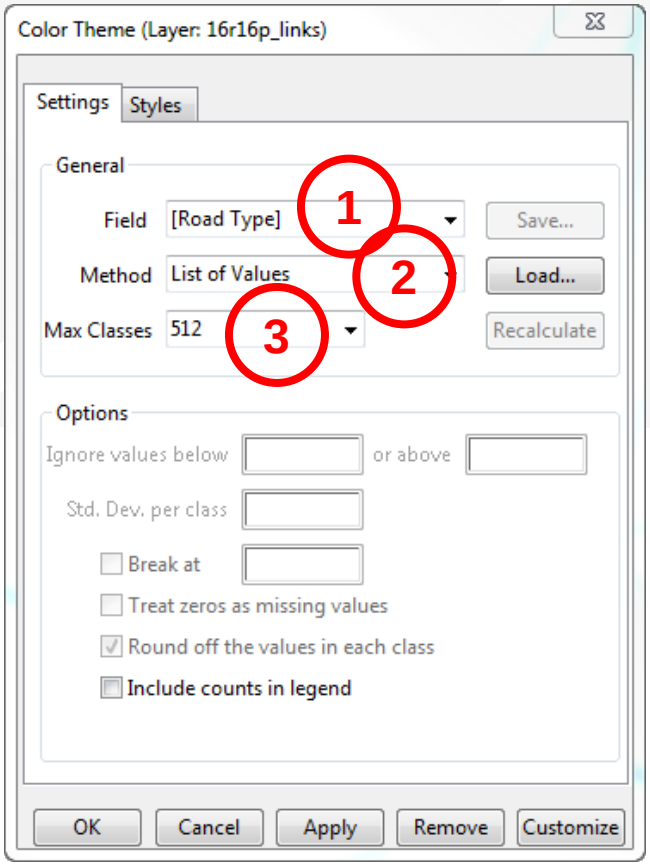
Color and Pattern Themes

- 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

Color and Pattern Themes

The Settings Tab



1. Choose a field to represent
2. Choose a method to create categories and number of classes

* Use the Load and Save buttons to store and recall settings
  - » *This is a huge time-saver!*

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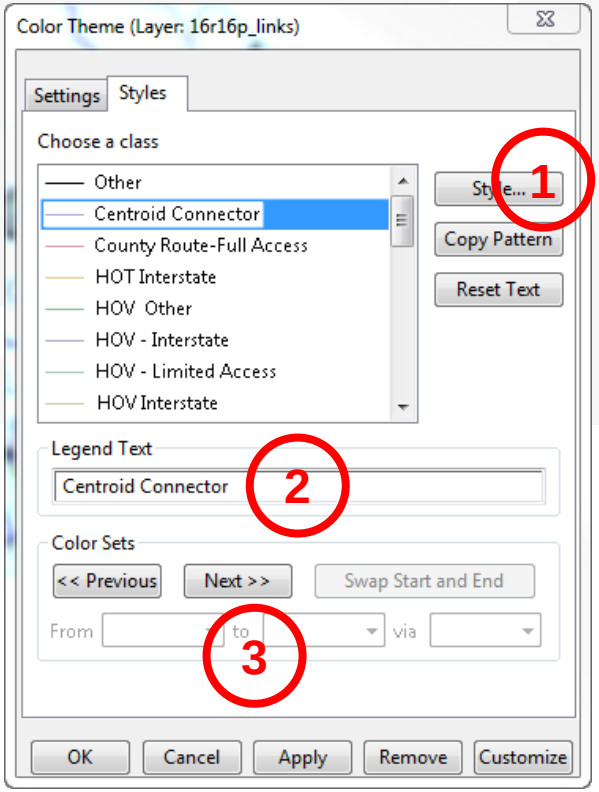
Color and Pattern Themes

The Styles Tab



1. Choose a style for each class
2. Select a legend text for each class
3. Choose from pre-defined color settings if desired

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

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

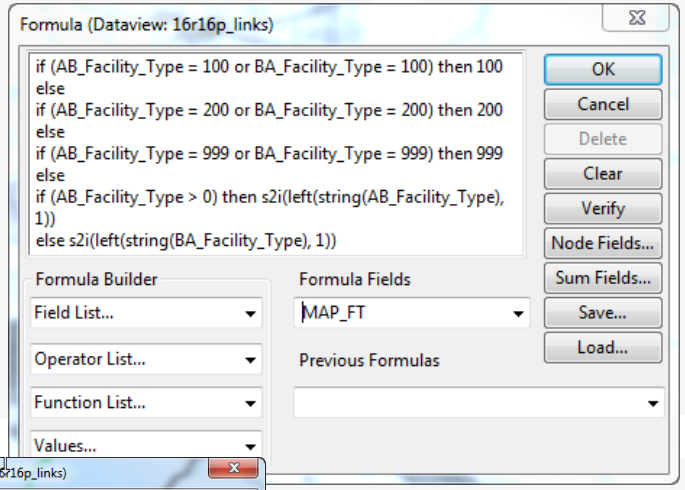
```
MAP_FT:
-------
if (AB_Facility_Type = 100 or BA_Facility_Type = 100) then 100 else
if (AB_Facility_Type = 200 or BA_Facility_Type = 200) then 200 else
if (AB_Facility_Type = 999 or BA_Facility_Type = 999) then 999 else
if (AB_Facility_Type > 0) then s2i(left(string(AB_Facility_Type), 1))
else s2i(left(string(BA_Facility_Type),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

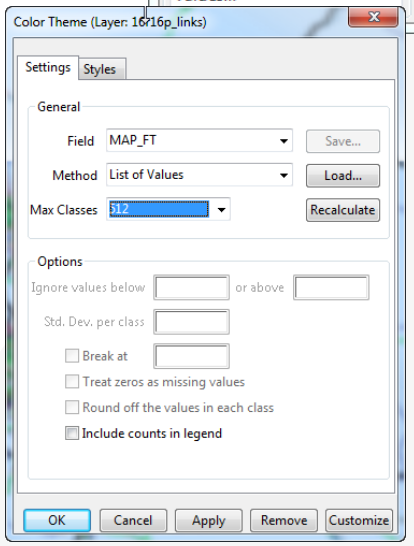
Note: We will discuss formulas in more detail in a later section

Practice 1: Create a color theme for line layer using IFC field

1. Open the SCAG Network File (16R16pl_links.dbd)
   - ✓ File→Open, then in the file type dropdown next to 'File name:' select Geographic File(*.cdf,.*dbd) option
   - ✓ Browse to the location/folder where the geographic file is located and select the 'abmload.dbd' and click 'Open' button
2. Add the MAP_FT Formula Field
   - ✓ Dataview→Formula Fields
   - ✓ Open TransCAD Formuals.txt in notepad, then copy the MAP_FT formula
   - ✓ Paste the formula and name the formula MAP_FT
   - ✓ Click OK
3. On the top ribbon, click  it is called 'color theme map wizard'
4. It opens up a dialog box with two tabs. In the first tab 'Settings' tab:
   - ✓ Select the MAP_FT from the 'Field' drop down options
   - ✓ Select the 'List of Values' from the 'Method' drop down options
   - ✓ Max. Classes: Use the default value (512)
5. Go to the 'Styles' tab
   - ✓ Observe the default styles
   - ✓ Optional: Set a preferred style for each facility type (we will use a shortcut)
6. Go back to the Settings tab, click the Load button.
   - ✓ 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
7. Save the settings (optional, method 1) **Skip this step in training.**
   - ✓ Tools → Geographic Utilties → Geographic file
   - ✓ Click Save Settings

1. Save the settings (optional, method 2) **Use this method in training.**
   - ✓ File –Save As
   - ✓ Save a Map file that you can open later with the settings applied





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Labels

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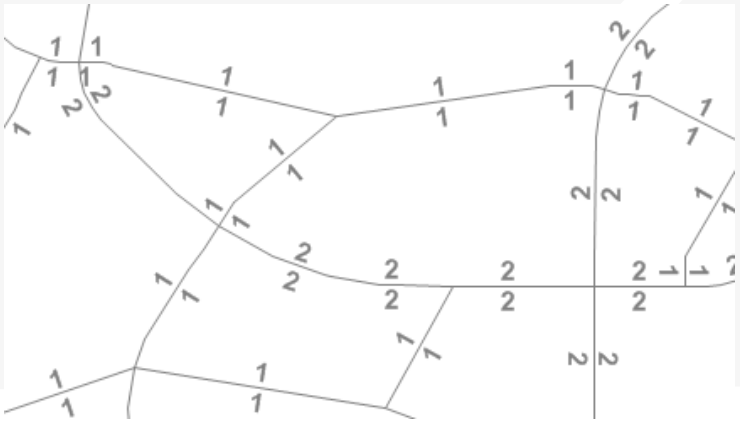
Automatic Labels

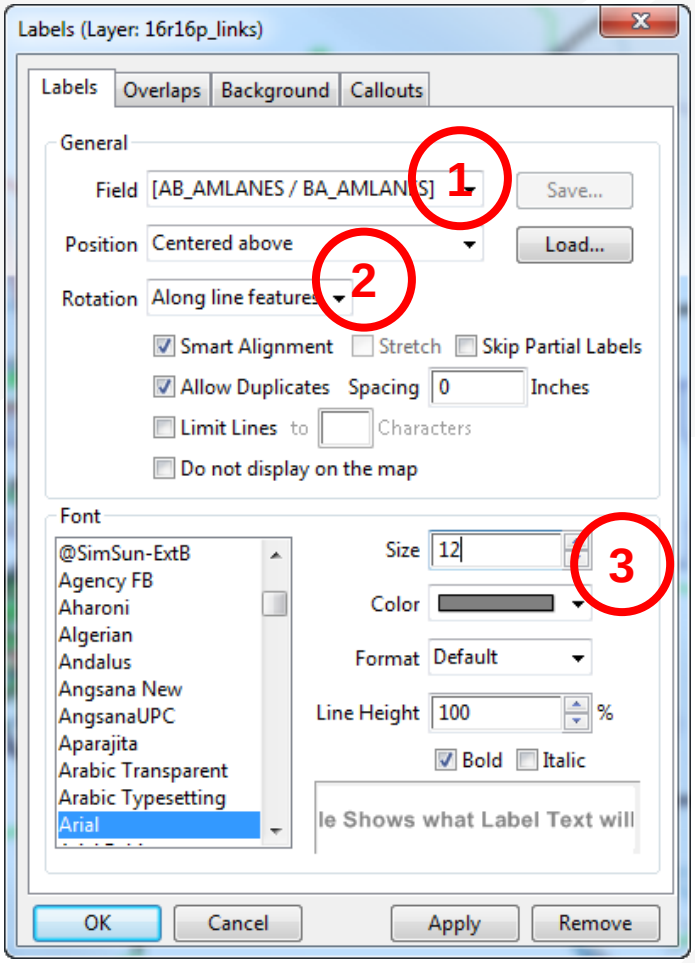
- Labels ( ) can be used to show things including:
  - Traffic Volumes
  - Number of Lanes
  - Centroid Numbers
  - SED/Land Use Data



- Labels can be set differently for different selection sets

Automatic Labels

The Labels Tab



1. Select the field to use for labels
2. Set label placement options
   - » *Note the "Allow Duplicates" checkbox*
3. Set the label style options

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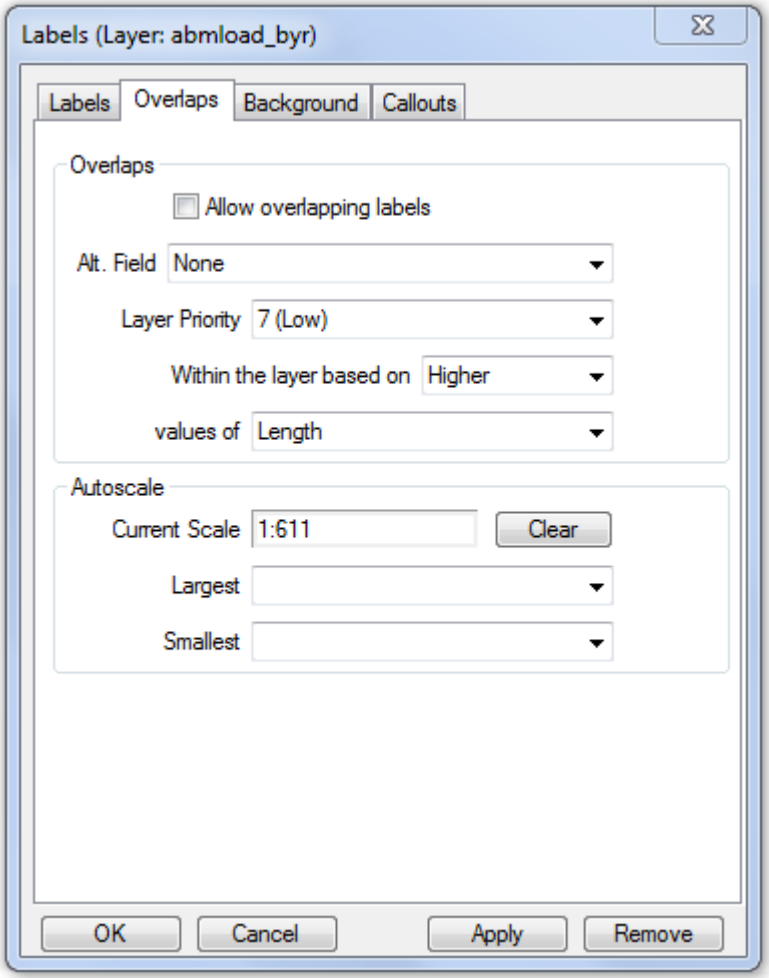
Automatic Labels

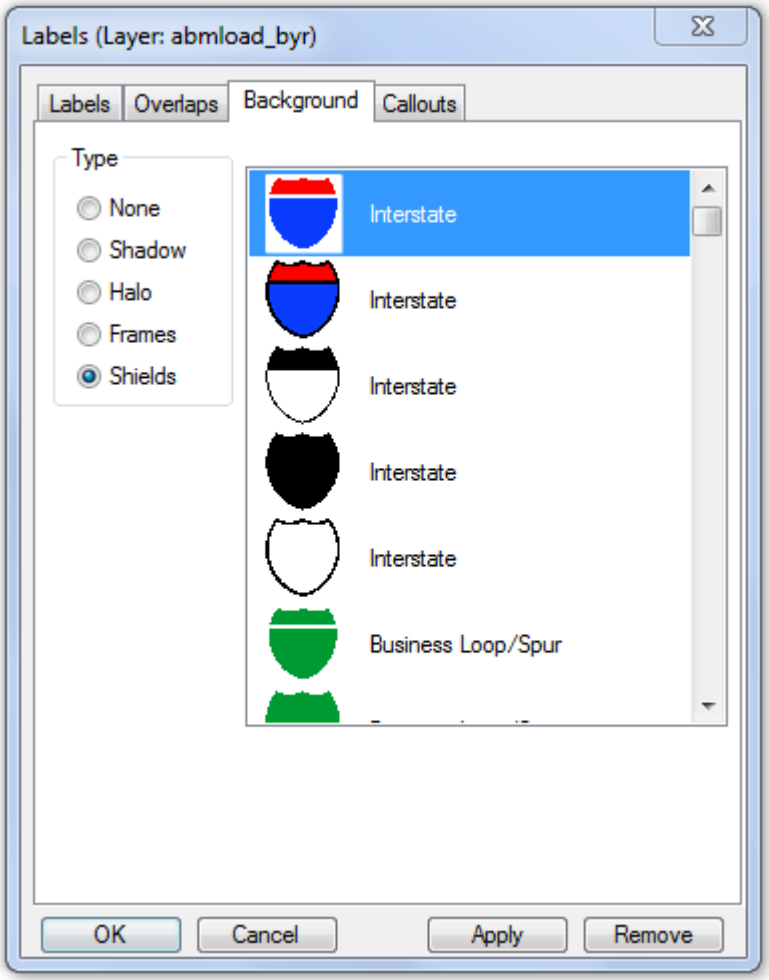
The Overlaps Tab



- Overlapping labels can be allowed if desired
- Different layers can have different priorities
- Autoscale can turn labels on and off automatically

Automatic Labels

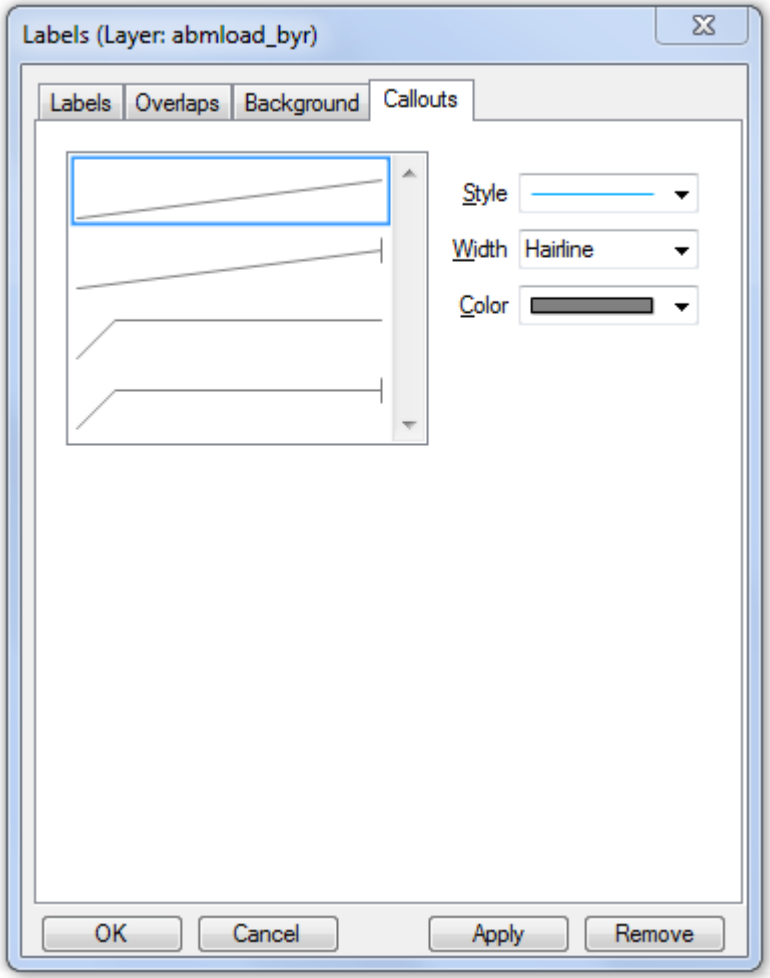
The Background Tab



- Shadows, halos, frames, or shields can be added to labels to create better looking and more informative maps

Automatic Labels

The Callouts Tab



- Set the default callout style to use when labels are manually re-positioned

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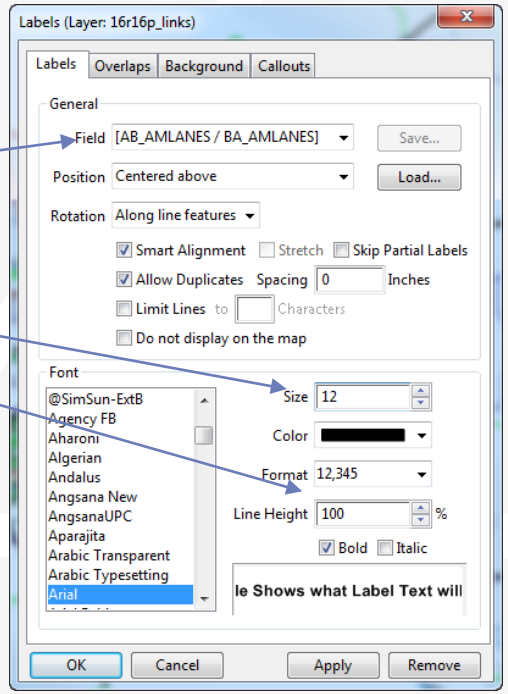
Practice 2: Add number of lanes labels

TIP
Right click on the gray area of the layout and print to pdf.

1. Start with the results from Practice 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



In training, save the map for future use

CAMBRIDGE SYSTEMATICS

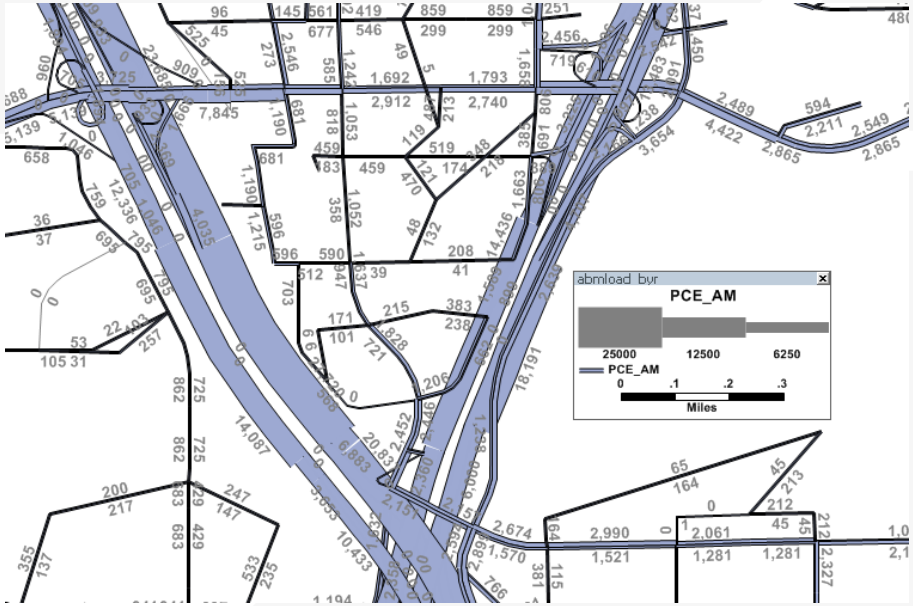
Create Scaled Symbol Theme

(also known as bandwidth map)

CAMBRIDGE SYSTEMATICS

Scaled Symbol Themes

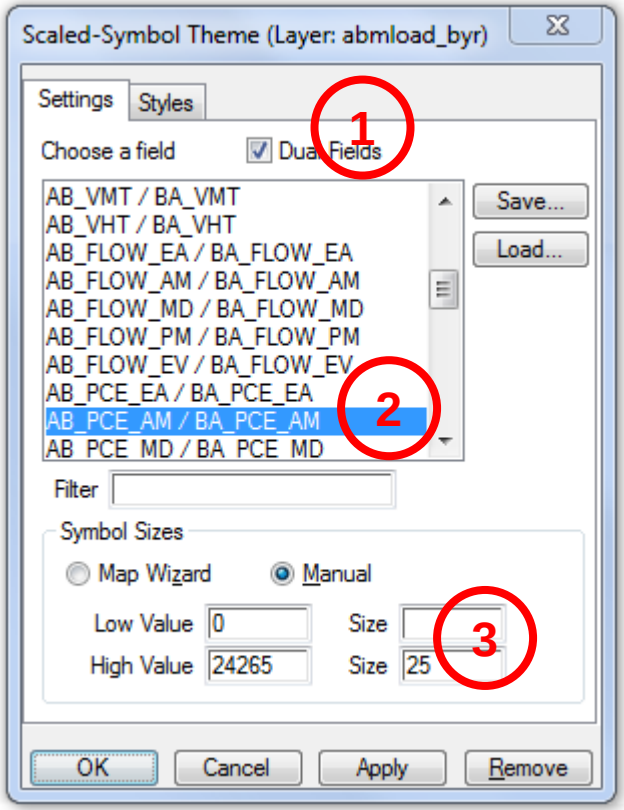
- Scaled Symbol Themes () are often used to:
  - Display traffic volumes
  - Display results of a select link or node analysis



CAMBRIDGE SYSTEMATICS

Scaled Symbol Themes

The Settings Tab



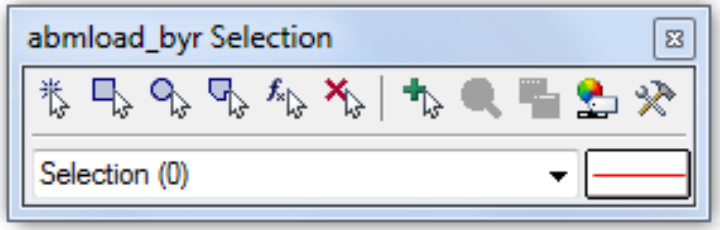
- Show directional fields only, or all fields
- Select a field to use
- Specify a scale, or let TransCAD specify one automatically

Create Selection Sets

CAMBRIDGE SYSTEMATICS

Selection Sets

- Add additional formatting capability
- Useful for analysis and data processing
- Use the Selection Set Toolbox
  - Select items with a query
  - Select items by pointing
  - View the Selection Settings

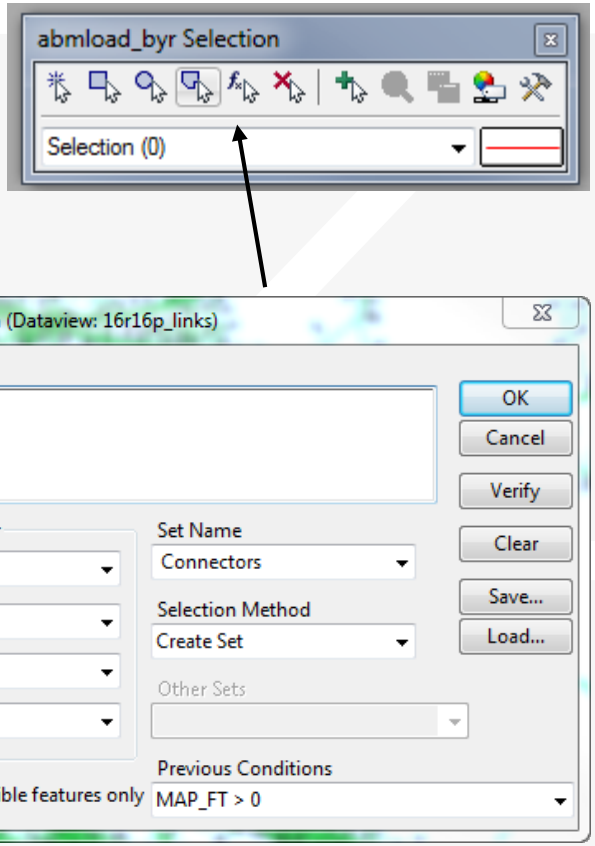


- One map can contain many selection sets
  - Show or hide selected items
  - Format selected items with different colors, styles, and labels

Practice 3: Create selection sets and color and label them

- Start with the results from Practice 2
  - ✓ Open the saved map if needed

1. Goto Tools and select ‘Selection’ or hit F9
   - ✓ This will show 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)
2. Change the centroid connector lane labels
   - ✓ Open selection settings (Selection → Settings or)
   - ✓ Choose Connectors, then click Style
   - ✓ Set the color to “default gray) – this allows the color theme to override
   - ✓ Click Labels
   - ✓ Set the label to a smaller font size and different color
   - ✓ Close the selection settings



✓ **TIP:** You can make other changes to multiple different selection sets, or can hide some features altogether!

In training, save the map for future use

CAMBRIDGE SYSTEMATICS

Data Tables (“Dataviews”)

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Working with dataviews

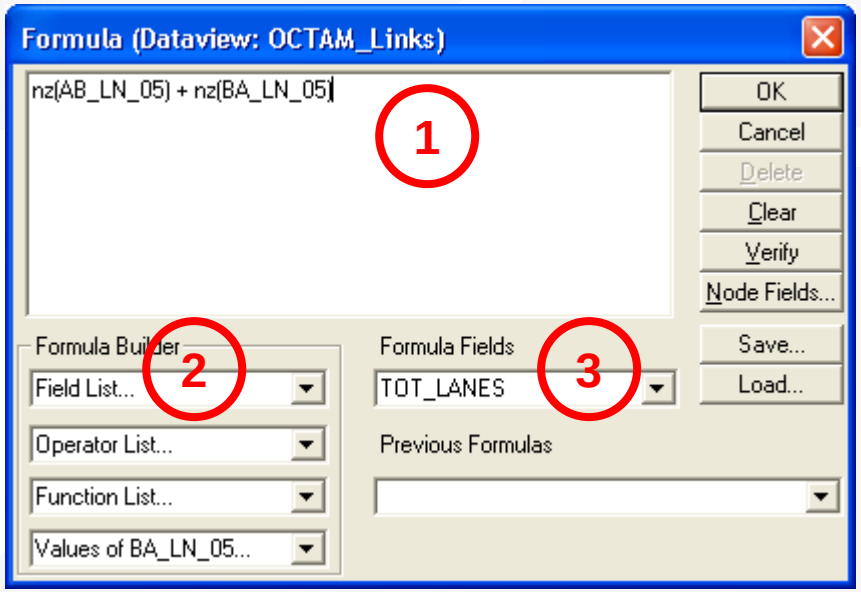
- Open a dataview for any existing layer ()
- Open a standalone table with File → Open
- Add/Remove fields with Dataview → Modify Table
  - (or )
  - Be careful: Changes are permanent once you click “OK”
- Data can be edited directly in the dataview
  - Be careful: Changes are saved as you go
- Create 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***
  - » Formula ***Fill*** adds new data and saves values in the table
  - » Formula ***Fields*** are updated when other values change, but are not stored in the data table
    - Formula fields are stored in a map, dataview (*.dvw), or workspace (*wrk)

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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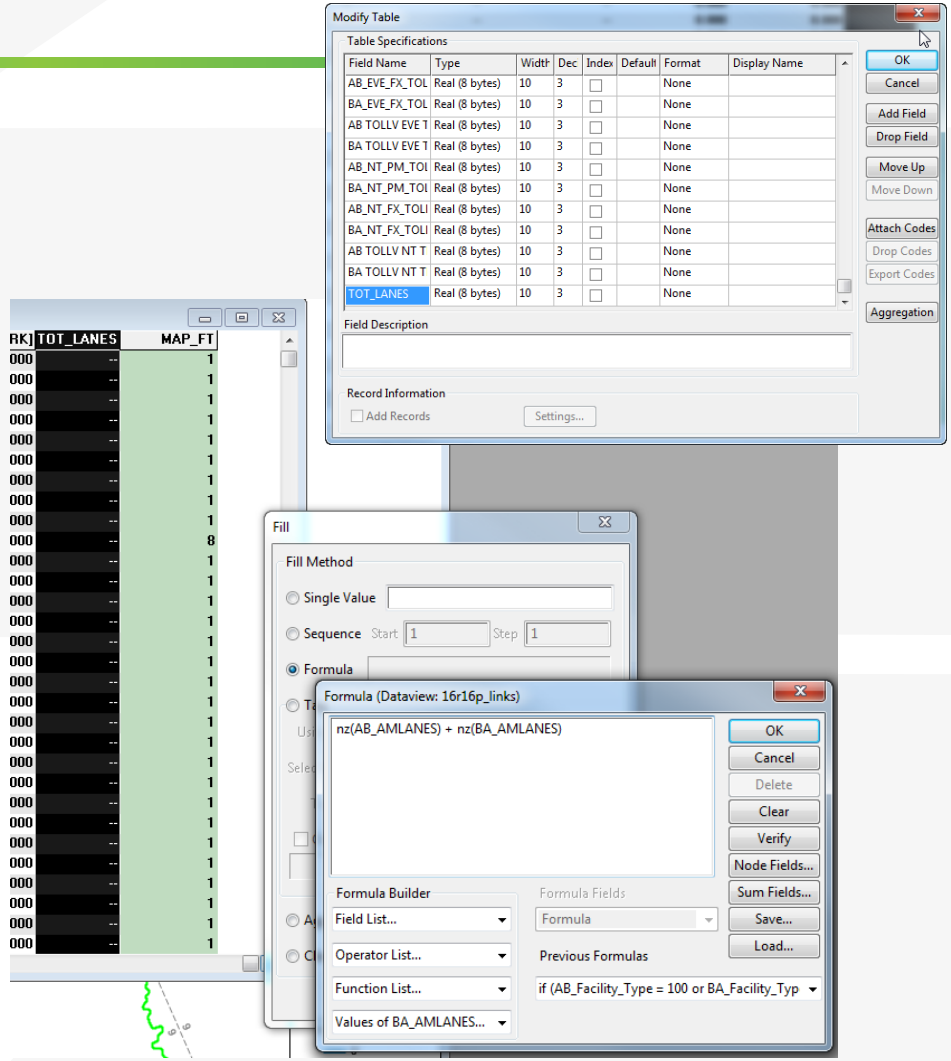
Practice 4: Add total number of lanes in a **NEW FIELD**

- Start with the results from Practice 3
  - ✓ Open the saved map if needed

1. On the top ribbon, click  it will open the links layer daataview table

2. Use Dataview → Modify Table or click 
   - ✓ Click ‘Add Field’
   - ✓ Name the field “TOT_LANES”
   - ✓ You can move the field position using Move Up and Move Down buttons to the right
   - ✓ Click ‘OK’

3. Go to ‘Dataview’ window
   - ✓ Right click the top part of the ‘TOT_LANES’ field
   - ✓ Select ‘Fill’
   - ✓ Select the ‘Formula’ in the fill method options
   - ✓ Type: nz(AB_AMLANES) + nz(BA_BALANES)
   - ✓ Alternatively you can use the formula builder
   - ✓ Click ‘OK’ button.
   - ✓ This fills in two-way number of lanes



Bonus: Try this example using a formula field instead!

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Joining Data

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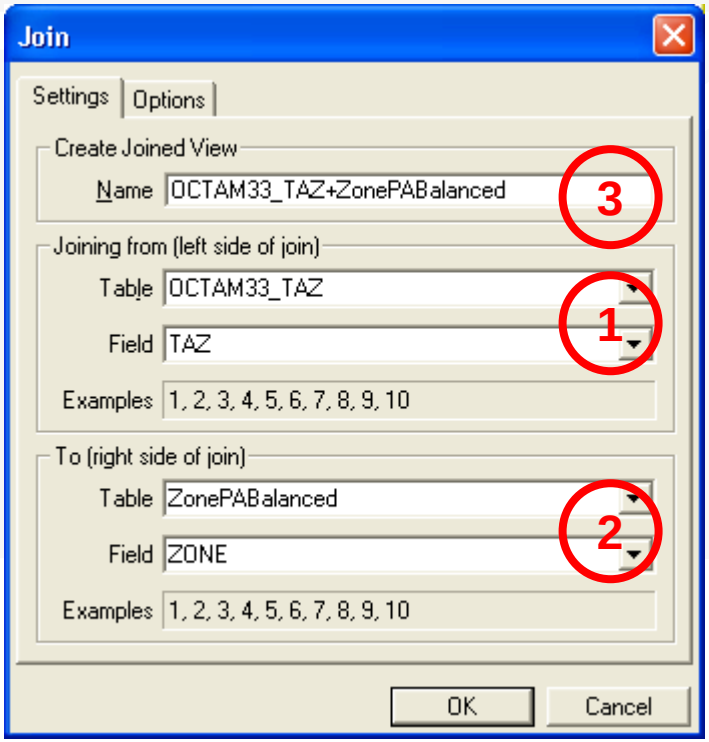
Joining Data

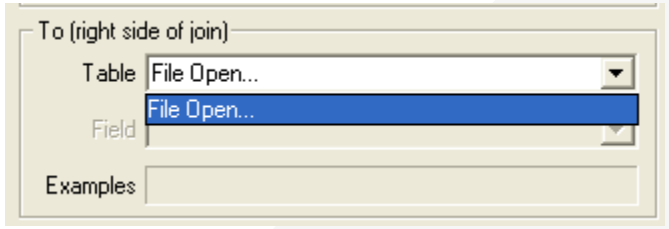
- Layers have an associated data table ()
- Data can be joined () to other tables
  - Roadway Network + Traffic Assignment results
  - TAZ layer + Land Use Data
  - Roadway Network + Lookup Table
  - More…
- This is how traffic assignment results are viewed in TransCAD
- Fields cannot be added/removed 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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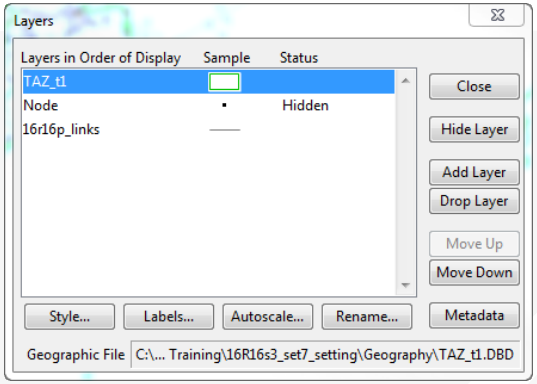
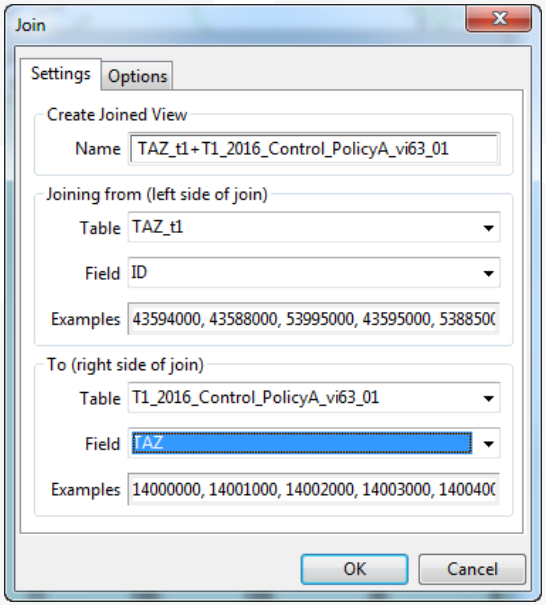
Practice 5: Join the TAZ data to the TAZ layer (Tier 1)

1. Start with the results from Practice 4
   - ✓ Open the saved map if needed
2. Add the TAZ layer to the map
   - ✓ Open the Layers dialog ( )
   - ✓ Click Add Layer
   - ✓ Browse to: **16R16s3_set7_setting\Geography\TAZ_t1.dbd**
   - ✓ Move the TAZs to be drawn first (top of the list)
   - ✓ Click 'Close'
3. Open the TAZ Data Table
   - ✓ File → Open
   - ✓ File Type Comma- or Tab-delimited Text
   - ✓ Browse to **\16R16s3_set7_setting\SED\Inputs\~~TAZ_t1.dbd~~\ T1_2016_Control_PolicyA_vi63_013116.csv**
   - ✓ Note that this is opened as read-only (all cells are green)
4. Create a join from Dataview → join or
   - ✓ Set the left side of the join to TAZ_t1, field 'ID'
   - ✓ Set the right side of the join to T1_2016_Control_PolicyA_vi63_01
   - ✓ Set the right side join field to TAZ ***NOT TAZPREV**
   - ✓ Click 'OK', then use "info" to review the data
   - ✓ **Warning: Do NOT close the joined view!**





Bonus: Create a shading theme with darker colors for more households. Try again for employment

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Printing Maps (Layouts)

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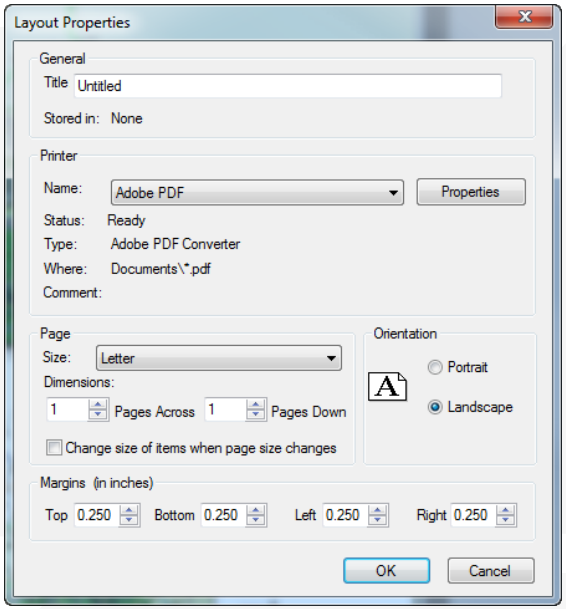
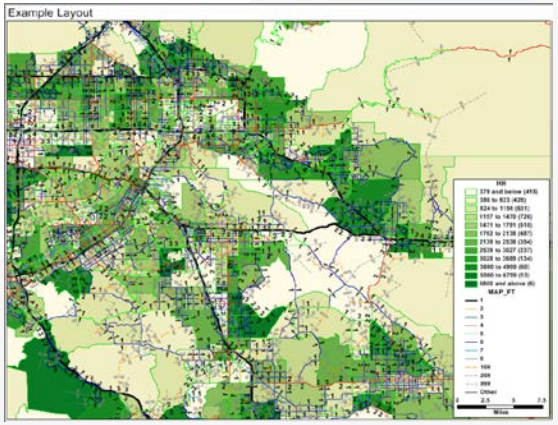
Layouts

- Allow users to create a page to be printed
  - Set paper size
  - Set a specific printer **PDF writers work best!**
- Created from File → New
- Print maps, drawing items, tables, and insets
- Add titles, legends, etc.
  - Title / Project reference
  - Model run source
  - Model run year
  - Map created by
  - Date run
  - Date created
  - Legend (colors, labels, etc)

Practice 6: Create a Layout with your map

1. Start with the results from Practice 5
   - ✓ Open the saved map if needed
2. Create a new layout using File → New or
   - ✓ Check the page settings with File → Properties or
   - ✓ Select a printer and page size
   - ✓ Set to landsape
   - ✓ **Important:** Un-check Change size of items when page size changes
3. Add your map to the layout using
   - ✓ Draw a box to place the map
   - ✓ Select Map, check 'Use actual point sizes'
   - ✓ Optionally un-check 'Keep map's aspect ratio'
   - ✓ Click 'OK'
4. Position and edit the legend
   - ✓ Use the pointer tool ( )
   - ✓ Drag the legend to a good location
   - ✓ Double-click to edit legend text and contents
5. Add a legend title
   - ✓ Use the 'Freehand Text' tool (A), usually at the bottom of the window
   - ✓ Drag a box, then type a title
   - ✓ Use the pointer to reposition, double-clicking to edit





CAMBRIDGE SYSTEMATICS

Highway Assignment

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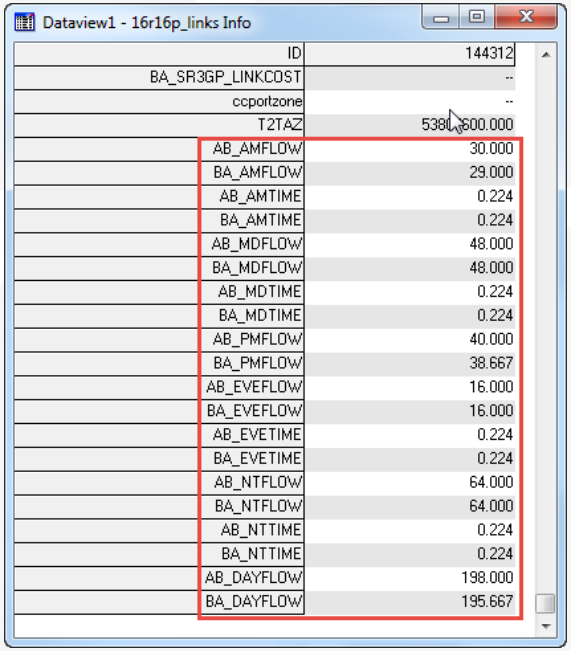
Assignment Results

- 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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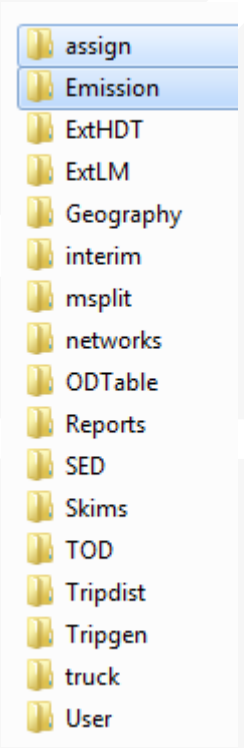
Assignment Results

- 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

Practice 7: Review Assignment Results

1. Open the output roadway network
   - ✓ Use File → Open
   - ✓ Browse to Assign\Outputs\scag_network_loaded.dbd
   - ✓ Review the built-in assignment results
2. Open the detailed assignment results
   - ✓ Use File → Open
   - ✓ Browse to Assign\Outputs\day_flow.bin
3. Create the join from Dataview → Join or 
   - ✓ Left side: link layer and 'ID'
   - ✓ Right side: day_flow and 'ID1'
   - ✓ Click 'OK'
   - ✓ Remember: Do not close the joined view.
4. Use the info tool to review the results

Challenge: Apply what you've learned

5. Label the links with the % share of vehicles that are "Drive Alone"
(Hint: create a formula field)

6. Try creating a bandwidth (scaled symbol) theme showing directional volume
(hint: Use )

More on Networks and Zones

CAMBRIDGE SYSTEMATICS

User Variables

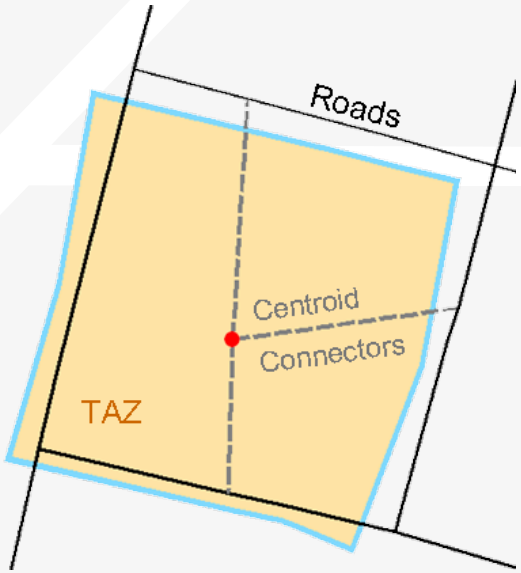
- Creating your own variables
  - Additional fields can be added to links & nodes layers
  - Field names can contain spaces and numbers, and do not have a practical limit to the number of characters
  - HOWEVER…

User Variables

- Creating your own variables
  - Example Varaibles:
    - TCR Segment Number
    - Air Quality Project Link ID
  - It is preferable to:
    - Avoid using spaces
    - Avoid starting a field name with a number
  - If these guidelines are followed, compatibility with other GIS programs will be improved
    - Field names that do not follow these guidelines will have truncated or confusing names when exported to a shapefile

Centroids

- Centroids are special nodes that are linked to socioeconomic data
  - SCAG's Model has three tiers of TAZs
    - Tier 1: Least amount of detail
    - Tier 2: More detail
    - Tier 3: Used for subarea models.
  - TAZ numbers match the TAZ layer, data tables, and matrices
    - **Sometimes, files use sequential TAZ numbers instead!**



Centroids

- Nodes are identified as centroids using the following rules:

Field Name	Contents
Tier1TAZ	User friendly nested TAZ ID numbers (sequenced by county, type, etc)
Tier2TAZ	
ZoneType_Tier1	Internal, External, Airport, or Seaport
ZoneType_Tier2	
Internal_sequence_id_T1	TAZ numbers used internally by TransCAD – but important to model users
Internal_sequence_id_T2	

Tiered TAZ Structure

- Tier 1 Zones
  4,192
  - Used in traffic assignment
  - Results in 17.5 ***million*** cells per matrix

- Tier 2 Zones
  11,350
  - Used in trip generation, distribution, and mode choice
  - Results in 128.9 ***million*** cells per matrix

Fun with Math:

Why these models take so long

$$\frac{4,192}{11,350} = 2.7 \qquad \frac{17.5\,m}{128.9\,m} = 7.3$$

$$2.7^2 = 7.3$$

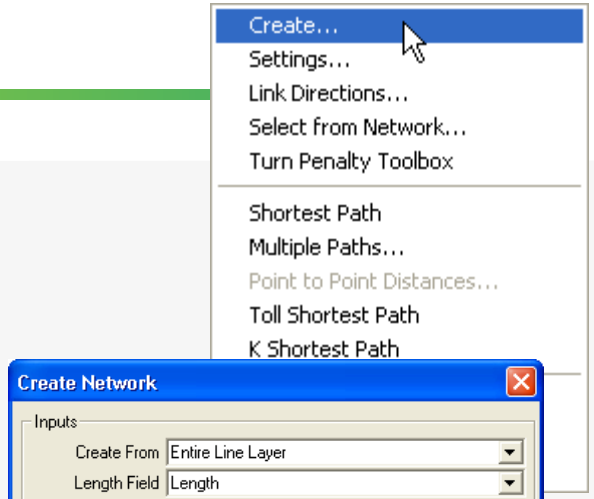
Routable Roadway Networks

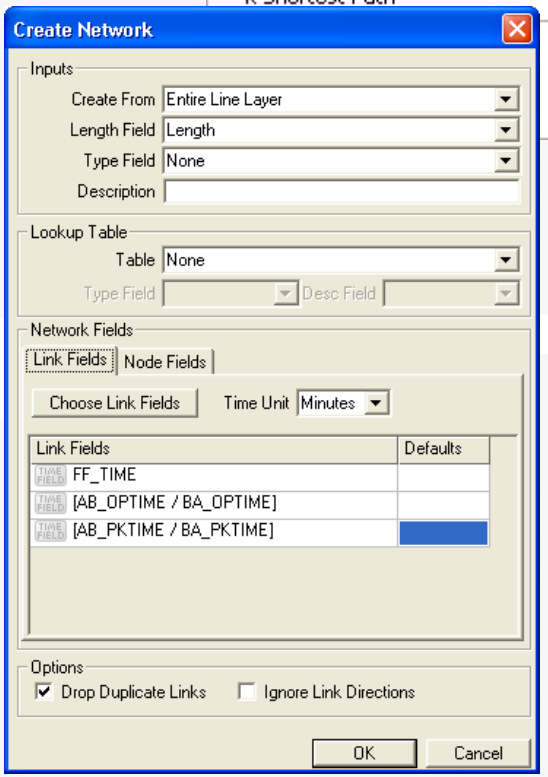
Routable Networks

- By themselves, geographic files are not “routable”
  - A network file (.net) must be created before certain actions can be done
    - The SCAG Model creates this automatically
  - To increase efficiency, only selected variables are contained in the network file
- The routable network can also include turn penalties and prohibitions
  - By default, the SCAG model does not use turn penalties

Routable Networks

- Create a routable network using Networks/Paths → Create
- For a working network, only length needs to be included
  - » Other variables as necessary
- Networks/Paths → Settings can be used to change additional network properties





CAMBRIDGE SYSTEMATICS

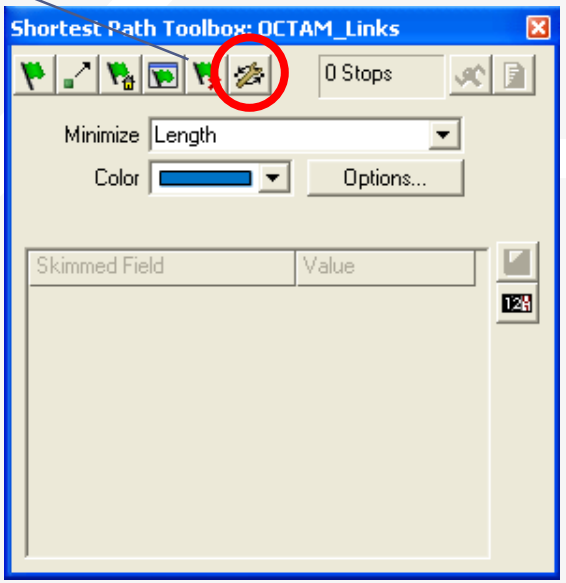
Routable Networks

- Shortest Paths
  - Use Networks\Paths → Shortest Path to see how TransCAD routes traffic based on time, length, and turn penalties
  - A ".net" network is required (Optional in TransCAD 6)
    - In TransCAD 6, a using .net network will allow more functionality
  - The network must contain all variables of interest
    - More variables can be added to the network later if needed

Routing on the Network

- Shortest Paths
  - The shortest path is based on the selected variable
  - Other variables can be tracked, or “Skimmed” along the way
- No “.net” file?
  - On-the-fly pathbuilding when no “.net” network is open
    - Turn penalties not applied
    - Not possible to “skim” other variables
    - Useful for quick and easy tests

If this button is missing, close the toolbox, open a .net file, and re-open the toolbox



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Practice: Shortest Paths

1. Close all files and start with a clean workspace
2. Open the output roadway network
   - ✓ Use File → Open
   - ✓ Browse to Assign\Outputs\scag_network_loaded.bin
   - ✓ Review the built-in assignment results
3. Create a ".net"network
   - ✓ Include FreeTime, AMTIME, and MDTIME
   - ✓ These are directional fields
4. Find the shortest path between two points
   - ✓ Try using intermediate points to find the difference between the shortest and next shortest path
   - ✓ Build a path through a centroid connector
5. Select centroid nodes
   - ✓ Tier1TAZ > 0 or Tier2TAZ > 0 (node layer)
   - ✓ Use Networks/Paths → Settings to identify centroid connectors in the network file
6. Try to build a path through a centroid connector
7. Discussion: How might this tool be useful?
   - ✓ For model troubleshooting
   - ✓ To answer policy questions

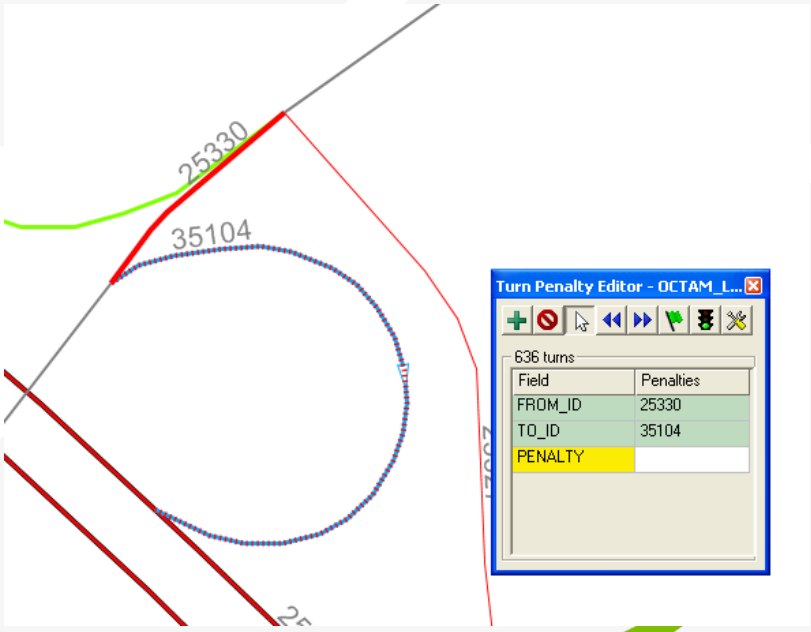
Turn Penalties

Example only: The SCAG model doesn't currently use turn penalties, but they can be added manually if needed

- Turn penalties and Prohibitions
  - Turn penalties are stored in a table (.BIN)
  - This table can be viewed in a dataview
  - Turn penalties are most easily managed using TransCAD's Turn Penalty Toolbox:
    - Add, Delete, or review turn penalties
    - Enter a turn penalty value in minutes
    - Create a turn prohibition by leaving the penalty value blank
- Load into a network from Networks/Paths → Settings

Turn Penalties

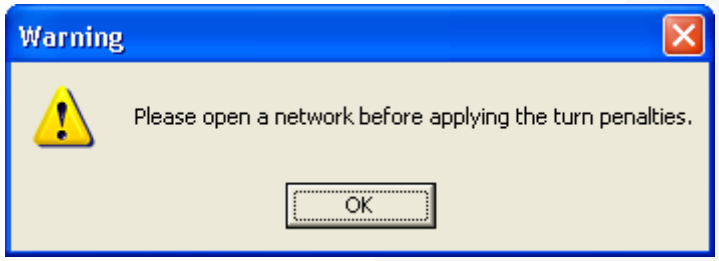
- Turn penalties and Prohibitions
  - Networks/Paths → Turn Penalty Toolbox
  - Links will be colored to indicate turn penalties
  - Available turn penalties will be shown in green or blue
  - The selected turn penalty will be shown in red
    - Solid = From
    - Dash = To



CAMBRIDGE SYSTEMATICS

Turn Penalties

- Applying to a Network
  - Apply .bin file turn penalties from Network → Settings
  - If you are using the turn penalty toolbox, penalties are applied to the network as you go
    - Turn penalties are applied to the network with the green light
    - You can ignore this error if a “net” file is not open and you will apply the “.bin” file later



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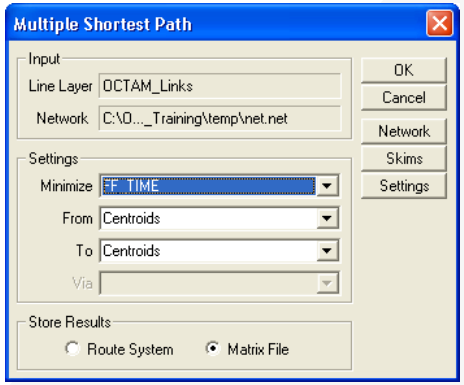
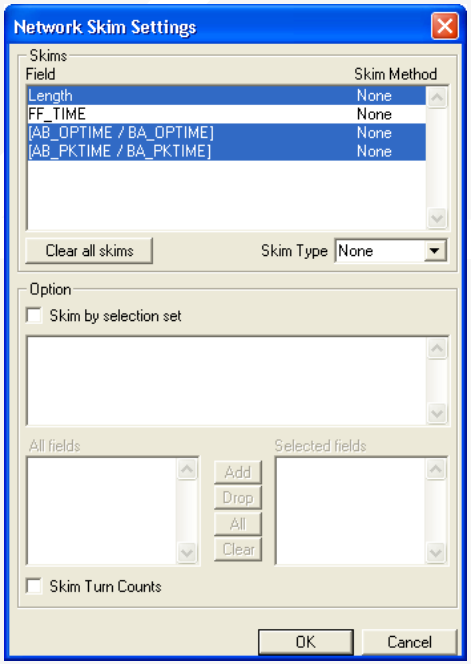
Routable Networks

- Creating a skim matrix
  - » Build shortest paths between all zone pairs
    - *Technically: Builds shortest paths between two sets of selected nodes*
  - » Allows user to specify attributes to "skim" along the paths
  - » Saves results in a zone to zone matrix file
- Accessed from Networks/Paths → Multiple Paths





CAMBRIDGE SYSTEMATICS

Practice: Shortest Path Matrix

1. Start with the workspace from the previous practice
2. Select Tier 1 Zones
   - ✓ Select by the condition: Tier1TAZ > 0
   - ✓ Name the set Tier1TAZ
3. Create a skim matrix between all zone pairs
   - ✓ Find the shortest FF time
   - ✓ Skim length, AM, and MD time
   - ✓ Review the warnings and/or report
   - ✓ Investigate one or two warnings
4. Compare results to the interactive pathfinder for a selected zone pair

Roadway Network Editing

CAMBRIDGE SYSTEMATICS

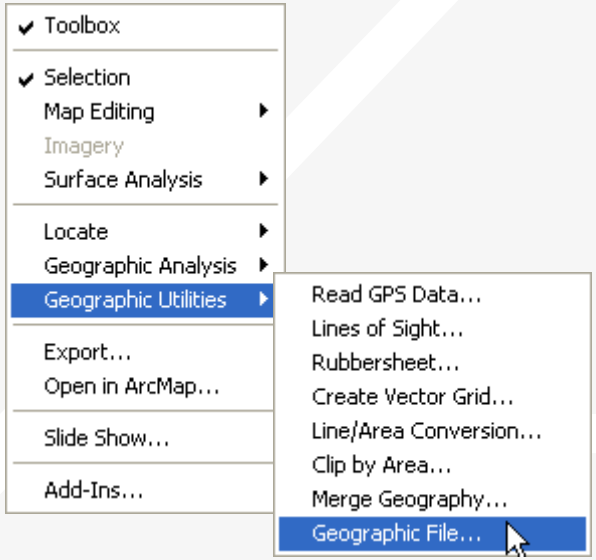
Network Editing

- Warning: Make a backup copy first!
  - There is an “Undo” function in TransCAD
  - Edits are made directly to the network file: You can’t close without saving to discard changes
  - Network files sometimes become corrupt

The Undo function in TransCAD 5+ makes network editing less risky

Network Editing

- Backing up the Roadway Network
- **Method 1 (recommended):**
  - Open the network in TransCAD
  - Use Tools → Geographic Utilities → Geographic File
  - *Click **Archive** to save in a zip file*
- **Method 2 (advanced):**
  - Close all files in TransCAD
  - Create a zip file with the line layer and route system files
  - Make sure to get <u>all</u> related files



CAMBRIDGE SYSTEMATICS

Network Editing

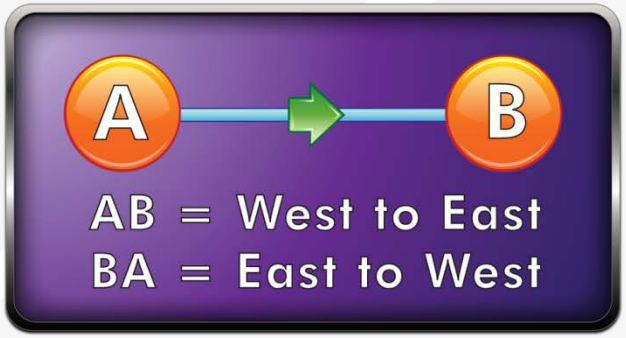
- Once you have made a backup, you can:
  - Edit attributes of existing links
  - Change data for a specific year or for multiple years and alternatives
  - Add new links, delete existing links, or realign existing links
  - Add data for a year not yet included in the network

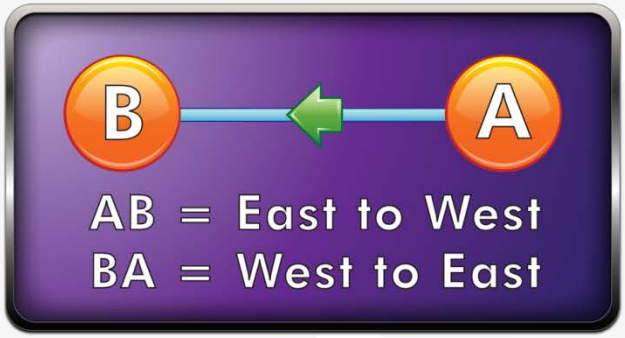
Network Editing

- Edit attributes of existing links
  - » Display settings can assist with editing
- Additional labels and/or themes can be useful
  - » Label # of lanes or other values
  - » Show Topology () to see AB vs. BA

Network Topology

- Show topology to identify AB and BA directions

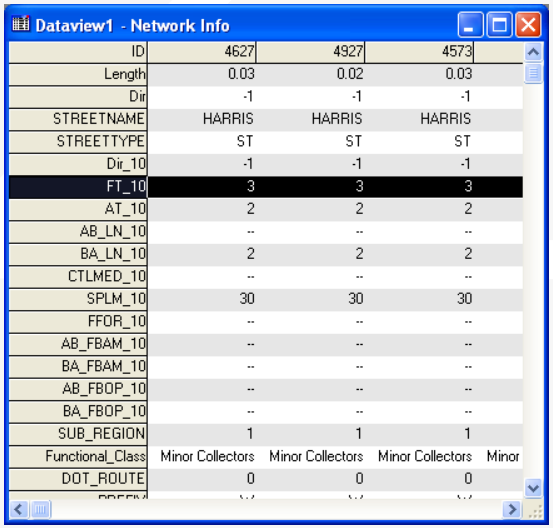




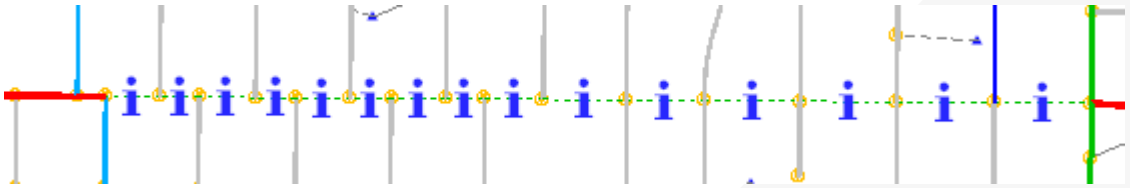
- To identify one-way roads, use the DIR field:
  - 0: Two-way travel
  - 1: A → B travel
  - -1: B → A travel

Network Editing

- Edit attributes of existing links – Method 1
  - To make most edits, use the information tool () and edit text in the form that appears
  - Changes can be undone
    - Each edit action creates an undo point
  - You can select and fill multiple links with the information tool
    - Multiple values can be filled by right-clicking on row names



ID	4627	4927	4573	
Length	0.03	0.02	0.03	
Dir	-1	-1	-1	
STREETNAME	HARRIS	HARRIS	HARRIS	
STREETTYPE	ST	ST	ST	
Dir_10	-1	-1	-1	
FT_10	3	3	3	
AT_10	2	2	2	
AB_LN_10	--	--	--	
BA_LN_10	2	2	2	
CTLMED_10	--	--	--	
SPLM_10	30	30	30	
FFOR_10	--	--	--	
AB_FBAM_10	--	--	--	
BA_FBAM_10	--	--	--	
AB_FBOP_10	--	--	--	
BA_FBOP_10	--	--	--	
SUB_REGION	1	1	1	
Functional_Class	Minor Collectors	Minor Collectors	Minor Collectors	Minor
DOT_ROUTE	0	0	0	



Network Editing
Alternate Method

- Edit attributes of existing links *Alternate Method*
  - Use the map editing toolbox ( )
  - Use the Edit Line Attributes ( ) button
    - Operation of this tool is similar to using the information button
  - Edits are saved when the green light ( ) is clicked
  - Use the red ( ) light to cancel all unsaved edits
  - The Undo function will undo all edits that are saved at once with the green light

Network Editing

- What Fields do I Edit???
  - **Facility Type**
    - Facility type identifier
  - **Lanes**
    - Directional number of lanes, by time period
    - Aux. lanes (freeway links only)
  - **Direction**
  - **Area Type**
    - Use nearby links as a guide
  - **MODE**
    - 2 for most links (other values are for transit)
  - **Other fields as necessary**

Network Editing

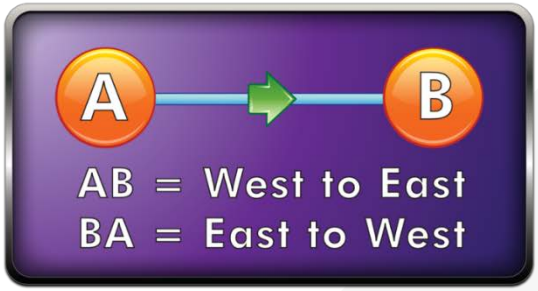
- What Fields do I Edit ??? (cont'd)
  - Toll coding guidelines
    - Use TOLL, Toll_flag
    - See assign\inputs\toll_hot_penalty for toll and express lane coding details
- See the SCAG Model User's Guide for more guidance

Practice: Network Editing

- Open the input network file
- Make a backup copy of this network in a folder called “Backup”
  - Use Tools → Geographic Utilities → Geographic File and archive the network
  - Add the date to the backup filename
  - Edit the original network file
- Try using the different editing approaches to:
  - Change the facility type
  - Widen a Road

Practice: Network Editing

- Show Topology on the network
- Change a roadway to represent a different number of lanes in each direction
- Change a different roadway to a one-way road
  - 0 = Two-Way
  - 1 = A to B
  - -1 = to A

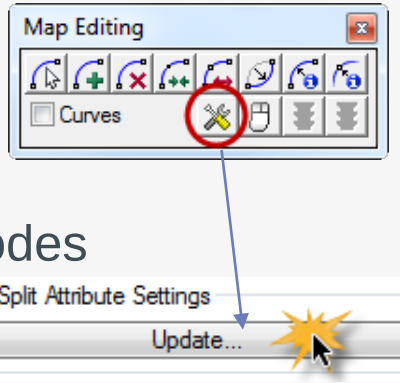


Network Editing

- Adding new links
  - Use the map editing toolbox ()
  - Add links using Add Line ()
    - To work properly, links must be connected at nodes
    - Existing links may need to be split
    - Avoid splitting links if possible
  - Make sure that links are connected by:
    - Saving edits
    - Moving a node around – do all of the attached links move with it?
    - Canceling the edit

Network Editing

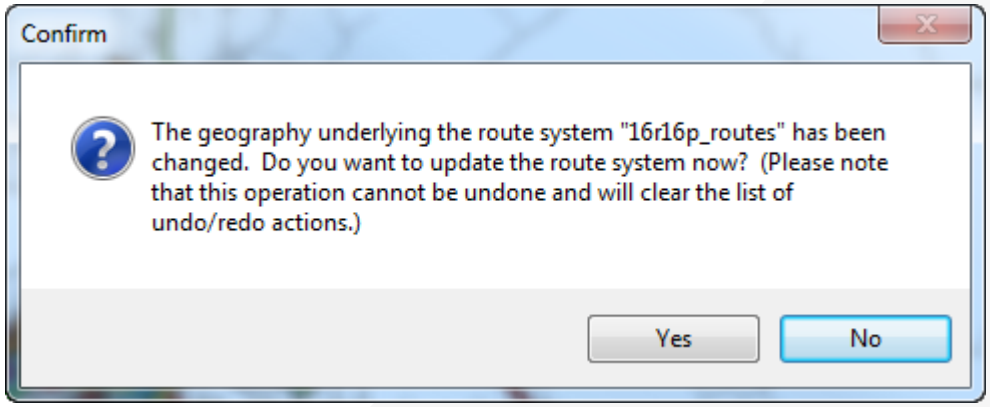
- Adding New Links
  - New links need new data!
  - Copy data from an existing link with similar characteristics
    - Use the Edit Link Attributes () button
    - Click/shift-click on the new link(s)
    - Shift-click on the similar old link
    - Right-click on the data for the “old” link and choose “Copy Values”
  - Splitting/Joining Links
    - **Check the split/join settings**
    - Use the split/join tools ()
    - New/moved links may be connected at new nodes
    - Check data on split/joined links



CAMBRIDGE SYSTEMATICS

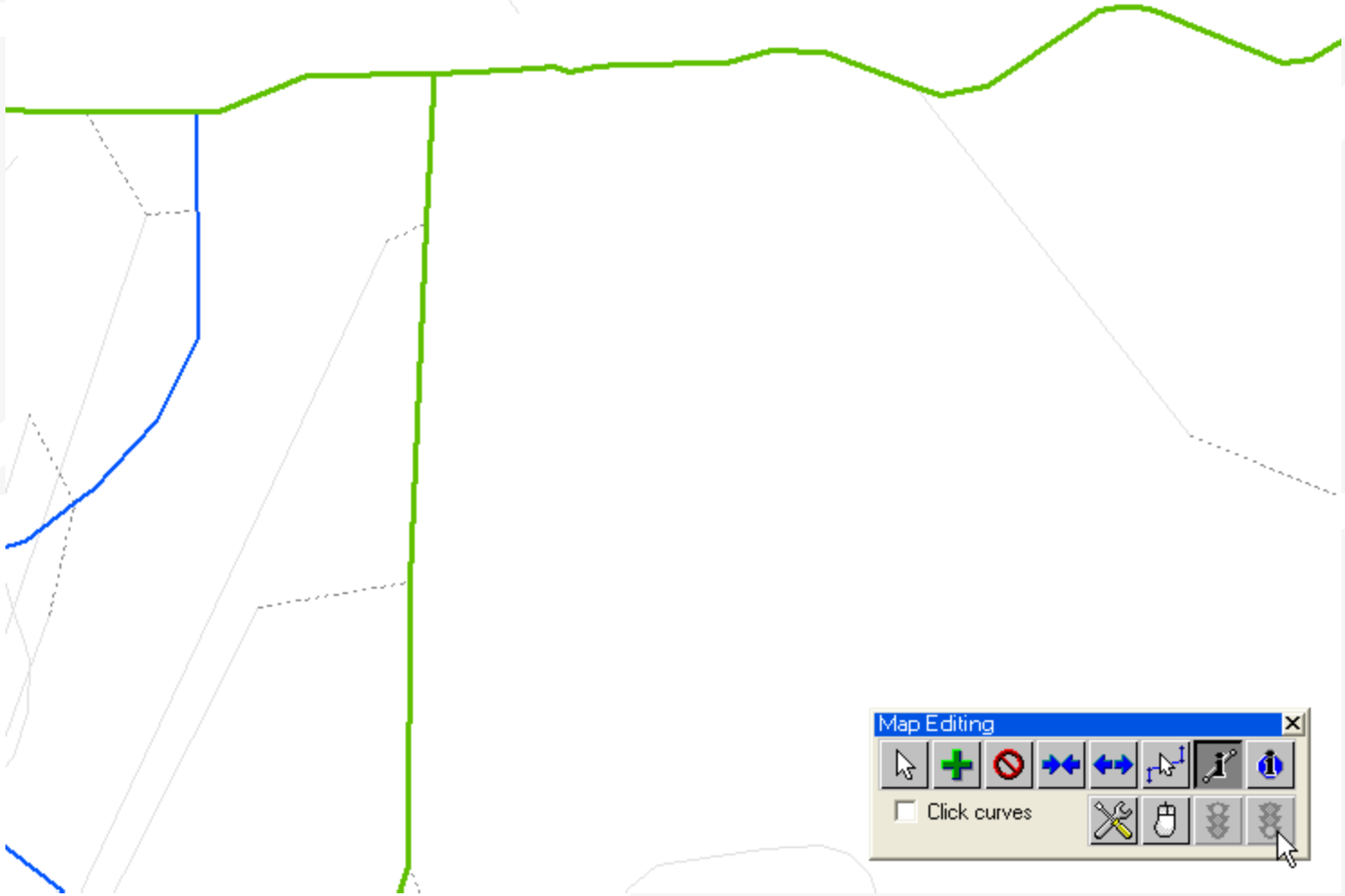
Network Editing

- Keeping Transit up to date
  - Always add the route system to the network before making edits (link additions, splits, or joins)
  - Add the route system from networks\Inputs
    Note: Make sure to choose the Route System file type
  - Make the route system active after every few edits
  - TransCAD will prompt and update the transit network based on your changes



CAMBRIDGE SYSTEMATICS

Network Editing



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Practice: Network Editing

- Continue editing the input network
- Add, delete, and realign some links
  - » Show topology: Note that the way a new link is created defines its AB direction
- Copy link values from an old road to newly created links
- Split and join links
  - » look at the data that appears on each half
  - » Look at the network editor settings ()

Network Editing

- Things to keep in mind:
  - When splitting links, make sure the data on both pieces still makes sense
  - When adding new roadways, adjust centroid connectors if necessary
  - Adding detail or making corrections?
    - You may need to make edits to base and forecast networks

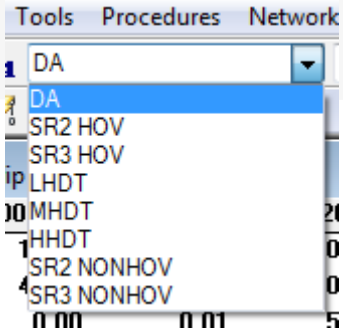
Working with Matrices

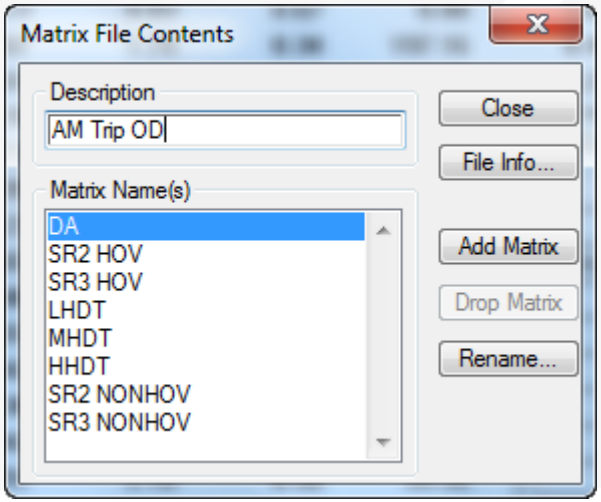
Matrix Files

- Contain zone to zone data
  - Trip tables
  - Shortest Paths (“Skims”)
  - Mode shares, logsums, etc
- Tend to be very large files
  - Real numbers = Big files
  - Compression reduces file size and increases access speed
    - CPU Speed > Disk Speed

Matrix Files

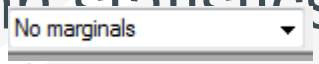
- Matrix Cores
  - One file, multiple tables
  - Add/Delete/Rename Cores ( )
  - Select the active core





CAMBRIDGE SYSTEMATICS

Matrix Files

- Show row/column statistics 

  - Sum, min, max, etc.
  - TransCAD 5.
  - Sort by matrix marginals
  - Store marginals in a table ( )
- Get overall matrix statistics with Matrix Statistics ( )
- Compare all core values in a single cell
  - Right-click → Info
- QuickSum ( ) Adds a new core with the sum of all existing cores in the file

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Practice: Matrix Files

- Open the PK Person trip distribution results
  - Also open the input PK PA Balanced Table
- Copy/Paste trip generation and distribution data into Excel
  - Use Matrix → Statistics ( ) to identify the total for each matrix core
  - Use Dataview → Summary Statistics ( ) to get the total balanced Ps and As
  - Verify that trip generation and distribution are consistent
- Use the QuickSum tool ( ) to create a total core
  - Re-summarize the matrix
  - Verify that the QuickSum core is the sum of core totals

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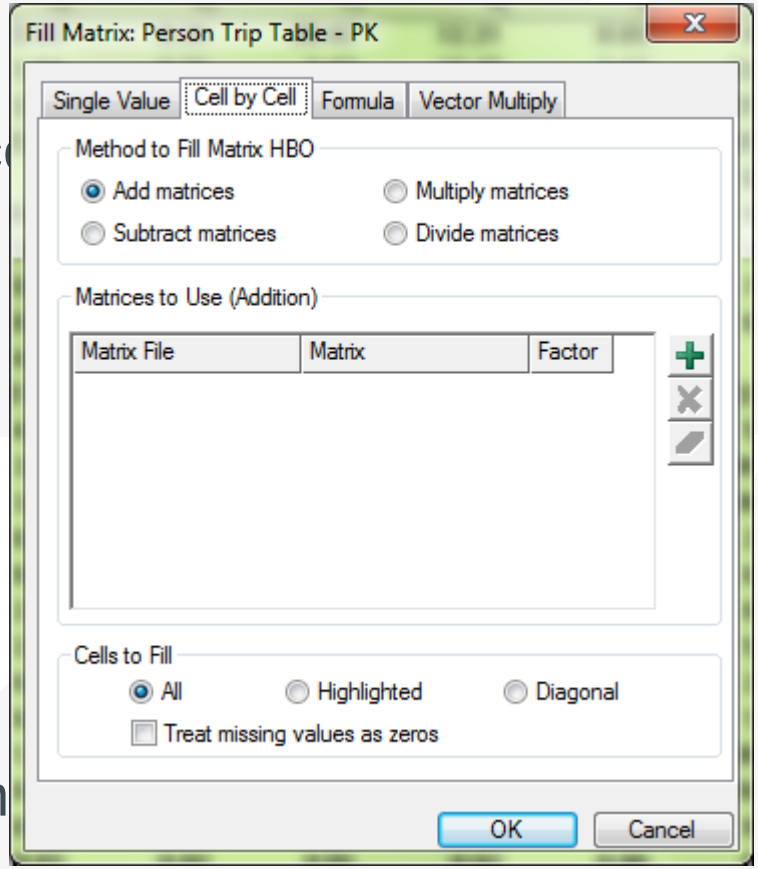
Matrix Files

- Matrix Calculations
  - Matrix → Fill ( )
- Single Value
  - Simple add/subtract/clear/replac
- Cell by Cell
  - Compute values from two or more matrix cores
- Formula
  - Mix operators and use functions
- Vector Multiply
  - Multiply by a row or column from a dataview



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Practice: Matrix Files

- Continue with the previous workspace
- Add a “MyTest” core to the matrix file
- Fill MyTest with the sum of HBSc + HBU + HBS + HBSR + HBO
  - Use both Cell by Cell ***and*** Formula
- Add a column to the PA dataview
  - Fill the column with 1
  - Set a few rows to 0 or 0.5
- Try vector multiplication
  - How are row and column multiplication applied?

Matrix Files

- Matrix Indices ( )
- View only a subset of a matrix file
  - Use a selection set to identify rows/columns to view
  - The matrix will be “shrunk”
  - Row/Column marginals will reflect the smaller matrix
- Change ID numbers
  - Use a dataview as a correspondence table
  - Example:
    - SCAG has both TAZ IDs and sequential TAZ Ids
    - Different matrix indices have the same number of rows/columns, but different row/column IDs

Practice: Matrix Files

- Start with the previous workspace
- Create Orange County indices
  - OCZones
  - NotOC
  - Check the Excel file to identify the OC county code
- Summarize trips to, from, and within Orange County
  - Trip-Ends vs. Trips
- Create a formula field: TAZ + 1000
  - Create an index called BigZones
  - Include all zones, but change ID numbers

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Matrix Files

- Aggregate Matrices
  - Squeeze a matrix, summing within districts or superzones
  - Matrix → Aggregate
  - Requires dataview
  - Rows, Columns, or both
- Disaggregate Matrices
  - Matrix → Disaggregate
  - Requires a specially designed dataview
    - Multiple rows for some exi rows/columns
    - Unique sub-zone field

ZONE	NewID	Percent
1	101	.20
1	102	.20
1	103	.60
2	2	1.00
3	301	.30
3	302	.70

Practice: Matrix Files

- Aggregate the PA table to counties
  - Compare results to to/from/within OC from the previous practice
- Disaggregate 5-10 TAZs
  - Create a new TAZ correspondence table
    - Work in Excel, or copy the PA table and work directly in TransCAD
    - In TransCAD, use Edit → Add Records to add new rows
  - Run the matrix disaggregation function
  - Look at pre- and post- disaggregation data
    - row and column totals
    - Individual cell values

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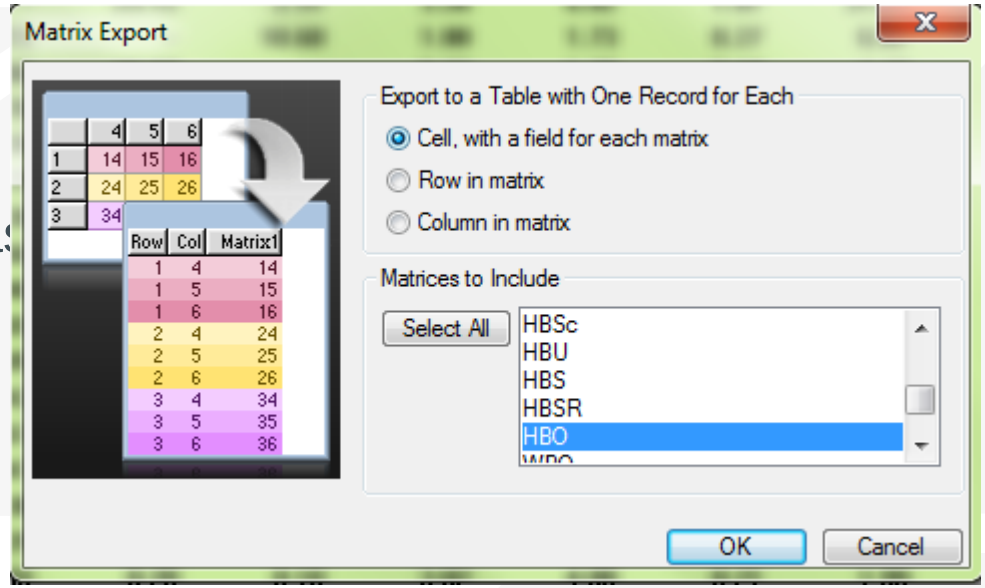
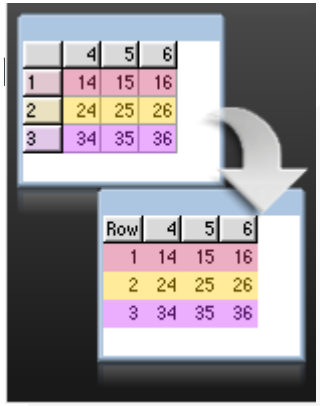
Exporting / Importing

- Matrix → Import
  - » Format 1:
    - Good for databas
      work



  - » Format 2/3
    - OK for manual wo



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Matrix Files

- Using GISDK
  - Much easier when running multiple calculations
  - Straightforward syntax
- Important Functions
  - OpenMatrix: Open a matrix File
    - Creates a matrix handle (e.g., mat)
  - CreateMatrixCurrency: Identify core and indices
    - Creates a matrix currency (e.g., cur)
  - CreateMatrixCurrencies: Access all cores conveniently
    - Creates a list of matrix currencies (e.g., curs.Core1, curs.Core2)

Matrix Files

- Matrix Operations (:=)
  - Treat matrices like simple variables
  - Cur1 := cur2 + cur3 / 2
- Closing matrix files
  - Set all matrix handles and currencies to null
  - Especially important in loops
  - All matrix files are closed when a macro completes
    - Exception: the matrix has been opened in a view
  - Good Practice: Keep track of matrix variables and set them to null on completion

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Matrix Files

```
Macro "Example"

    //Define the path and filename
    mat_file = "C:\\OCTAM_Training\\dst\\TestMat.mtx"

    //Open the matrix
    mat = OpenMatrix(mat_file, )  //(filename, "True"/"False" to ope

    //Add a new core called HBNW
    AddMatrixCore(mat, "HBNW")

    //Access the matrix cores using default indices
    curs = CreateMatrixCurrencies(mat, , , )  //(matrix_handle, row_

    //Add HBSc, HBU, HBS, HBSR, and HBO
    curs.HBNW := nz(HBSc) + nz(HBU) + nz(HBS) + nz(HBWR) + nz(HBO)

    //Close the matrix file
    mat = null
    curs = null

EndMacro
```


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Practice: Matrix Files

- Close all files in TransCAD
- Copy the Peak PA matrix to TestMat.mtx
- Write a script to:
  - Open TestMat
  - Add a HBNW core
  - Fill the HBNW core with all HBNW trip purposes
- Extra Credit
  - Add a second core called Temp
  - Fill the Temp core with HBS * 2 – HBO * 0.5

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Advanced Topics

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Advanced Topics

- Matrix Files and OD Tables
  - Matching matrix files to zones/centroids
  - Visualizing trip table data
    - Desire Lines
- Setting up Select Link and Zone Analysis
  - Creating a query file
  - Running assignment only with select analysis activated
- Routable Networks
  - Creating and updating a “.net” Network
  - Interactive pathbuilding
- Basic Scripting
  - Batch Recorder
  - Simple Macro Creation

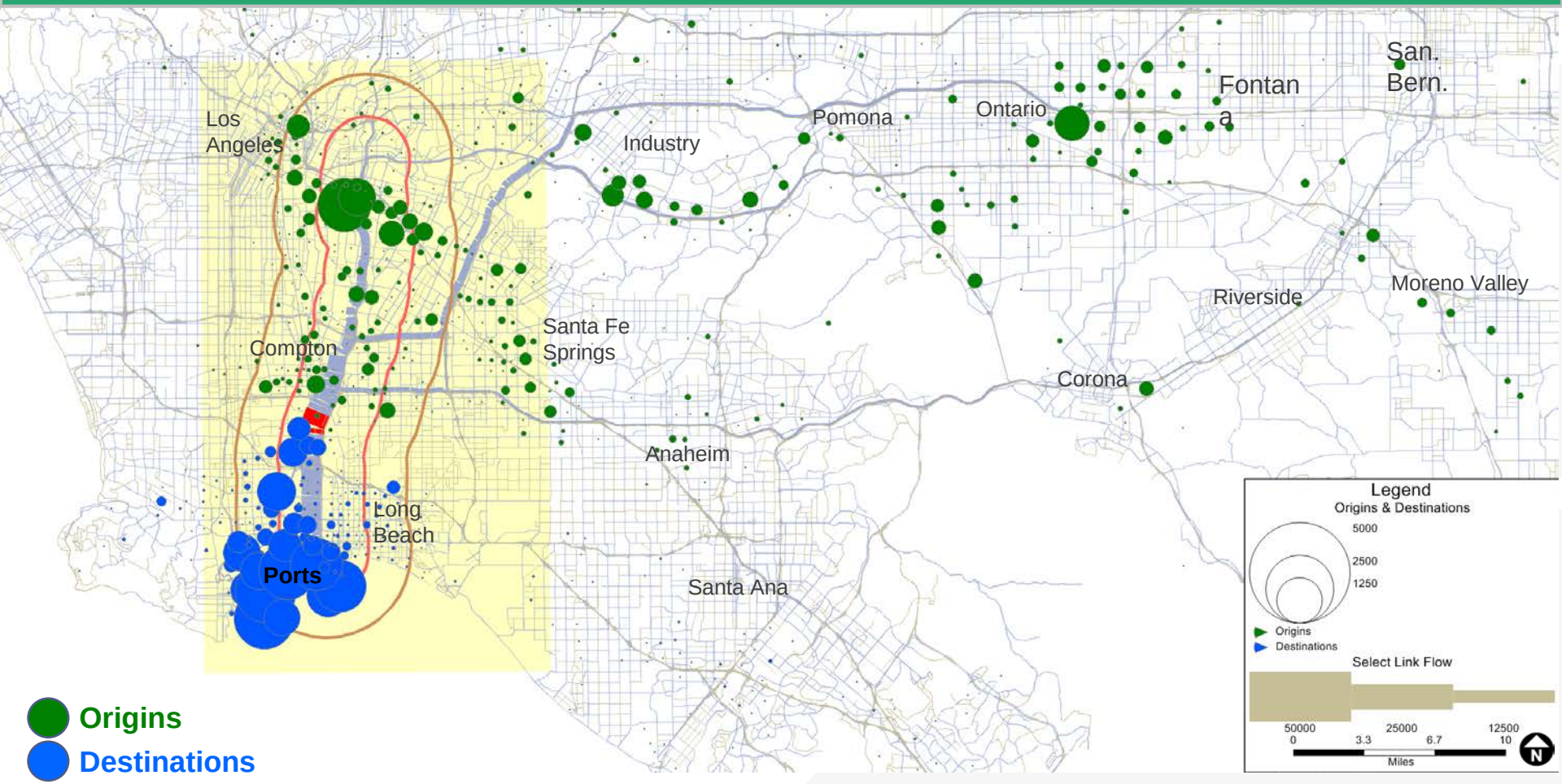
Thank You!

Examples

CAMBRIDGE SYSTEMATICS

Year 2035 Alternative 5C: Select Link Analysis Daily HHDTs

Southbound 710 Freeway Long Beach Blvd. Location (Pair A)



Origins

Destinations

** Example only: not meant for reading the text in PowerPoint presentation format*

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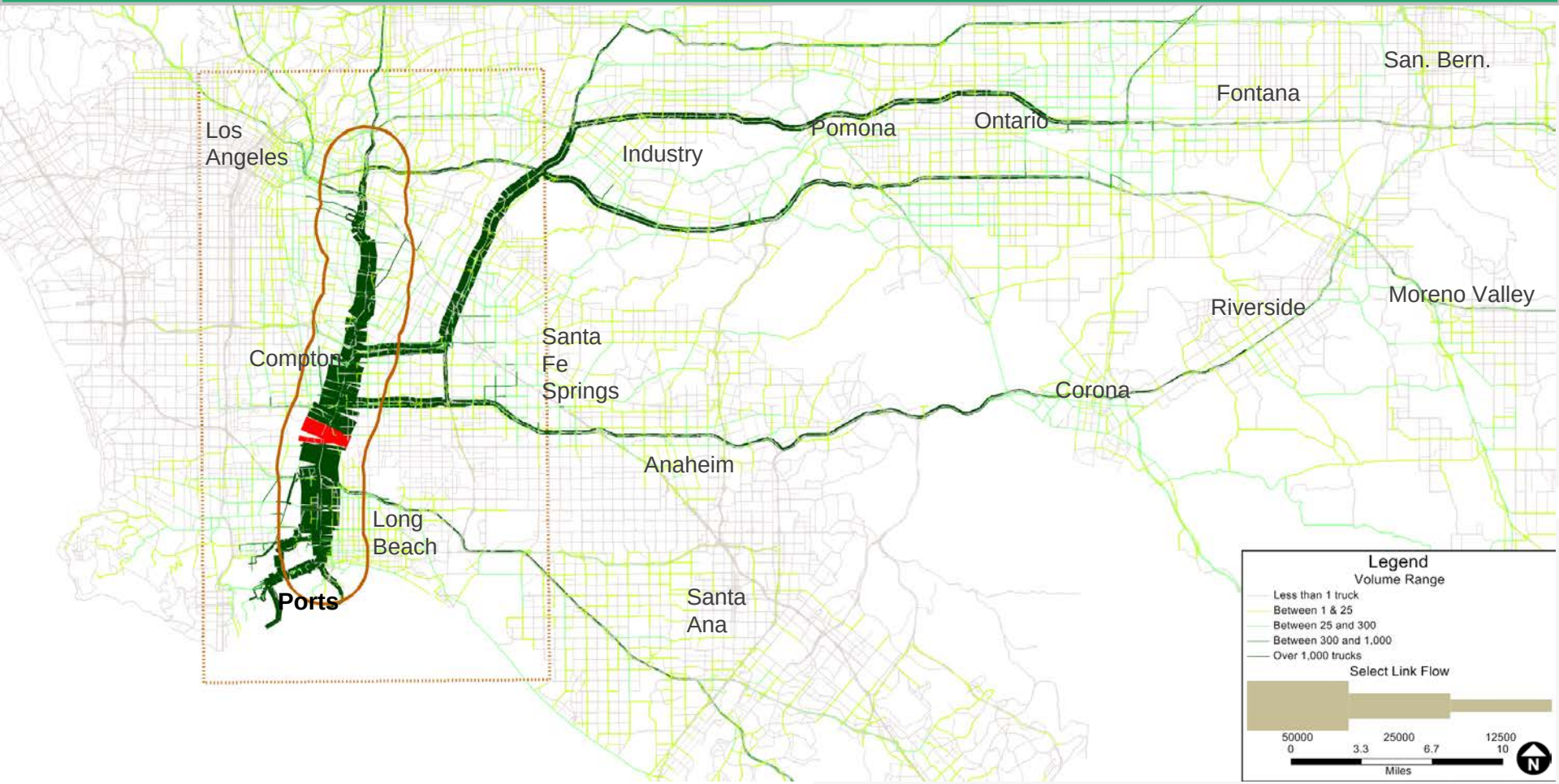
Year 2035 Alternative 5C: Select Link Analysis Daily HHDTs

Long Beach Blvd Location Bandwidth HHDT Volumes

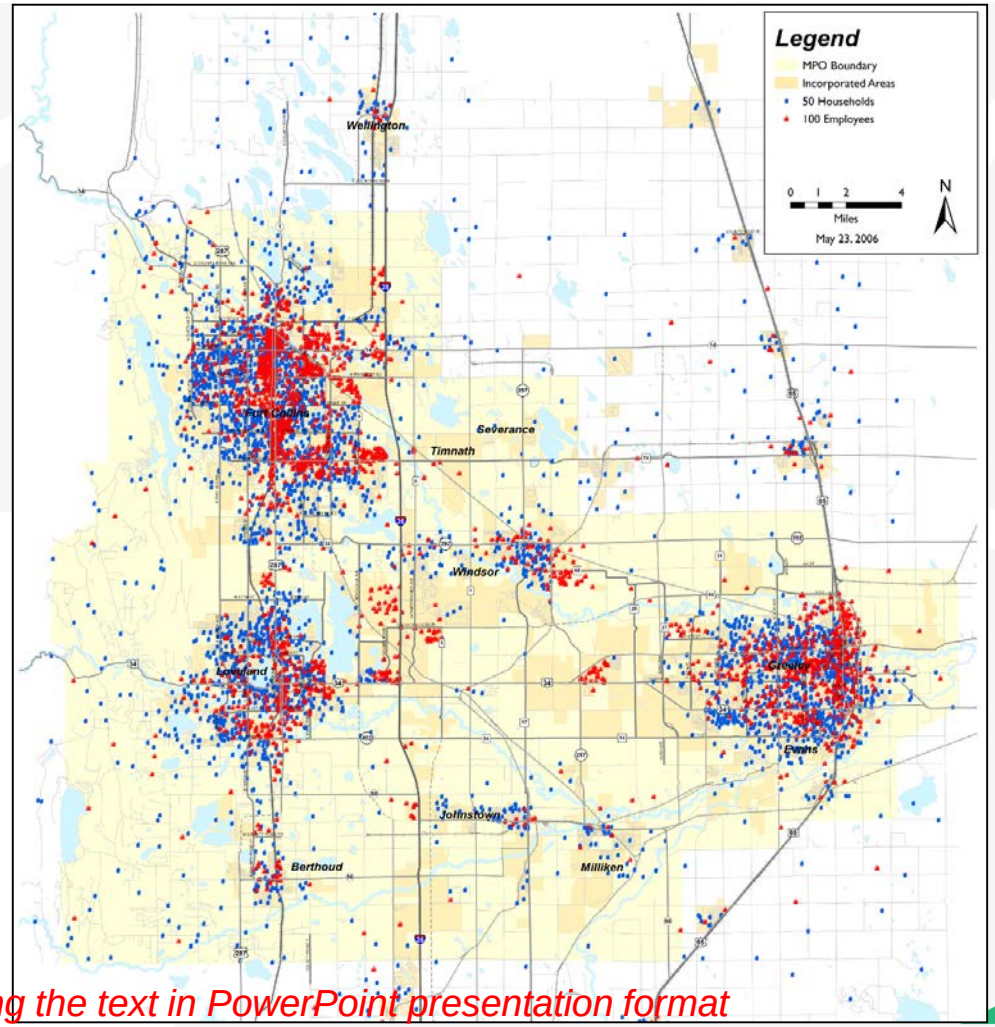


** Example only: not meant for reading the text in PowerPoint presentation format*

CAMBRIDGE SYSTEMATICS

Household And Employment Growth

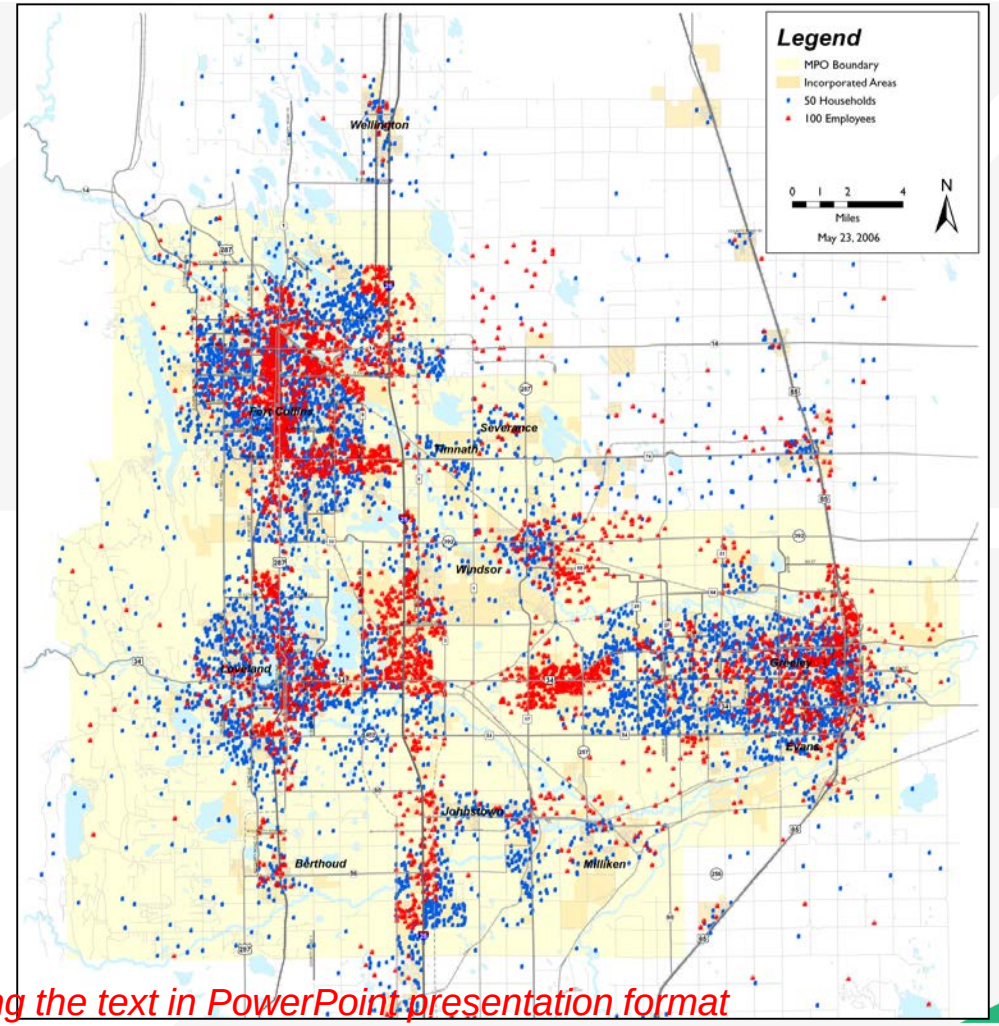
Today



** Example only: not meant for reading the text in PowerPoint presentation format*

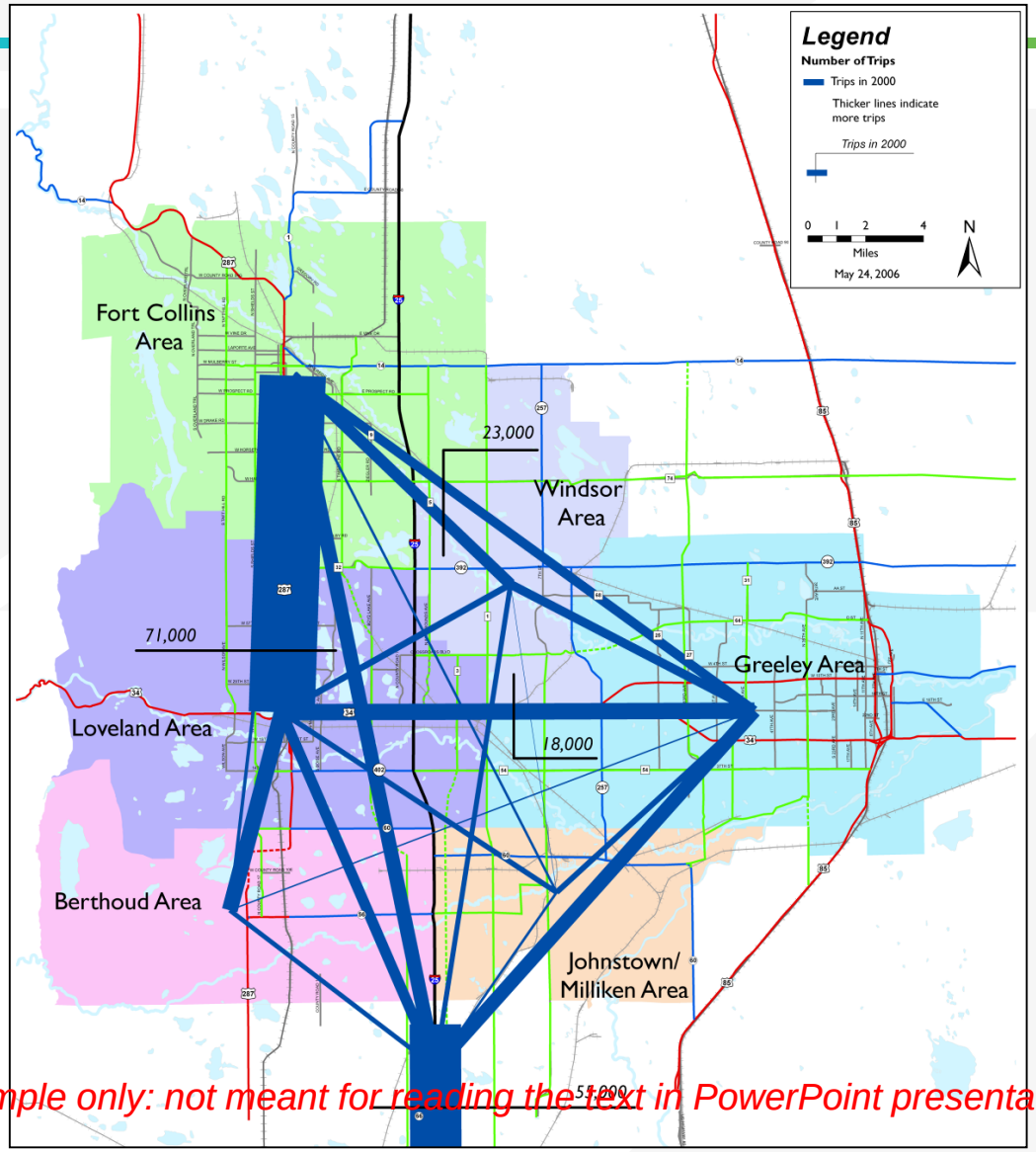
Household And Employment Growth

Future



** Example only: not meant for reading the text in PowerPoint presentation format*

Travel Patterns

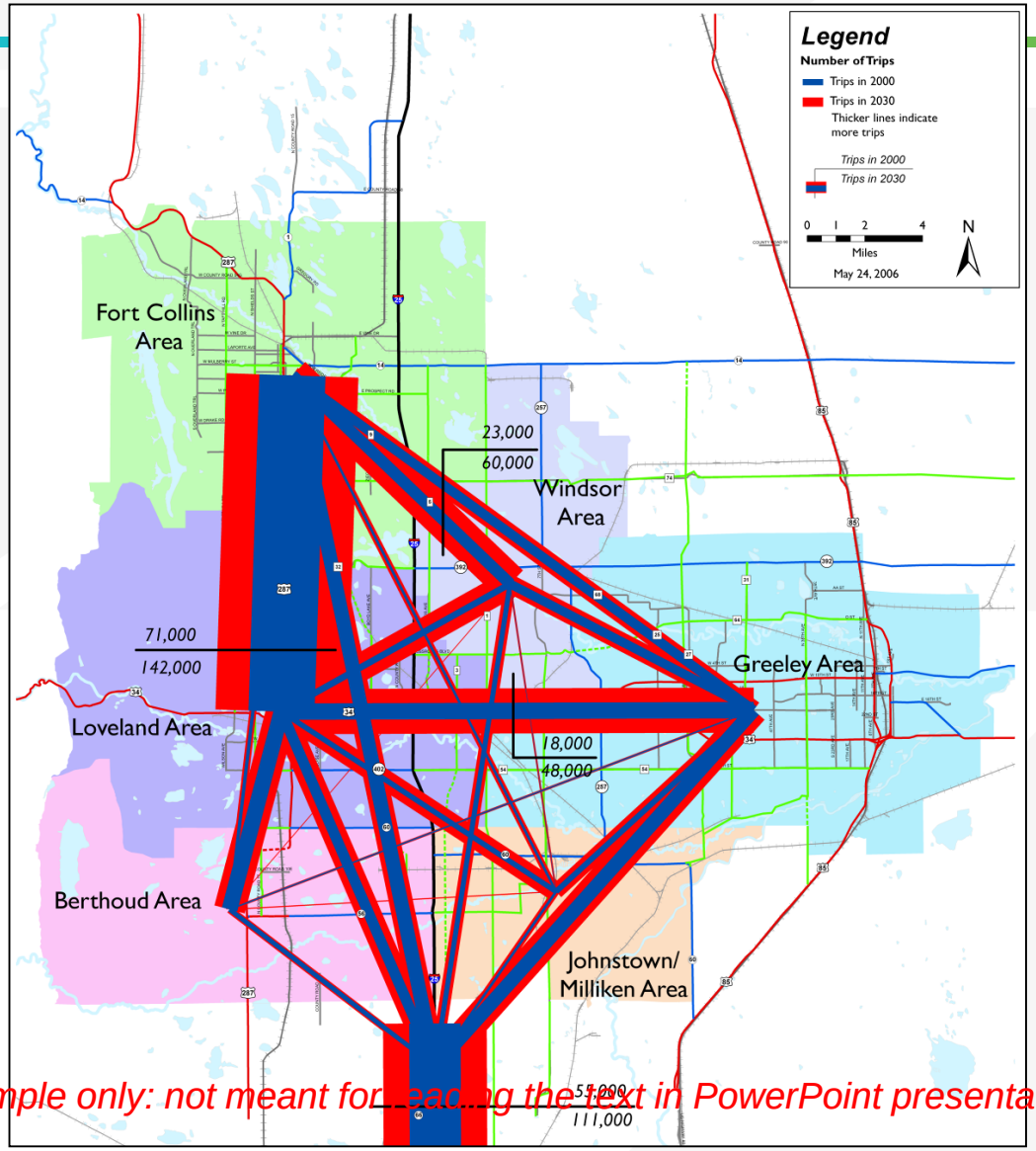


Today

** Example only: not meant for reading the text in PowerPoint presentation format*

CAMBRIDGE SYSTEMATICS

Travel Patterns

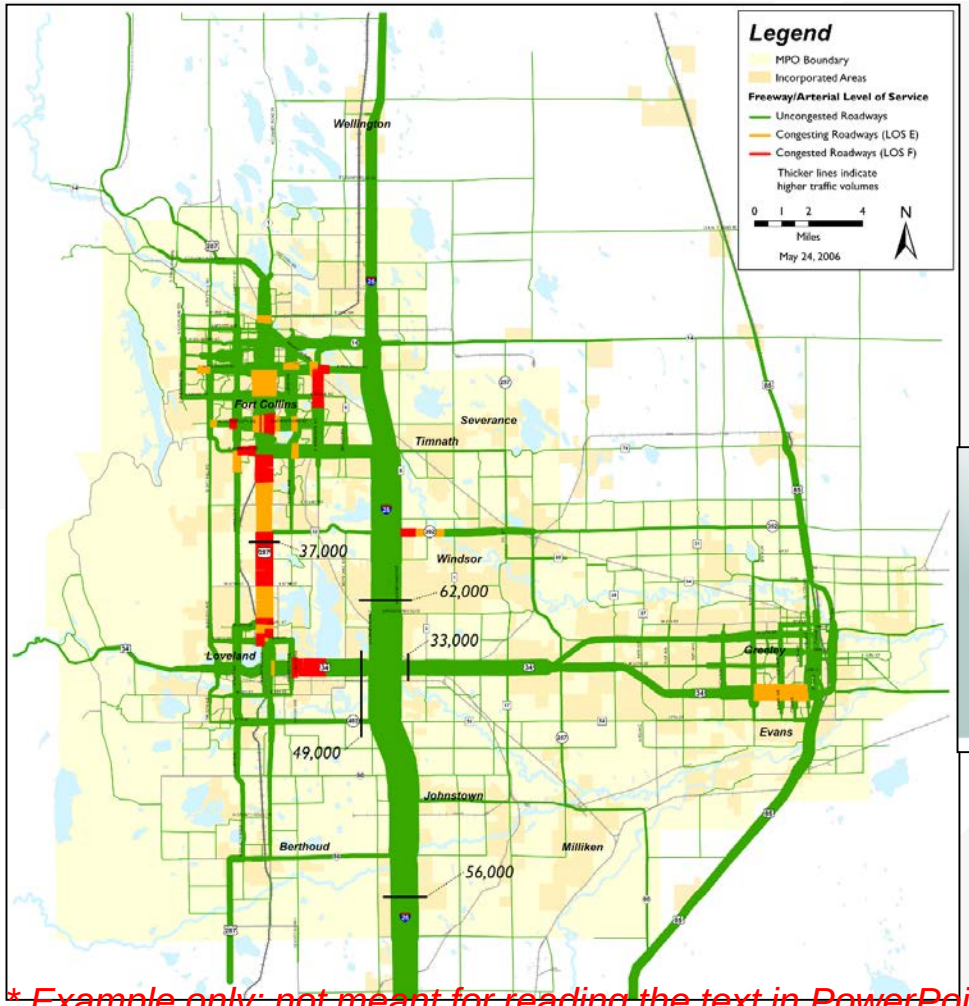


Future

** Example only: not meant for reading the text in PowerPoint presentation format*

CAMBRIDGE SYSTEMATICS

Traffic Volumes And Congestion



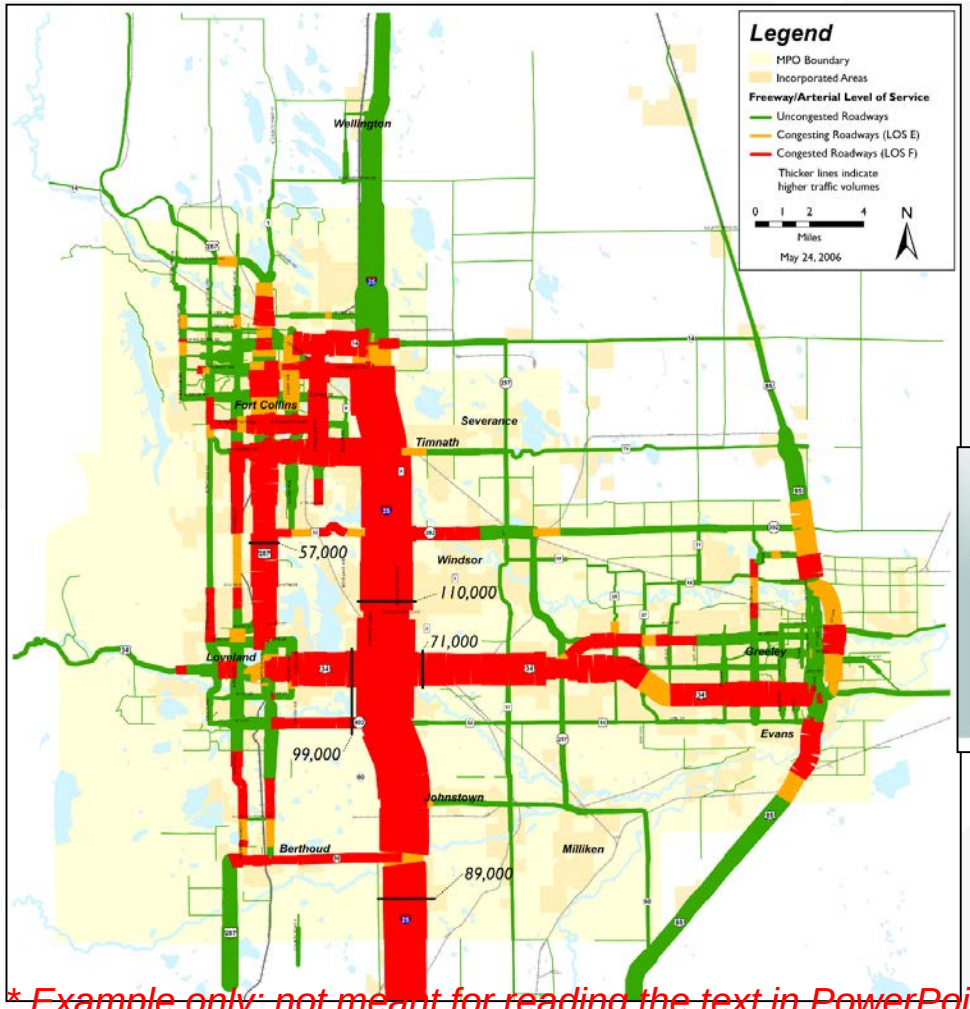
Today

Travel Times			
From/To	Today	2030	Increase
Fort Collins to Denver	73 Minutes	119 Minutes	46 Minutes (63%)
Fort Collins to Greeley	37 Minutes	49 Minutes	12 Minutes (32%)
Greeley to Loveland	29 Minutes	39 Minutes	10 Minutes (34%)
Berthoud to Windsor	24 Minutes	37 Minutes	13 Minutes (54%)

** Example only: not meant for reading the text in PowerPoint presentation format*

CAMBRIDGE SYSTEMATICS

Traffic Volumes And Congestion



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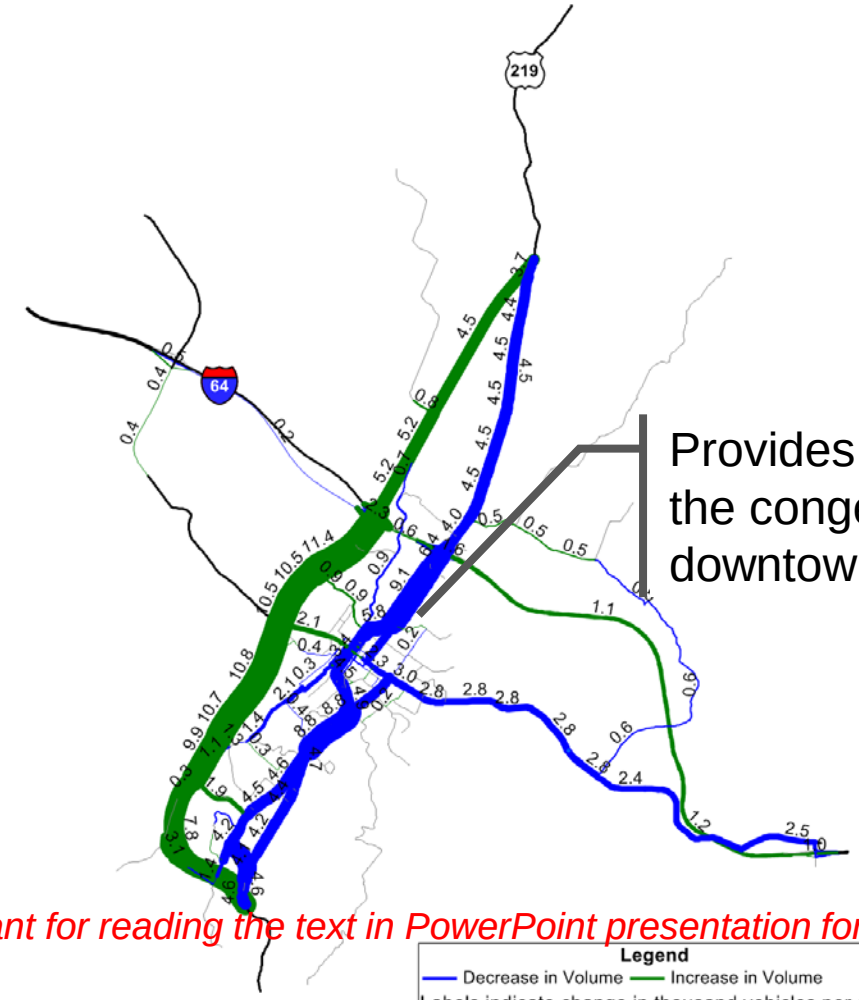
** Example only: not meant for reading the text in PowerPoint presentation format*

CAMBRIDGE SYSTEMATICS

Where Does The Traffic Go?

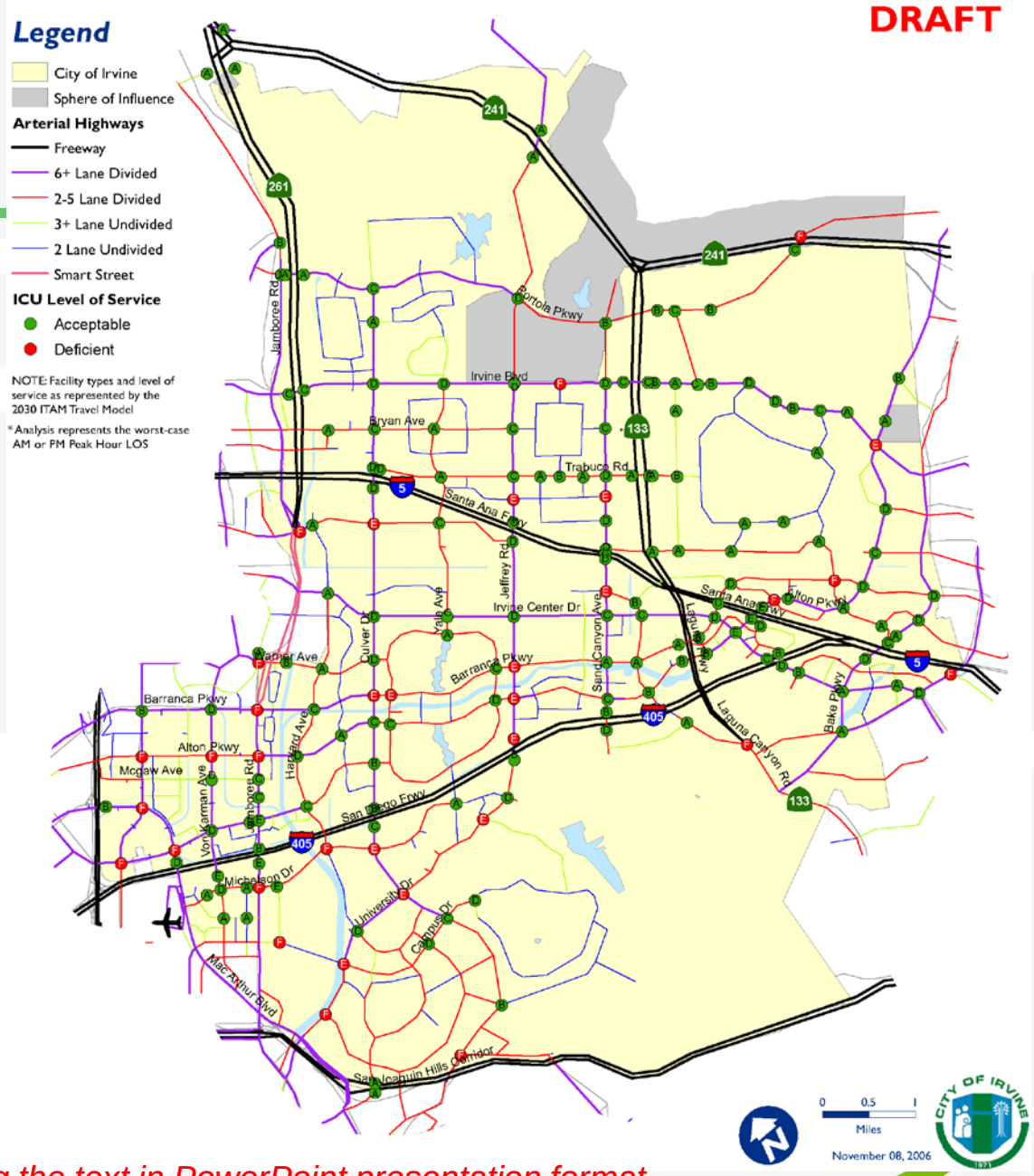
A new parkway serves through traffic



Provides relief in the congested downtown area

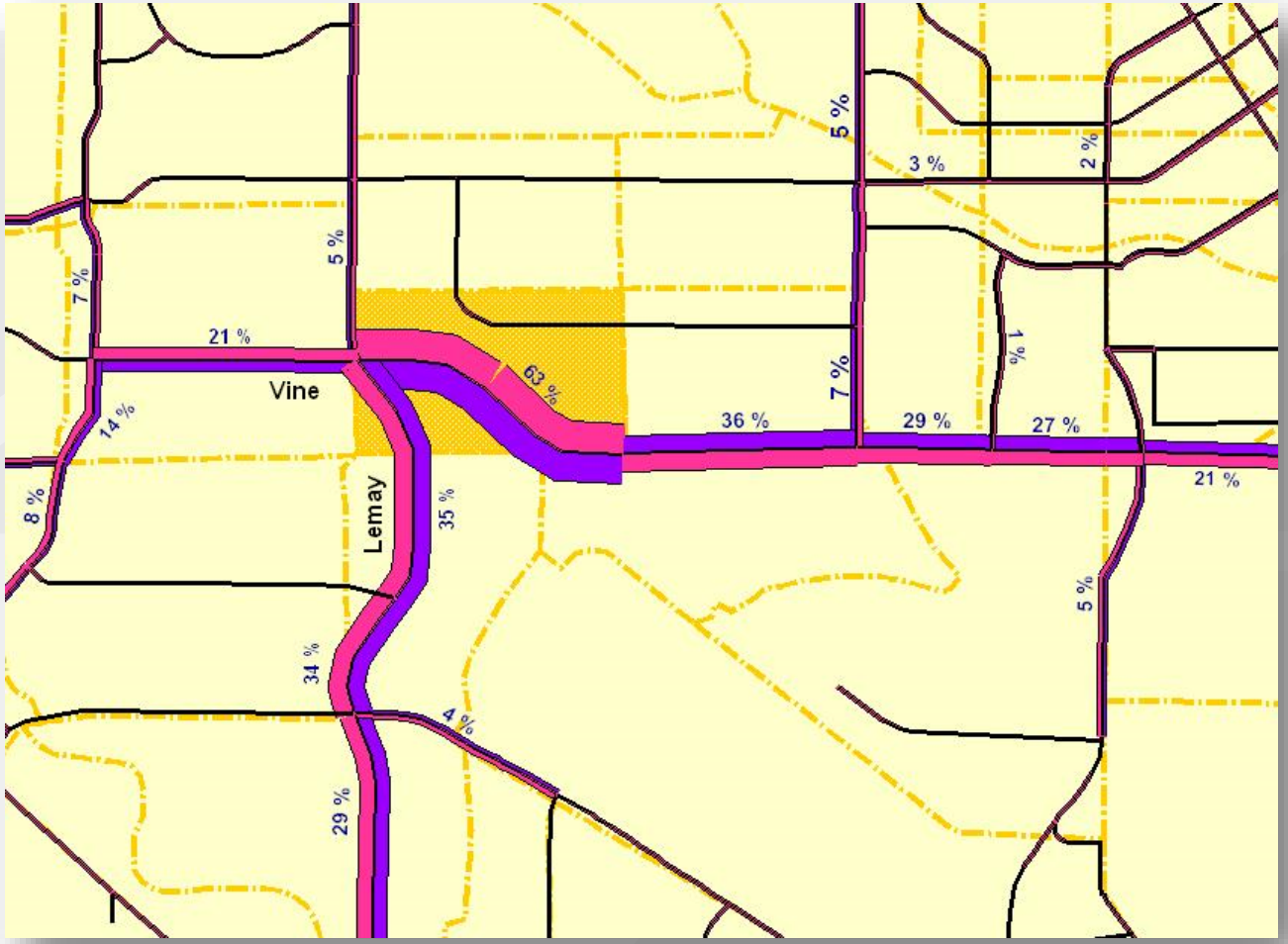
** Example only: not meant for reading the text in PowerPoint presentation format*

Intersection LOS



** Example only: not meant for reading the text in PowerPoint presentation format*

Traffic Impact Analysis



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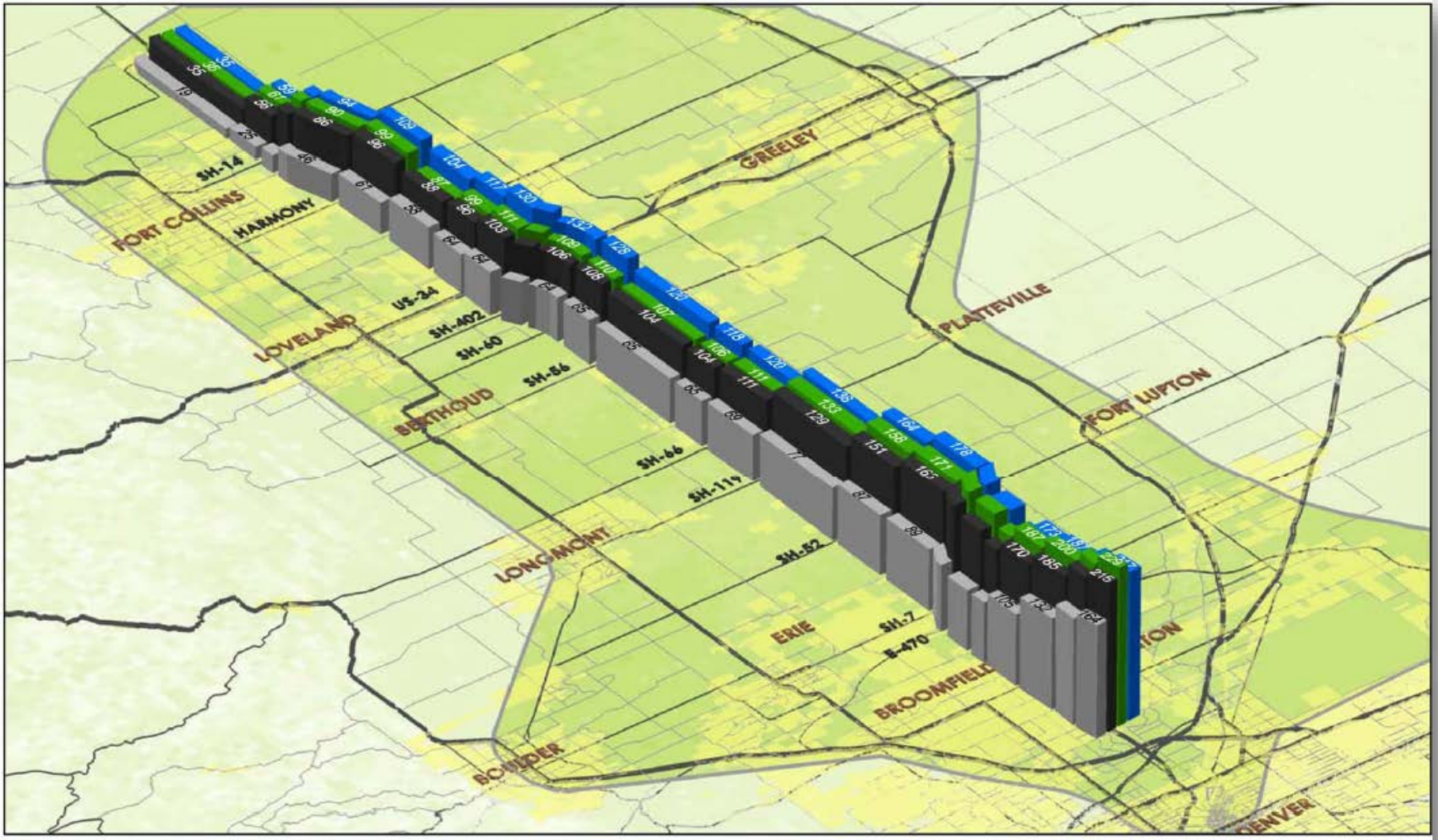


DEIS Results:
I-25 Daily Traffic Volumes Comparison

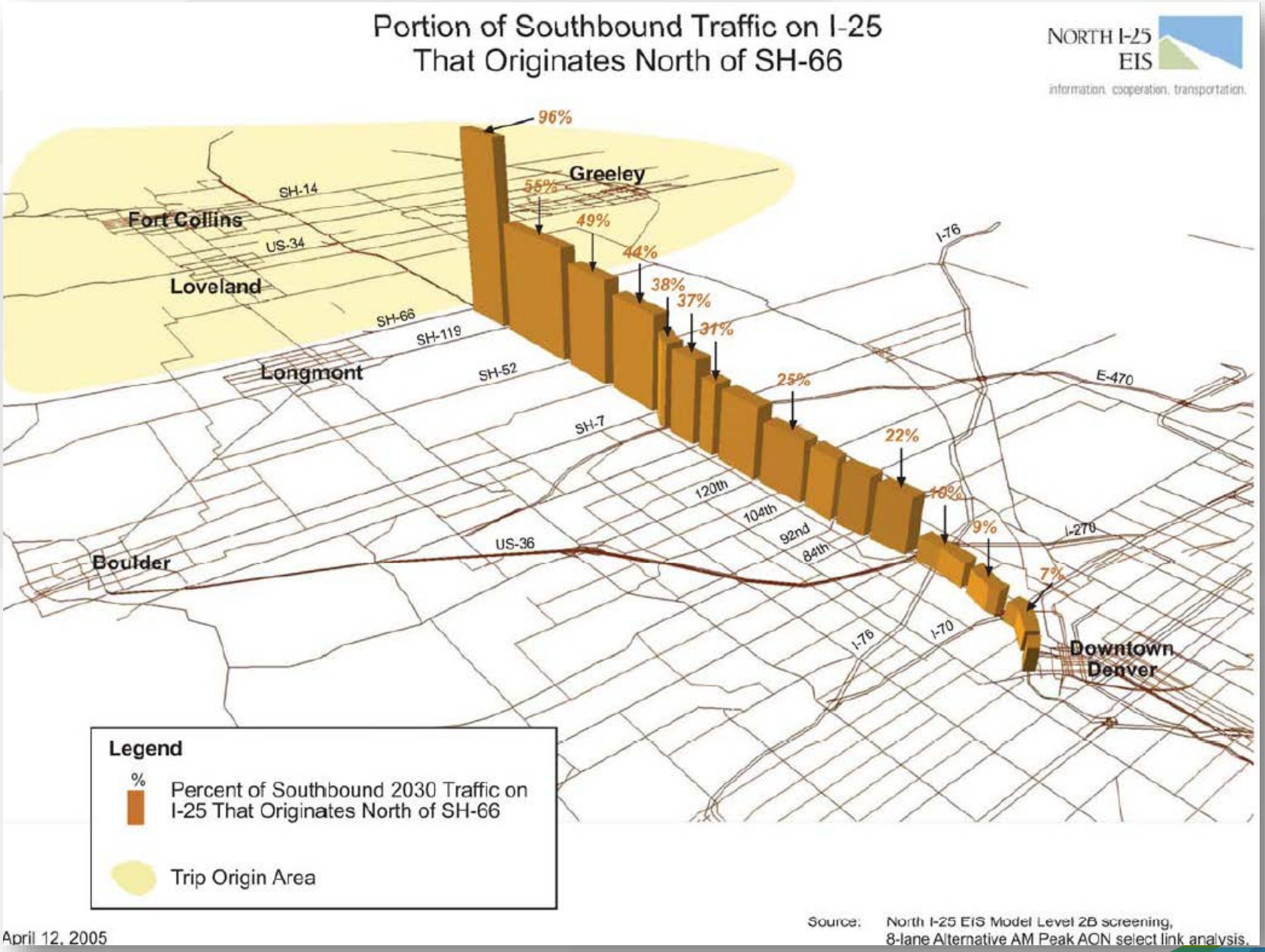
Legend

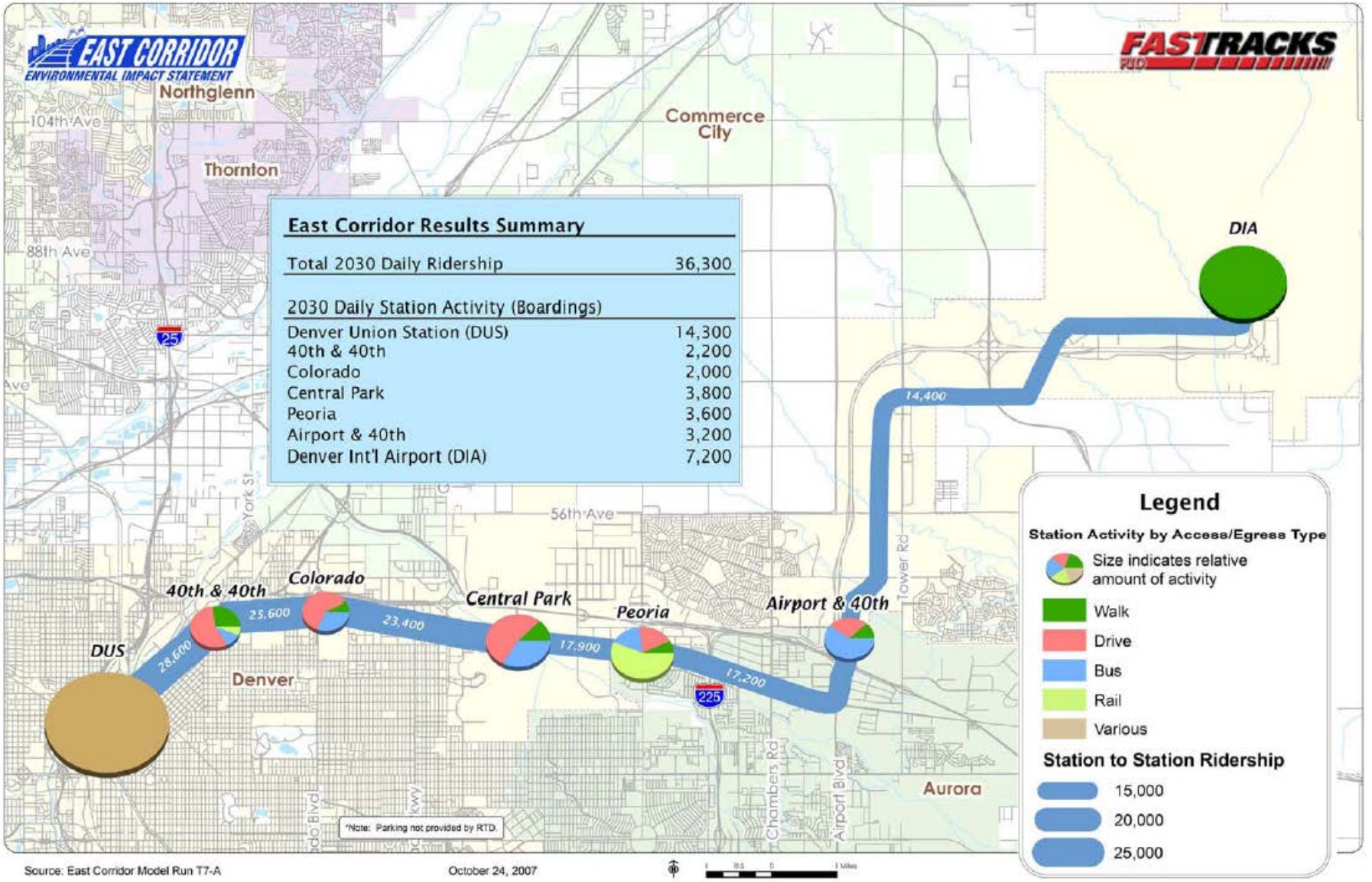
- Existing (Year 2005) Daily Traffic Counts, in thousands
- 2030 No-Action Daily Volumes, in thousands
- 2030 Package B Daily Volumes, in thousands
- 2030 Package A Daily Volumes, in thousands

Sources: 2005 Traffic Counts: North I-25 Travel Demand Forecast Model Runs. January 2007

NORTH I-25 EIS
information. cooperation. transportation.

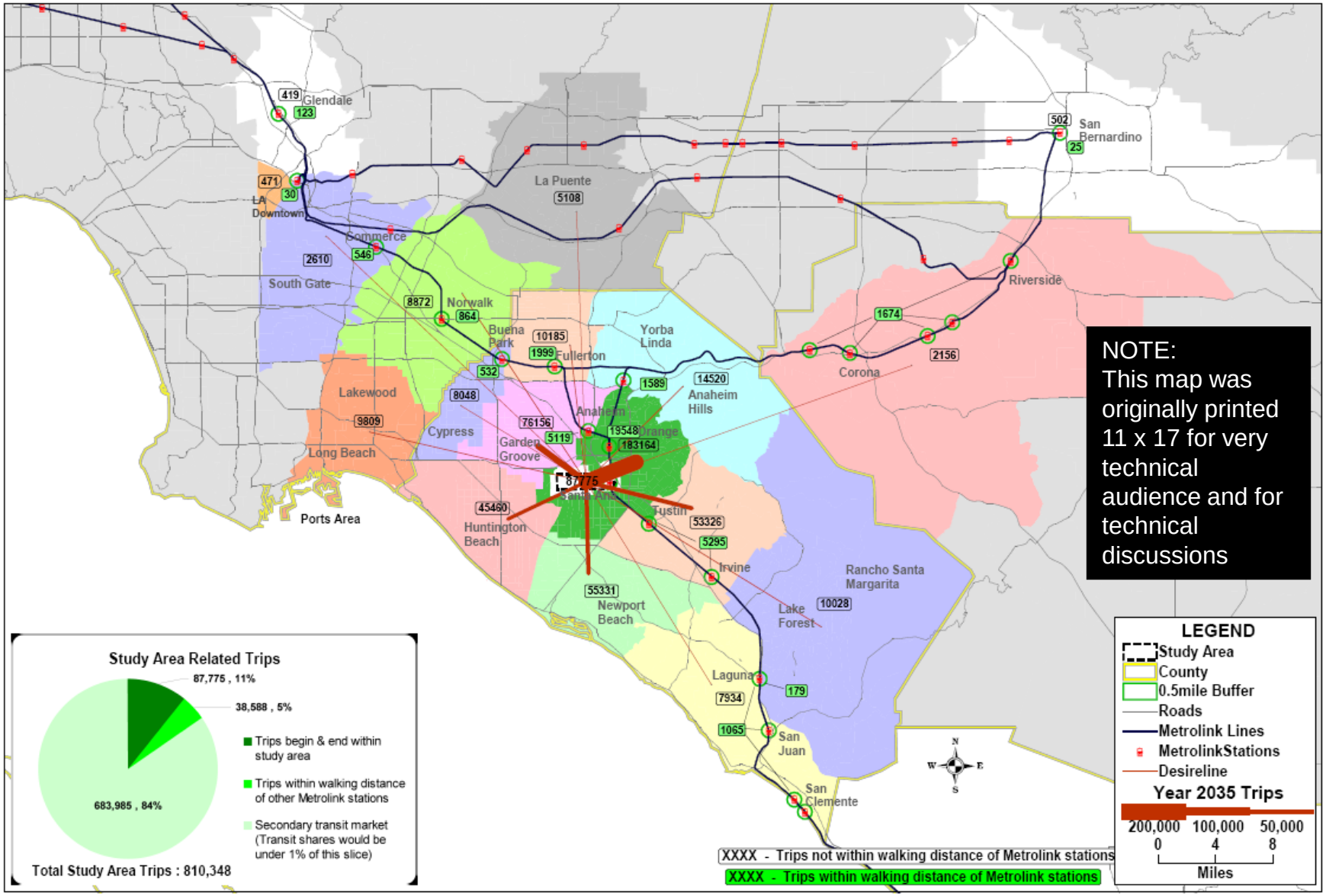
** Example only: not meant for reading the text in PowerPoint presentation format*


Portion of Southbound Traffic on I-25
That Originates North of SH-66
NORTH I-25 EIS
information. cooperation. transportation.
96%
55%
49%
44%
38%
37%
31%
25%
22%
10%
9%
7%
Greeley
Fort Collins
Loveland
Longmont
Boulder
Downtown Denver
SH-14
US-34
SH-66
SH-119
SH-52
SH-7
US-36
120th
104th
92nd
84th
I-76
E-470
I-270
I-70
Legend
% Percent of Southbound 2030 Traffic on I-25 That Originates North of SH-66
Trip Origin Area
April 12, 2005
Source: North I-25 EIS Model Level 2B screening, 8-lane Alternative AM Peak AON select link analysis.



** Example only: not meant for reading the text in PowerPoint presentation format*

Santa Ana Fixed Guideway - 2035 Daily Study Area Trips To/From Key Regional Subareas



NOTE: All Trips Summary (HBW + Other trips purposes combined)

** Example only: not meant for reading the text in PowerPoint presentation format*

CAMBRIDGE SYSTEMATICS

Thank you!

More Topics

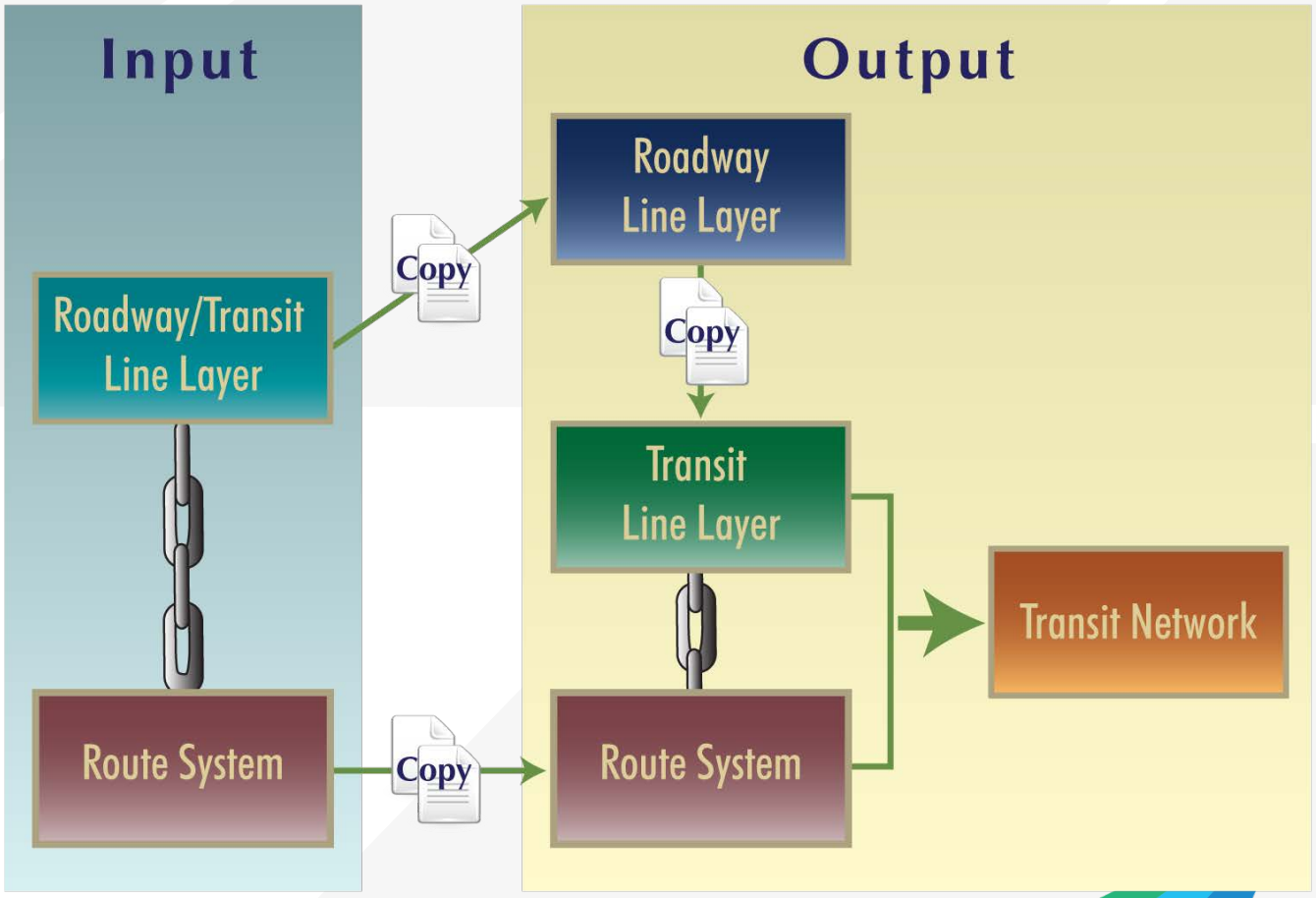
- GISDK
- MMA
- Select link/zone analysis
- Subarea analysis
- ODME
- Model estimation
- Other planning functions

Route Systems

CAMBRIDGE SYSTEMATICS

Route System Components

- Roadway Links
- Roadway Nodes
- Routes (Lines)
- Route Stops



Route System

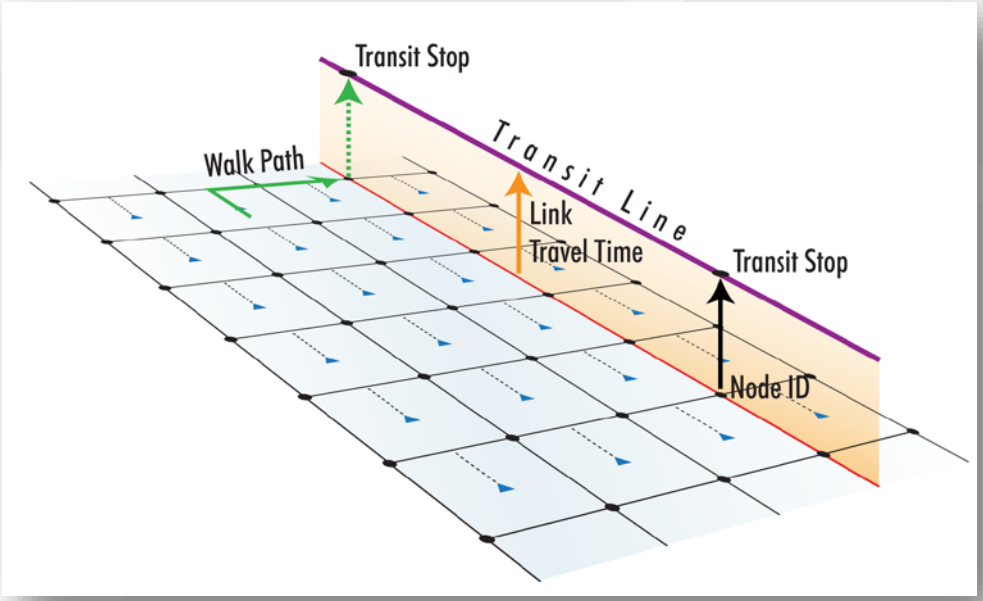
Roadway Links

Roadway Nodes

Routes (Lines)

Route Stops

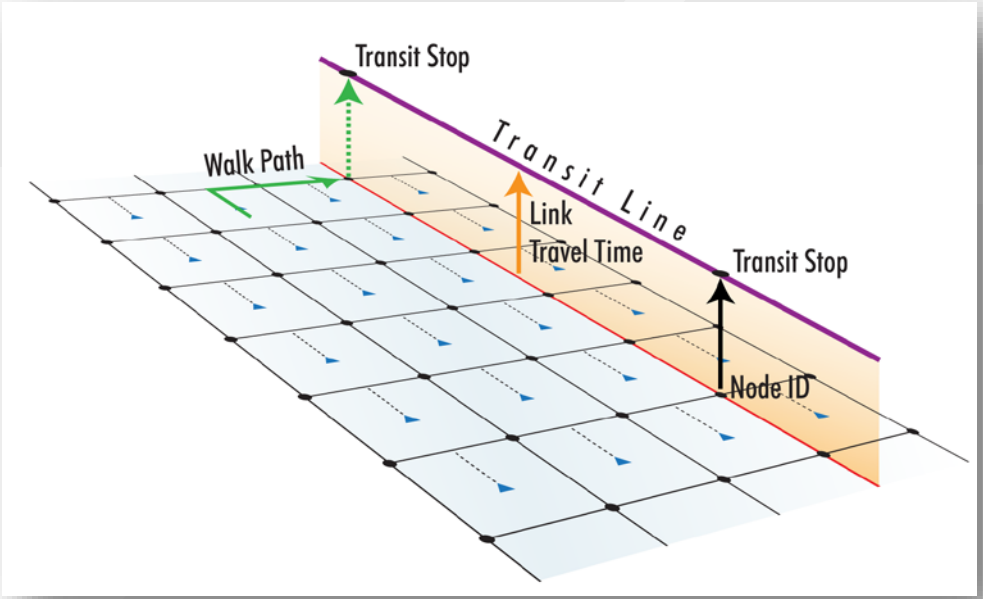
- Travel Time and Distance
- Walk and Drive Access



Route System

- **Roadway Links**
- **Roadway Nodes**
- **Routes (Lines)**
- **Route Stops**

- Centroids linked to Trip Data
- Nodes linked to Stops
- Nodes identified as Park and Rides



Route System

Roadway Links

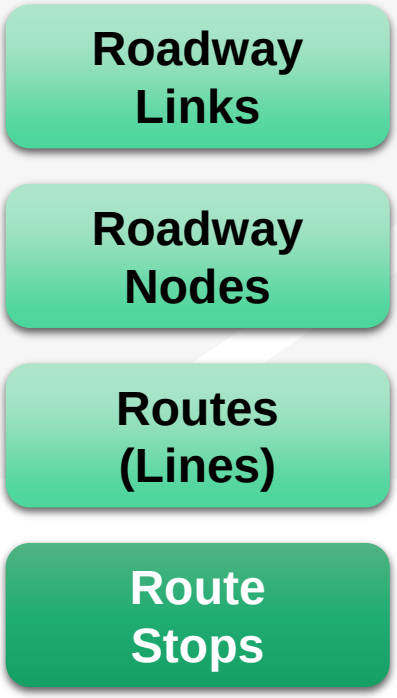
Roadway Nodes

Routes (Lines)

Route Stops

- Routes follow roadway links
  - Roadways
  - Centroid Connectors (possible, not recommended)
  - Transit only links (e.g., rail, BRT)
- Routes use link data
  - Travel Time
  - Distance
- Routes are stored in a ".rts" file

Route System



- Route Stops are stored in a pair of geographic files
  - » managed from the route system
  - » Physical Stops are common to all routes crossing a node
    - One required for each direction
  - » Route Stops are specific to one and only one route
    - Must be associated with a physical stop

Route/Network Link

- The Route System is linked directly to the Roadway Network by *Complete Filenames*
- If the network is moved or renamed, The Route System will fail to open unless:
  - The roadway network is opened first, or
  - The route system is re-linked to the roadway network

Route/Network Link

- Re-establishing a Link:
  - Route Systems → Utilities → Move
    - Open the dbd file, choose this menu item, then choose a route system
- Checking the Link
  - Close all files
  - Open the route system in TransCAD
  - Verify that the expected network has been loaded

Route System Editing

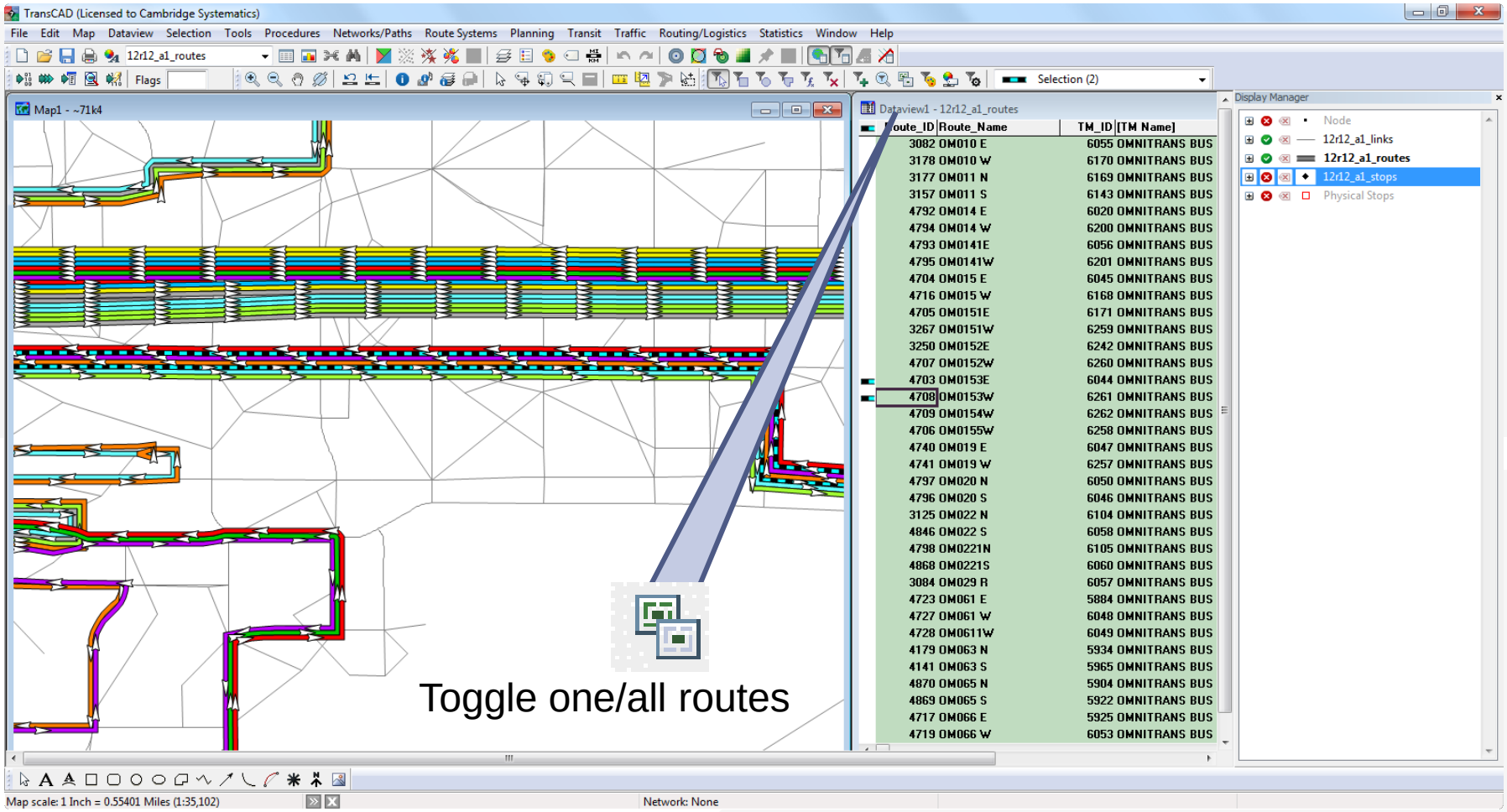
- Start by opening the **input** route system
  - Make sure the correct line layer has been opened
- Create a working ".net" network
  - Use default settings
  - Save this in the input directory
  - Use a temporary filename (e.g., net.net)
- Start the Route Editing Toolbox
  - Route Systems → Editing Toolbox

Note – Check the active layer as you try each step

Route System Display

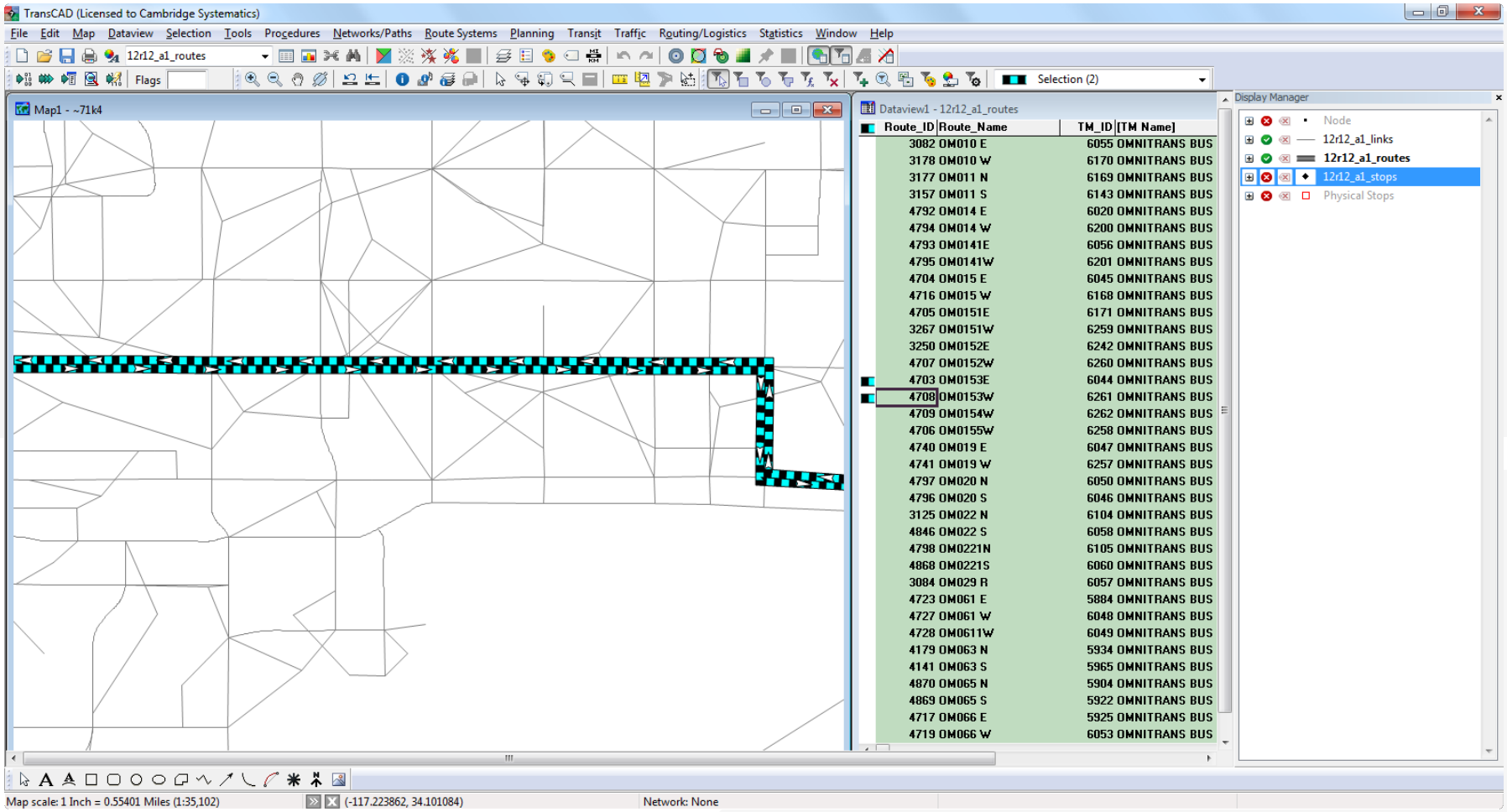
- Many routes can use the same corridor
- Edit route styles () to
  - Show Side by side
  - Show Topology
- Use selection sets to show only a set of routes
- Use screen real estate wisely

Example Editing Workspace



CAMBRIDGE SYSTEMATICS

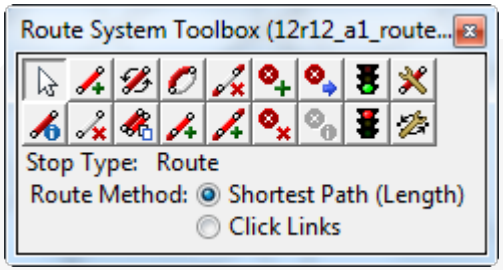
Example Editing Workspace



CAMBRIDGE SYSTEMATICS

Route System Editing

- Select a route to edit
- Edit route name
  - other route info can be edited with the standard info tool
- Add or delete a route
- Copy a route or add the reverse of a route
- Realign a route
- Extend a route or fill in a gap
- Delete a section of a route
- Add, delete, or move route stops
- Save or cancel changes



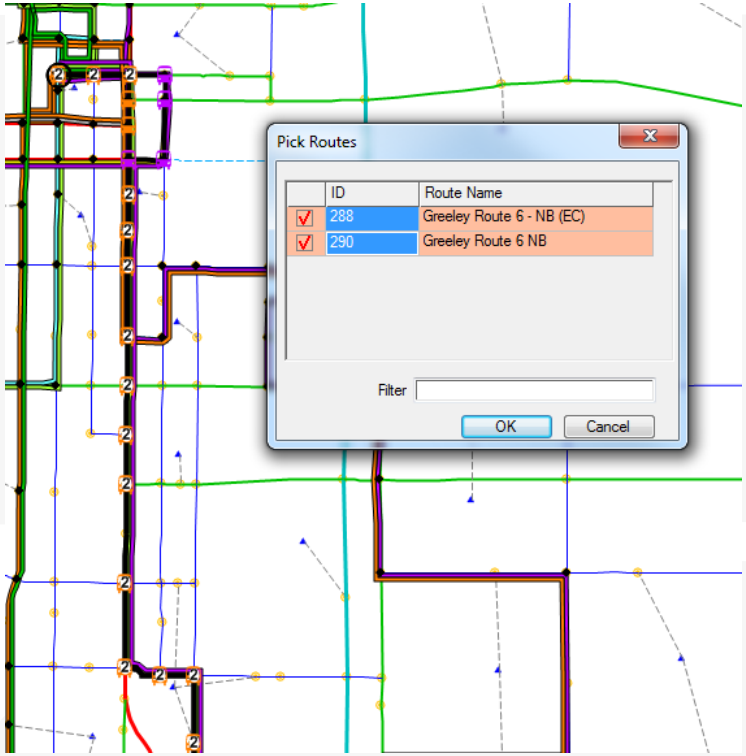
CAMBRIDGE SYSTEMATICS

Route System Editing

- Routes are usually edited by drawing paths
  - Click from node to node along a route
  - Only a few nodes along the route must be selected
- Potential Problem: A route does not take the shortest path between two nodes:
  - Change from **Shortest Path** to **Click Links**
  - Link mode can be especially helpful on freeways

Route System Editing

- Add stops to each route
  - » Manage both physical and route stops
- Stops must be adjacent to a node
- Be consistent
  - » Multiple routes with identical service should have identical stop placement



CAMBRIDGE SYSTEMATICS

Practice: Route Editing

- Use **Route Systems → Utilities → Move** to link the route system and network
- Verify the link
- Make some Changes:
  - Adjust a route headway
  - Add a new route
  - Add and/or remove route stops
  - Add a new Park and Ride

Transit Networks

CAMBRIDGE SYSTEMATICS

Transit Networks

- Contain all mode and pathbuilder settings
  - Mode.bin table contains mode-specific information
  - Modexfer.bin contains mode-to-mode values
  - Connection between link/node layers
    - Stops tagged to node
- In-program:
  - Create a new transit network
  - Review transit network settings
    - New network
    - Batch-created network

Transit Networks

- Pathbuilding
  - Build transit paths based on network settings
    - Interactive: Test specific paths and try various pathbuilder settings
    - Skim: Build zone-to-zone paths

Practice: Transit Networks

- Create a new transit network based on the route system
  - Review settings
  - Build a few paths interactively
- Change the transit network to a generated file
  - Build similar paths – how are they different?
  - Try changing network settings and observe how paths change
    - Combination factor
    - IVTT/OVTT weights

CAMBRIDGE SYSTEMATICS

Think Forward

TransCAD and the SCAG Model

presented to

Caltrans District 7

presented by

Cambridge Systematics, Inc.

Chao Wang, Sean McAtee

November 1st and 2nd 2016

Installing & Running the SCAG Model

Preparing a Computer

- TransCAD 6.0,
  - build 9215 or later
  - 64-bit version required
  - TransCAD 7 not supported (yet)

Also install 32-bit for GIS and Office compatibility!

- Minimum System Requirements
  - 24 GB RAM
  - 12 CPU cores
  - 500 GB free on system drive (C:\ Drive)
  - 800 GB free on model run drive (e.g., D:\ Drive)
  - 360 GB for model run storage

Requesting the SCAG Model

- Request the model from SCAG
  - Go to: http://www.scag.ca.gov/DataAndTools/Pages/Documents.aspx
  - Download the Model Data Request Form
  - Fill out and submit as instructed
- Cheryl Leising may be able to provide a Word version that is easier to fill out

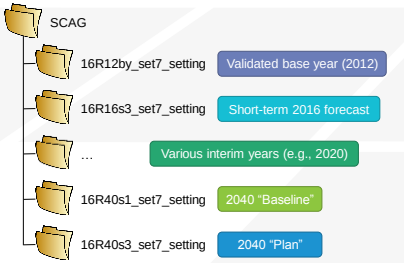
Installing the SCAG Model

- Install the User Interface (UI)
  - Follow Instructions provide by SCAG
    - **memo model installation v6.3.doc**
  - You may need administrator privileges

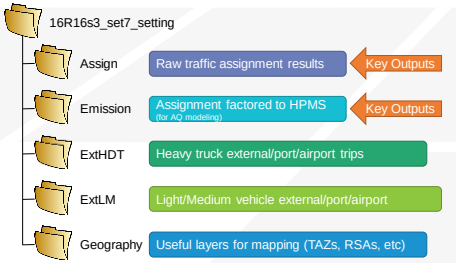
See Handout

- Copy the model data and model table
  - Place in a user-specified location
    - Example: D:\SCAG
  - One directory for each scenario
    - Example: 16R16s3_set7_setting
  - Model table with scenario information
    - Example: SCAGModelv63q.bin

SCAG Model File Structure



SCAG Model File Structure



SCAG Model File Structure

16R16s3_set7_setting *(Continued)*

- Interim — For internal model use
- msplit — Mode Choice Model
- Networks — Roadway network files — Key Inputs
- ODTable — Vehicle Trip table matrices — Key Outputs
- Reports — TransCAD Logging Information

SCAG Model File Structure

16R16s3_set7_setting *(Continued)*

- SED — Socioeconomic Data — Key Inputs
- Skims — Shortest Path Matrices
- TOD — Time of Day Model
- Tripdist — Trip Distribution Model
- Tripgen — Trip Generation Model

SCAG Model File Structure

16R16s3_set7_setting *(Continued)*

- Truck — Internal Heavy Duty Truck Model
- User — For troubleshooting / SCAG use

SCAG Model File Structure

Networks ***All folders have a the same structure***

- Inputs — Files provided by SCAG. Changes made here
- Outputs — Files generated by the model. Do not change.
- Reports — Model result summary tables

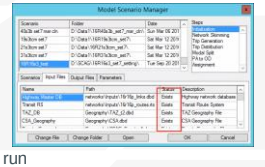
SCAG Model File Structure

Networks *All folders have a similar structure*

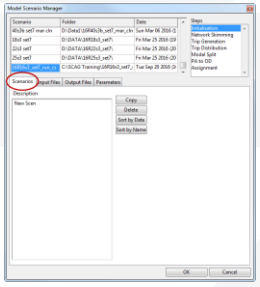
- Inputs — Files provided by SCAG. Changes made here
- Outputs — Files generated by the model. Do not change.
- Reports — Model result summary tables

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)

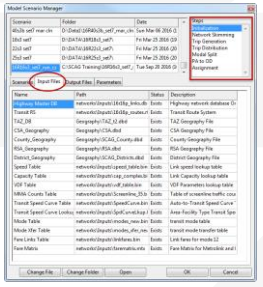


SCAG Model Scenarios



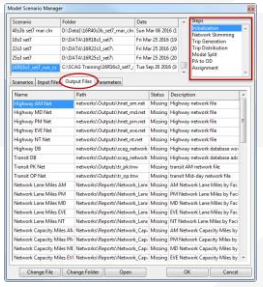
- Scenarios
  - Manage scenario list
  - Enter a description

SCAG Model Scenarios



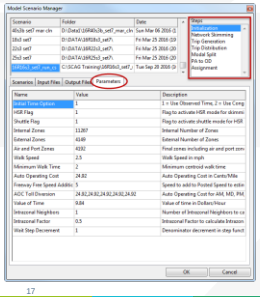
- Input Files
  - Varies by step
  - List input files
  - Rarely changed, but serves as a good reference
  - You ***could*** change filenames, but need to make sure valid files exist

SCAG Model Scenarios



- Output Files
  - Varies by step
  - List output files
  - **Never** changed, but serves as a good reference
  - Status changes from **Missing** to **Exists** when the model is run

SCAG Model Scenarios



- Parameters
  - Varies by step
  - List output files
  - **Rarely** changed – and always with ***extreme caution***
  - Only change with guidance from the User's Guide, SCAG, or Caliper

The Model Table

- Stores information from the scenarios
- In-Program Demo

Different Run Types

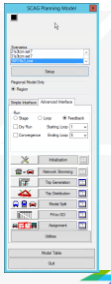
	Feedback	One Loop	Assignment
Run Time	7-10 Days	1-2 Days	< 1 Day
When to Run	• To generate original SCAG model results • To test large system wide network changes • To test any SED changes • To produce a final model dataset after alternatives analysis	• To test the impacts of small to moderate changes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

Running for Scenarios

- One-Loop Run
  - Run one complete feedback loop, starting with final loop from a full model
  - Can be useful for:
    - Large roadway and/or transit scenarios
  - Comparing directly? Run a 6th loop baseline as well
- Quick Run with network changes only
  - Trip tables and mode choice does not change
  - Can be useful for:
    - Testing roadway network changes
    - Running assignment again with select link / zone analysis

Running the SCAG Model

- Full Feedback Run
  - Set the model to run "Feedback"
  - Leave starting and ending loops at 1 and 5
  - Make sure the computer can run for 6 to 10 days without interruptions
  - Click 'Initialization'

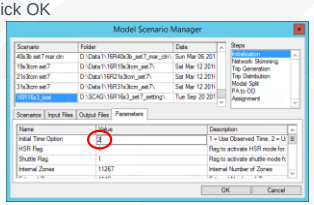


One Loop Run

- Copy your entire model scenario folder
- Modify the **inputs**
  - Highway network file
  - Route system File
  - Socioeconomic Data
- Run the **Check Network Attributes** utility
- Run the **Mergenet Run** utility
  - This merges speed feedback results with the modified network

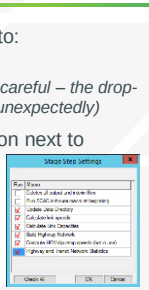
One-Loop run

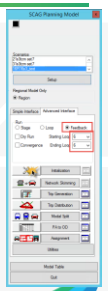
- Edit the scenario (click Setup)
  - Set the **Initial Time Option** to a value of 2
  - Click OK



One-Loop run

- Set the dialog box to:
  - Run Feedback
  - Run loop 6 to 6 *(Be careful – the drop-downs can change unexpectedly)*
- Click the button next to Initialization
  - Set steps as shown
  - Click OK





One-Loop run

- Click the **Initialization** button to start the run
  - This should take about a day to complete
- Did you get an error??
  - Try closing and restarting TransCAD, then picking up where you left off.
  - Always double-check feedback settings and active steps before starting a run

Assignment: Network Change

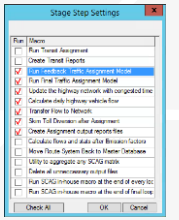
- Copy your entire model scenario folder
  - » Alternate: Just backup the original **networks** and **assign** folders
- Modify the **input** highway network file
  - » Remember: keep the route system up to date!
- Run the Check Network Attributes utility

Assignment : Network Change

- Double-check the scenario setup. Change directory or filenames if needed
- Set the model to run only a single stage
- Click 'Initialization'
- When asked if you want to delete all files, click '**No**'

Assignment : Network Change

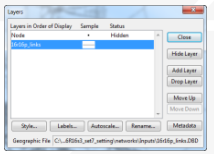
- When initialization completes, click on the button next to assignment
  - » Set steps as shown
  - » Click OK
- Click 'Assignment' to run traffic assignment
  - » This will take several hours



Map Basics: Visualizing

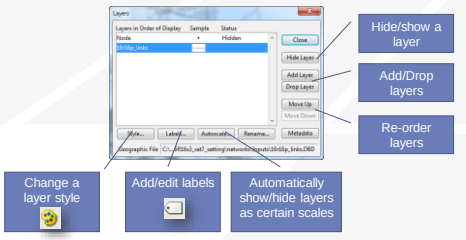
Working with Layers

- 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 ( )



Working with Layers

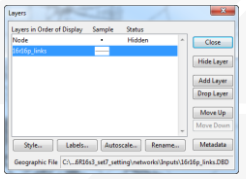
- **The Layers Dialog ( )**



Working with Layers

- **Layers are drawn from TOP to BOTTOM**

Top layer (drawn first)



Bottom layer (drawn last)

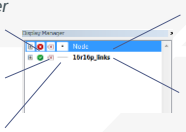
Display Manager

- 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



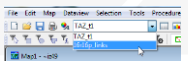
Node layer is NOT active

Bold text: links layer is active

Color Theme

Creating Maps

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



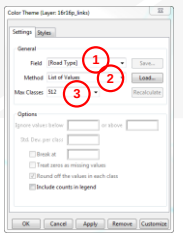
- Change the "default" styles for the layers
  - then Style... , or , or use the display manager
- Hide or show layers
  - or the display manager

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

Color and Pattern Themes

The Settings Tab



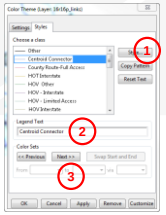
1. Choose a field to represent
2. Choose a method to create categories and number of classes

* Use the Load and Save buttons to store and recall settings

- *This is a huge time-saver!*

Color and Pattern Themes

The Styles Tab



1. Choose a style for each class
2. Select a legend text for each class
3. Choose from pre-defined color settings if desired

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 Collector	60	Undivided
		61	Divided
		62	Continuous Left Turn
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

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

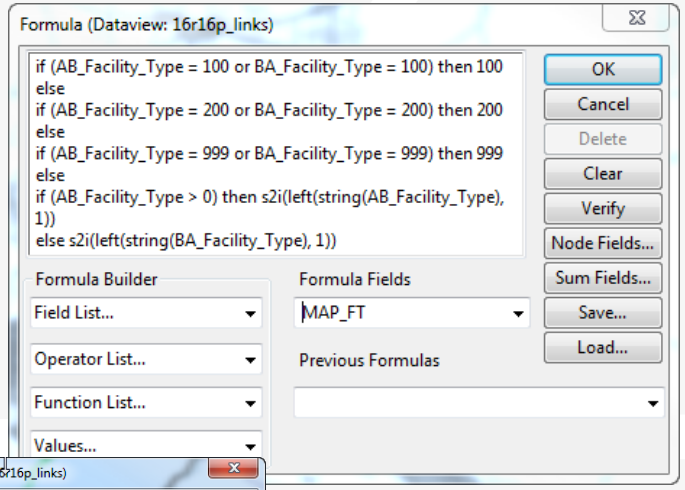
```
MAP_FT:
-------
if (AB_Facility_Type = 100 or BA_Facility_Type = 100) then 100 else
if (AB_Facility_Type = 200 or BA_Facility_Type = 200) then 200 else
if (AB_Facility_Type = 999 or BA_Facility_Type = 999) then 999 else
if (AB_Facility_Type > 0) then s2i(left(string(AB_Facility_Type), 1))
else s2i(left(string(BA_Facility_Type),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

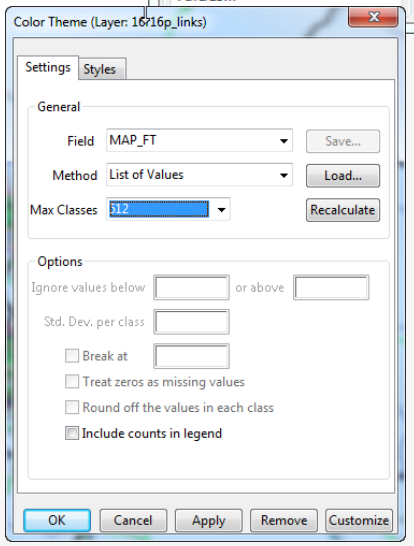
Note: We will discuss formulas in more detail in a later section

Practice 1: Create a color theme for line layer using IFC field

1. Open the SCAG Network File (16R16pl_links.dbd)
   - ✓ File→Open, then in the file type dropdown next to 'File name:' select Geographic File(*.cdf,.*dbd) option
   - ✓ Browse to the location/folder where the geographic file is located and select the 'abmload.dbd' and click 'Open' button
2. Add the MAP_FT Formula Field
   - ✓ Dataview→Formula Fields
   - ✓ Open TransCAD Formuals.txt in notepad, then copy the MAP_FT formula
   - ✓ Paste the formula and name the formula MAP_FT
   - ✓ Click OK
3. On the top ribbon, click  it is called 'color theme map wizard'
4. It opens up a dialog box with two tabs. In the first tab 'Settings' tab:
   - ✓ Select the MAP_FT from the 'Field' drop down options
   - ✓ Select the 'List of Values' from the 'Method' drop down options
   - ✓ Max. Classes: Use the default value (512)
5. Go to the 'Styles' tab
   - ✓ Observe the default styles
   - ✓ Optional: Set a preferred style for each facility type (we will use a shortcut)
6. Go back to the Settings tab, click the Load button.
   - ✓ 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
7. Save the settings (optional, method 1) **Skip this step in training.**
   - ✓ Tools → Geographic Utilties → Geographic file
   - ✓ Click Save Settings

1. Save the settings (optional, method 2) **Use this method in training.**
   - ✓ File –Save As
   - ✓ Save a Map file that you can open later with the settings applied





CAMBRIDGE SYSTEMATICS

Labels

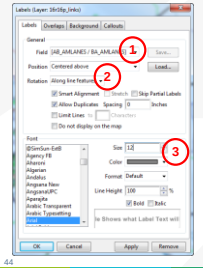
Automatic Labels

- Labels ( ) can be used to show things including:
  - Traffic Volumes
  - Number of Lanes
  - Centroid Numbers
  - SED/Land Use Data

- Labels can be set differently for different selection sets

Automatic Labels

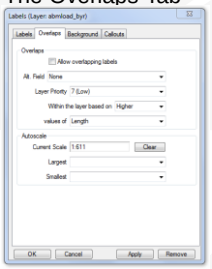
The Labels Tab



1. Select the field to use for labels
2. Set label placement options
   - *Note the "Allow Duplicates" checkbox*
3. Set the label style options

Automatic Labels

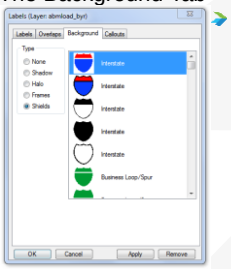
The Overlaps Tab



- Overlapping labels can be allowed if desired
- Different layers can have different priorities
- Autoscale can turn labels on and off automatically

Automatic Labels

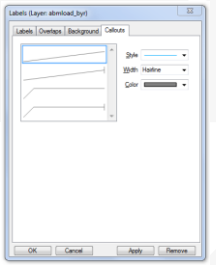
The Background Tab



- Shadows, halos, frames, or shields can be added to labels to create better looking and more informative maps

Automatic Labels

The Callouts Tab

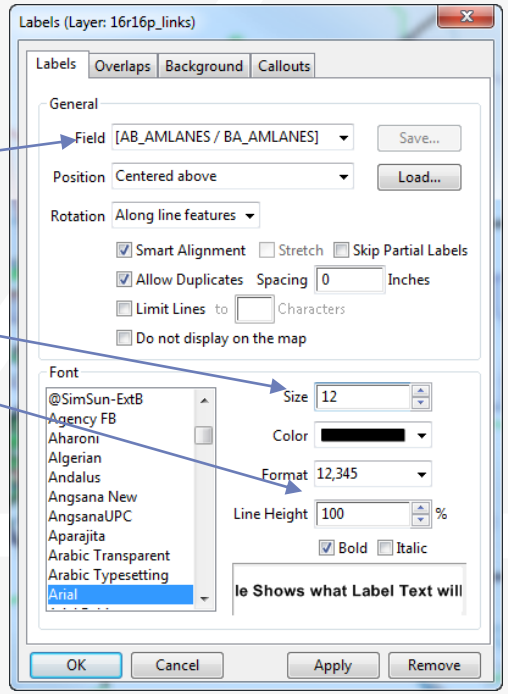


- Set the default callout style to use when labels are manually re-positioned

Practice 2: Add number of lanes labels

TIP
Right click on the gray area of the layout and print to pdf.

1. Start with the results from Practice 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



In training, save the map for future use

CAMBRIDGE SYSTEMATICS

Create Scaled Symbol Theme

(also known as bandwidth map)

CAMBRIDGE SYSTEMATICS

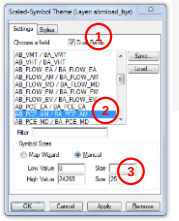
Scaled Symbol Themes

- Scaled Symbol Themes ( ) are often used to:
  - Display traffic volumes
  - Display results of a select link or node analysis

CAMBRIDGE SYSTEMATICS

Scaled Symbol Themes

The Settings Tab



- Show directional fields only, or all fields
- Select a field to use
- Specify a scale, or let TransCAD specify one automatically

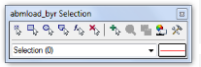
CAMBRIDGE SYSTEMATICS

Create Selection Sets

CAMBRIDGE SYSTEMATICS

Selection Sets

- Add additional formatting capability
- Useful for analysis and data processing
- Use the Selection Set Toolbox
  - Select items with a query
  - Select items by pointing
  - View the Selection Settings



- One map can contain many selection sets
  - Show or hide selected items
  - Format selected items with different colors, styles, and labels

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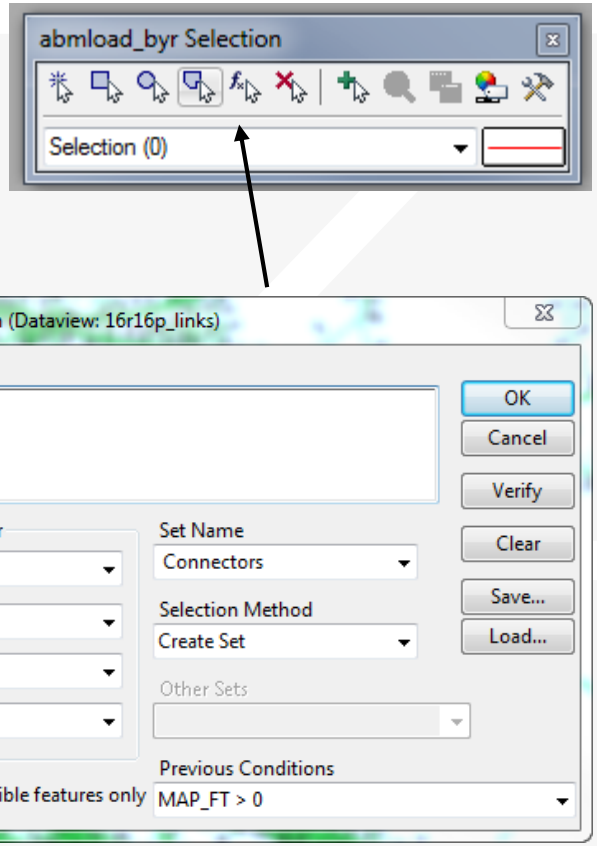
Practice 3: Create selection sets and color and label them

- Start with the results from Practice 2
  - ✓ Open the saved map if needed

1. Goto Tools and select ‘Selection’ or hit F9
   - ✓ This will show 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)
2. Change the centroid connector lane labels
   - ✓ Open selection settings (Selection → Settings or)
   - ✓ Choose Connectors, then click Style
   - ✓ Set the color to “default gray) – this allows the color theme to override
   - ✓ Click Labels
   - ✓ Set the label to a smaller font size and different color
   - ✓ Close the selection settings



✓ **TIP:** You can make other changes to multiple different selection sets, or can hide some features altogether!

In training, save the map for future use

CAMBRIDGE SYSTEMATICS

Data Tables (“Dataviews”)

CAMBRIDGE SYSTEMATICS

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

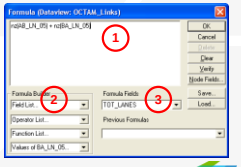
CAMBRIDGE SYSTEMATICS

Working with Dataviews

- Formula ***Field*** ***vs.*** Add Field & Formula ***Fill***
  - Formula ***Fill*** adds new data and saves values in the table
  - Formula ***Fields*** are updated when other values change, but are not stored in the data table
    - Formula fields are stored in a map, dataview (*.dvw), or workspace (*wrk)

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



CAMBRIDGE SYSTEMATICS

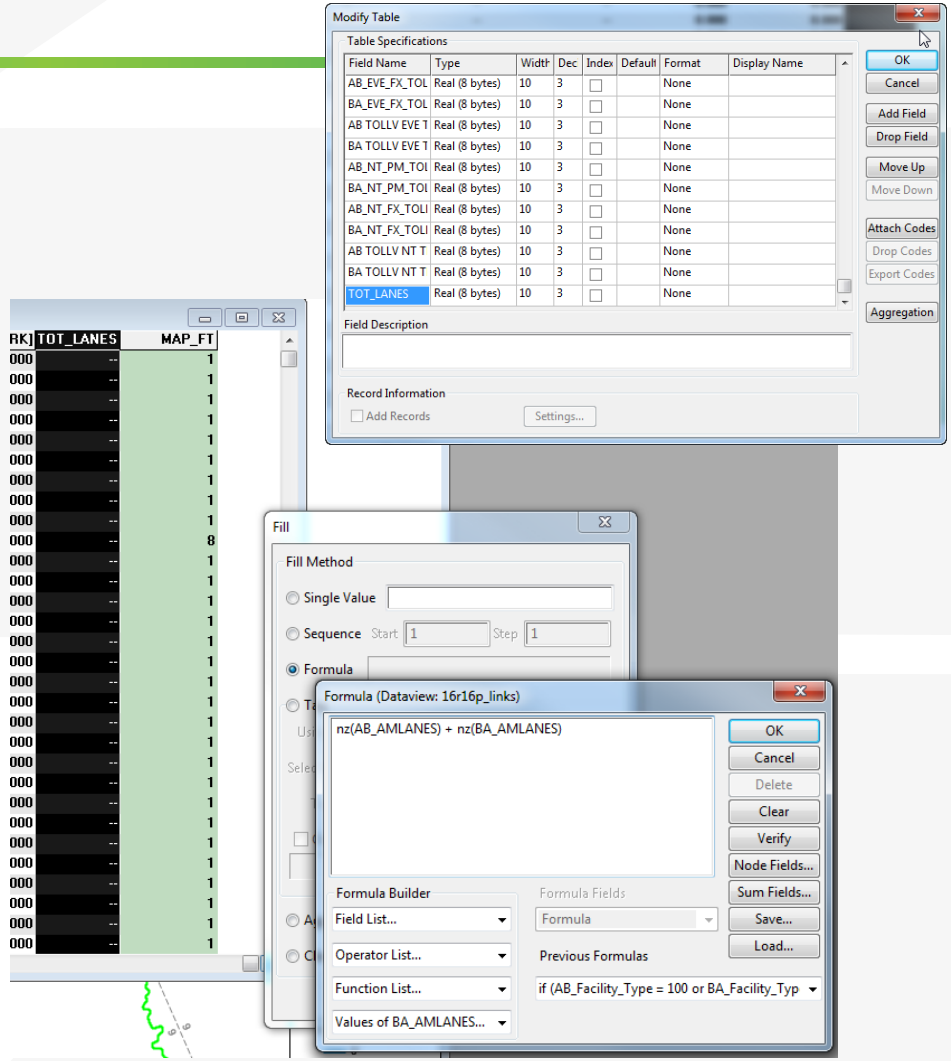
Practice 4: Add total number of lanes in a **NEW FIELD**

- Start with the results from Practice 3
  - ✓ Open the saved map if needed

1. On the top ribbon, click  it will open the links layer daataview table

2. Use Dataview → Modify Table or click 
   - ✓ Click ‘Add Field’
   - ✓ Name the field “TOT_LANES”
   - ✓ You can move the field position using Move Up and Move Down buttons to the right
   - ✓ Click ‘OK’

3. Go to ‘Dataview’ window
   - ✓ Right click the top part of the ‘TOT_LANES’ field
   - ✓ Select ‘Fill’
   - ✓ Select the ‘Formula’ in the fill method options
   - ✓ Type: nz(AB_AMLANES) + nz(BA_BALANES)
   - ✓ Alternatively you can use the formula builder
   - ✓ Click ‘OK’ button.
   - ✓ This fills in two-way number of lanes



Bonus: Try this example using a formula field instead!

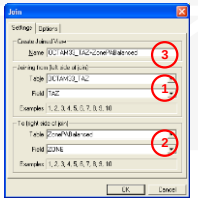
CAMBRIDGE SYSTEMATICS

Joining Data

Joining Data

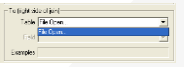
- Layers have an associated data table ( )
- Data can be joined ( ) to other tables
  - Roadway Network + Traffic Assignment results
  - TAZ layer + Land Use Data
  - Roadway Network + Lookup Table
  - More…
- This is how traffic assignment results are viewed in TransCAD
- Fields cannot be added/removed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

Joining Data



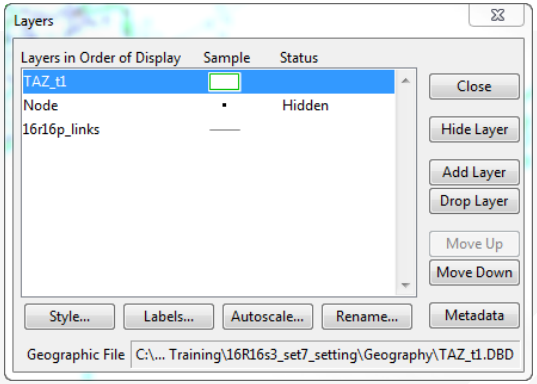
1. Select the Primary join table
   - *Be careful: Check the Field*
2. Select the secondary join table
   - *Be careful: Check the Field*
3. Create a name for the view, or use the default (do this last)

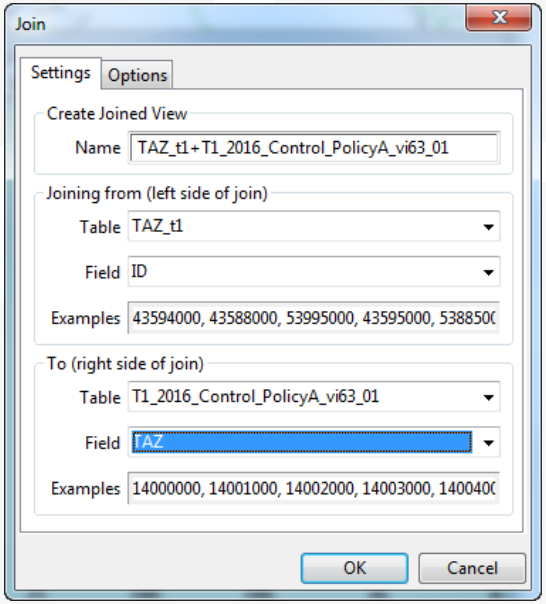
Tip: You can open a file from the join dialog box



Practice 5: Join the TAZ data to the TAZ layer (Tier 1)

1. Start with the results from Practice 4
   - ✓ Open the saved map if needed
2. Add the TAZ layer to the map
   - ✓ Open the Layers dialog ( )
   - ✓ Click Add Layer
   - ✓ Browse to: **16R16s3_set7_setting\Geography\TAZ_t1.dbd**
   - ✓ Move the TAZs to be drawn first (top of the list)
   - ✓ Click 'Close'
3. Open the TAZ Data Table
   - ✓ File → Open
   - ✓ File Type Comma- or Tab-delimited Text
   - ✓ Browse to **\16R16s3_set7_setting\SED\Inputs\TAZ_t1.dbd\ T1_2016_Control_PolicyA_vi63_013116.csv**
   - ✓ Note that this is opened as read-only (all cells are green)
4. Create a join from Dataview → join or
   - ✓ Set the left side of the join to TAZ_t1, field 'ID'
   - ✓ Set the right side of the join to T1_2016_Control_PolicyA_vi63_01
   - ✓ Set the right side join field to TAZ ***NOT TAZPREV**
   - ✓ Click 'OK', then use "info" to review the data
   - ✓ **Warning: Do NOT close the joined view!**





Bonus: Create a shading theme with darker colors for more households. Try again for employment

CAMBRIDGE SYSTEMATICS

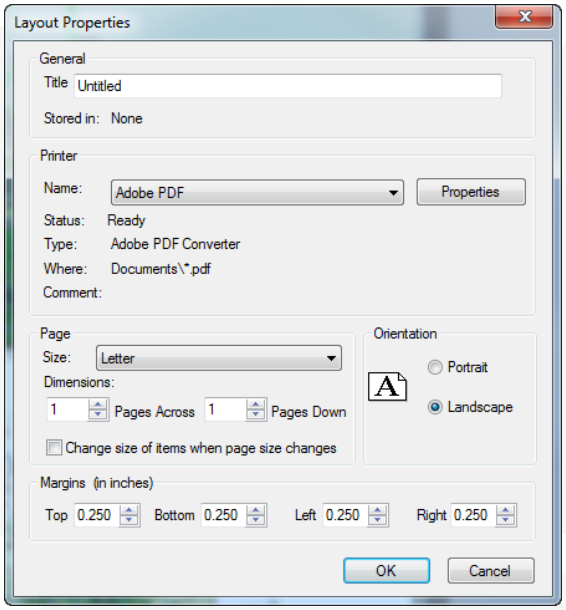
Printing Maps (Layouts)

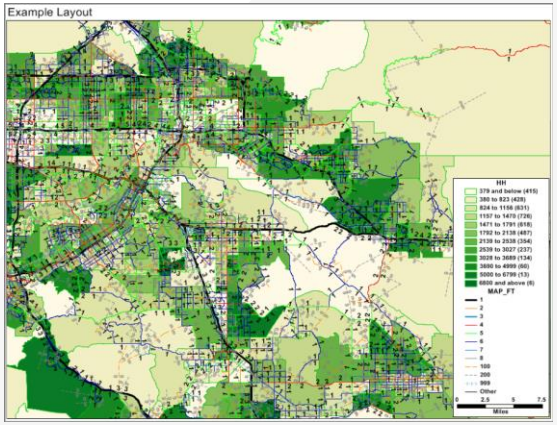
Layouts

- Allow users to create a page to be printed
  - Set paper size
  - Set a specific printer **PDF writers work best!**
- Created from File → New
- Print maps, drawing items, tables, and insets
- Add titles, legends, etc.
  - Title / Project reference
  - Model run source
  - Model run year
  - Map created by
  - Date run
  - Date created
  - Legend (colors, labels, etc)

Practice 6: Create a Layout with your map

1. Start with the results from Practice 5
   - ✓ Open the saved map if needed
2. Create a new layout using File → New or
   - ✓ Check the page settings with File → Properties or
   - ✓ Select a printer and page size
   - ✓ Set to landsape
   - ✓ **Important:** Un-check Change size of items when page size changes
3. Add your map to the layout using
   - ✓ Draw a box to place the map
   - ✓ Select Map, check 'Use actual point sizes'
   - ✓ Optionally un-check 'Keep map's aspect ratio'
   - ✓ Click 'OK'
4. Position and edit the legend
   - ✓ Use the pointer tool ( )
   - ✓ Drag the legend to a good location
   - ✓ Double-click to edit legend text and contents
5. Add a legend title
   - ✓ Use the 'Freehand Text' tool (A), usually at the bottom of the window
   - ✓ Drag a box, then type a title
   - ✓ Use the pointer to reposition, double-clicking to edit





CAMBRIDGE SYSTEMATICS

Highway Assignment

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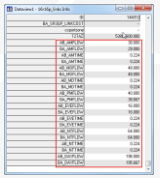
Assignment Results

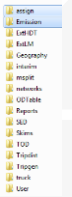
- Basic Volumes
  - Located on the **Loaded Network**
  - Assign\Output\scag_network_loaded.dbd
- Volume and Travel Time for:
  - Each Period (AM, MD, PM, NT, EVE)
  - Total daily



CAMBRIDGE SYSTEMATICS

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!



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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

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Practice 7: Review Assignment Results

1. Open the output roadway network
   - ✓ Use File → Open
   - ✓ Browse to Assign\Outputs\scag_network_loaded.bin
   - ✓ Review the built-in assignment results
2. Open the detailed assignment results
   - ✓ Use File → Open
   - ✓ Browse to Assign\Outputs\day_flow.bin
3. Create the join from Dataview → Join or 
   - ✓ Left side: link layer and 'ID'
   - ✓ Right side: day_flow and 'ID1'
   - ✓ Click 'OK'
   - ✓ Remember: Do not close the joined view.
4. Use the info tool to review the results

Challenge: Apply what you've learned

5. Label the links with the % share of vehicles that are "Drive Alone"
(Hint: create a formula field)

6. Try creating a bandwidth (scaled symbol) theme showing directional volume
(hint: Use )

More on Networks and Zones

User Variables

- Creating your own variables
  - Additional fields can be added to links & nodes layers
  - Field names can contain spaces and numbers, and do not have a practical limit to the number of characters
  - HOWEVER…

User Variables

- Creating your own variables
  - It is preferable to:
    - Limit field names to 10 characters
    - Avoid using spaces
    - Avoid starting a field name with a number
  - If these guidelines are followed, compatibility with other GIS programs will be improved
    - Field names that do not follow these guidelines will have truncated or confusing names when exported to a shapefile

Centroids

- Centroids are special nodes that are linked to socioeconomic data
  - SCAG's Model has three tiers of TAZs
    - Tier 1: Least amount of detail
    - Tier 2: More detail
    - Tier 3: Used for subarea models.
  - TAZ numbers match the TAZ layer, data tables, and matrices
    - **Sometimes, files use sequential TAZ numbers instead!**

Centroids

- Nodes are identified as centroids using the following rules:

Field Name	Contents
Tier1TAZ	User friendly nested TAZ ID numbers (sequenced by county, type, etc)
Tier2TAZ	
ZoneType_Tier1	Internal, External, Airport, or Seaport
ZoneType_Tier2	
Internal_sequence_id_T1	TAZ numbers used internally by TransCAD – but important to model users
Internal_sequence_id_T2	

Tiered TAZ Structure

- Tier 1 Zones
  4,192
  - Used in traffic assignment
  - Results in 17.5 ***million*** cells per matrix
- Tier 2 Zones
  11,350
  - Used in trip generation, distribution, and mode choice
  - Results in 128.9 ***million*** cells per matrix

Fun with Math:
Why these models take so long

$$\frac{4,192}{11,350} = 2.7 \qquad \frac{17.5\ m}{128.9\ m} = 7.3$$

$$2.7^2 = 7.3$$

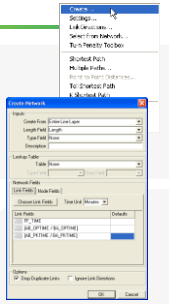
Routable Roadway Networks

Routable Networks

- By themselves, geographic files are not "routable"
  - A network file (.net) must be created before certain actions can be done
    - The SCAG Model creates this automatically
  - To increase efficiency, only selected variables are contained in the network file
- The routable network can also include turn penalties and prohibitions
  - By default, the SCAG model does not use turn penalties

Routable Networks

- Create a routable network using Networks/Paths → Create
- For a working network, only length needs to be included
  - Other variables as necessary
- Networks/Paths → Settings can be used to change additional network properties



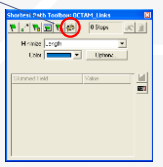
Routable Networks

- Shortest Paths
  - Use Networks\Paths → Shortest Path to see how TransCAD routes traffic based on time, length, and turn penalties
  - A ".net" network is required (Optional in TransCAD 6)
    - In TransCAD 6, a using .net network will allow more functionality
  - The network must contain all variables of interest
    - More variables can be added to the network later if needed

Routing on the Network

- Shortest Paths
  - The shortest path is based on the selected variable
  - Other variables can be tracked, or "Skimmed" along the way
- No ".net" file?
  - On-the-fly pathbuilding when no ".net" network is open
    - Turn penalties not applied
    - Not possible to "skim" other variables
    - Useful for quick and easy tests

If this button is missing, close the toolbox, open a .net file, and re-open the toolbox



Practice: Shortest Paths

1. Close all files and start with a clean workspace
2. Open the output roadway network
   - ✓ Use File → Open
   - ✓ Browse to Assign\Outputs\scag_network_loaded.bin
   - ✓ Review the built-in assignment results
3. Create a ".net"network
   - ✓ Include FreeTime, AMTIME, and MDTIME
   - ✓ These are directional fields
4. Find the shortest path between two points
   - ✓ Try using intermediate points to find the difference between the shortest and next shortest path
   - ✓ Build a path through a centroid connector
5. Select centroid nodes
   - ✓ Tier1TAZ > 0 or Tier2TAZ > 0 (node layer)
   - ✓ Use Networks/Paths → Settings to identify centroid connectors in the network file
6. Try to build a path through a centroid connector
7. Discussion: How might this tool be useful?
   - ✓ For model troubleshooting
   - ✓ To answer policy questions

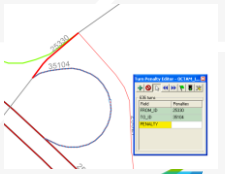
Turn Penalties

Example only: The SCAG model doesn't currently use turn penalties, but they can be added manually if needed

- Turn penalties and Prohibitions
  - Turn penalties are stored in a table (.BIN)
  - This table can be viewed in a dataview
  - Turn penalties are most easily managed using TransCAD's Turn Penalty Toolbox:
    - Add, Delete, or review turn penalties
    - Enter a turn penalty value in minutes
    - Create a turn prohibition by leaving the penalty value blank
- Load into a network from Networks/Paths → Settings

Turn Penalties

- Turn penalties and Prohibitions
  - Networks/Paths → Turn Penalty Toolbox
  - Links will be colored to indicate turn penalties
  - Available turn penalties will be shown in green or blue
  - The selected turn penalty will be shown in red
    - Solid = From
    - Dash = To

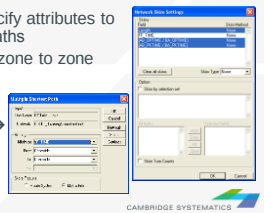


Turn Penalties

- Applying to a Network
  - Apply .bin file turn penalties from Network → Settings
  - If you are using the turn penalty toolbox, penalties are applied to the network as you go
    - Turn penalties are applied to the network with the green light
    - You can ignore this error if a "net" file is not open and you will apply the ".bin" file later

Routable Networks

- Creating a skim matrix
  - Build shortest paths between all zone pairs
    - *Technically: Builds shortest paths between two sets of selected nodes*
  - Allows user to specify attributes to "skim" along the paths
  - Saves results in a zone to zone matrix file
- Accessed from Networks/Paths → Multiple Paths



Practice: Shortest Path Matrix

1. Start with the workspace from the previous practice
2. Select Tier 1 Zones
   - ✓ Select by the condition: Tier1TAZ > 0
   - ✓ Name the set Tier1TAZ
3. Create a skim matrix between all zone pairs
   - ✓ Find the shortest FF time
   - ✓ Skim length, AM, and MD time
   - ✓ Review the warnings and/or report
   - ✓ Investigate one or two warnings
4. Compare results to the interactive pathfinder for a selected zone pair

Roadway Network Editing

Network Editing

- Warning: Make a backup copy first!
  - There is an "Undo" function in TransCAD
  - Edits are made directly to the network file: You can't close without saving to discard changes
  - Network files sometimes become corrupt

The Undo function in TransCAD 5+ makes network editing less risky

Network Editing

- Backing up the Roadway Network
- **Method 1 (recommended):**
  - Open the network in TransCAD
  - Use Tools → Geographic Utilities → Geographic File
  - *Click **Archive** to save in a zip file*
- **Method 2 (advanced):**
  - Close all files in TransCAD
  - Create a zip file with the line layer and route system files
  - Make sure to get all related files

Network Editing

- Once you have made a backup, you can:
  - Edit attributes of existing links
  - Change data for a specific year or for multiple years and alternatives
  - Add new links, delete existing links, or realign existing links
  - Add data for a year not yet included in the network

Network Editing

- Edit attributes of existing links
  - Display settings can assist with editing
- Additional labels and/or themes can be useful
  - Label # of lanes or other values
  - Show Topology ( ) to see AB vs. BA

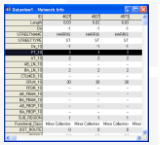
Network Topology

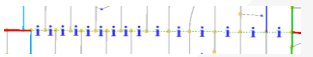
- Show topology to identify AB and BA directions

- To identify one-way roads, use the DIR field:
  - 0: Two-way travel
  - 1: A → B travel
  - -1: B → A travel

Network Editing

- Edit attributes of existing links – Method 1
  - To make most edits, use the information tool ( ) and edit text in the form that appears
  - Changes can be undone
    - Each edit action creates an undo point
  - You can select and fill multiple links with the information tool
    - Multiple values can be filled by right-clicking on row names





Network Editing
Alternate Method

- Edit attributes of existing links *Alternate Method*
  - Use the map editing toolbox ( )
  - Use the Edit Line Attributes ( ) button
    - Operation of this tool is similar to using the information button
  - Edits are saved when the green light ( ) is clicked
  - Use the red ( ) light to cancel all unsaved edits
  - The Undo function will undo all edits that are saved at once with the green light

Network Editing

- What Fields do I Edit???
  - **Facility Type**
    - Facility type identifier
  - **Lanes**
    - Directional number of lanes, by time period
    - Aux. lanes (freeway links only)
  - **Direction**
  - **Area Type**
    - Use nearby links as a guide
  - **MODE**
    - 2 for most links (other values are for transit)
  - **Other fields as necessary**

Network Editing

- What Fields do I Edit ??? (cont'd)
  - Toll coding guidelines
    - Use TOLL, Toll_flag
    - See assign\inputs\toll_hot_penalty for toll and express lane coding details
- See the SCAG Model User's Guide for more guidance

Practice: Network Editing

- Open the input network file
- Make a backup copy of this network in a folder called "Backup"
  - Use Tools → Geographic Utilities → Geographic File and archive the network
  - Add the date to the backup filename
  - Edit the original network file
- Try using the different editing approaches to:
  - Change the facility type
  - Widen a Road

Practice: Network Editing

- Show Topology on the network
- Change a roadway to represent a different number of lanes in each direction
- Change a different roadway to a one-way road
  - 0 = Two-Way
  - 1 = A to B
  - -1 = to A

Network Editing

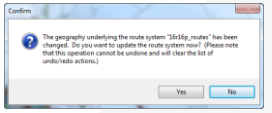
- Adding new links
  - Use the map editing toolbox ( )
  - Add links using Add Line ( )
    - To work properly, links must be connected at nodes
    - Existing links may need to be split
    - Avoid splitting links if possible
  - Make sure that links are connected by:
    - Saving edits
    - Moving a node around – do all of the attached links move with it?
    - Canceling the edit

Network Editing

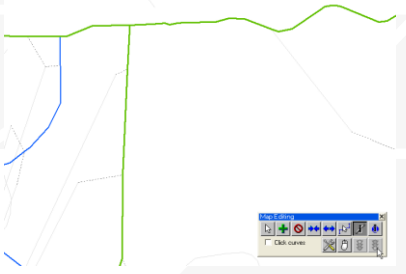
- Adding New Links
  - » New links need new data!
  - » Copy data from an existing link with similar characteristics
    - Use the Edit Link Attributes ( ) button
    - Click/shift-click on the new link(s)
    - Shift-click on the similar old link
    - Right-click on the data for the "old" link and choose "Copy Values"
  - » Splitting/Joining Links
    - **Check the split/join settings**
    - Use the split/join tools ( )
    - New/moved links may be connected at new nodes
    - Check data on split/joined links

Network Editing

- Keeping Transit up to date
  - » Always add the route system to the network before making edits (link additions, splits, or joins)
  - » Add the route system from networks\Inputs
    Note: Make sure to choose the Route System file type
  - » Make the route system active after every few edits
  - » TransCAD will prompt and update the transit network based on your changes



Network Editing



Practice: Network Editing

- Continue editing the input network
- Add, delete, and realign some links
  - » Show topology: Note that the way a new link is created defines its AB direction
- Copy link values from an old road to newly created links
- Split and join links
  - » look at the data that appears on each half
  - » Look at the network editor settings ( )

Network Editing

- Things to keep in mind:
  - » When splitting links, make sure the data on both pieces still makes sense
  - » When adding new roadways, adjust centroid connectors if necessary
  - » Adding detail or making corrections?
    - You may need to make edits to base and forecast networks

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Think Forward

TransCAD Tools for Caltrans District 7

presented to

Caltrans District 7

presented by

Cambridge Systematics, Inc.

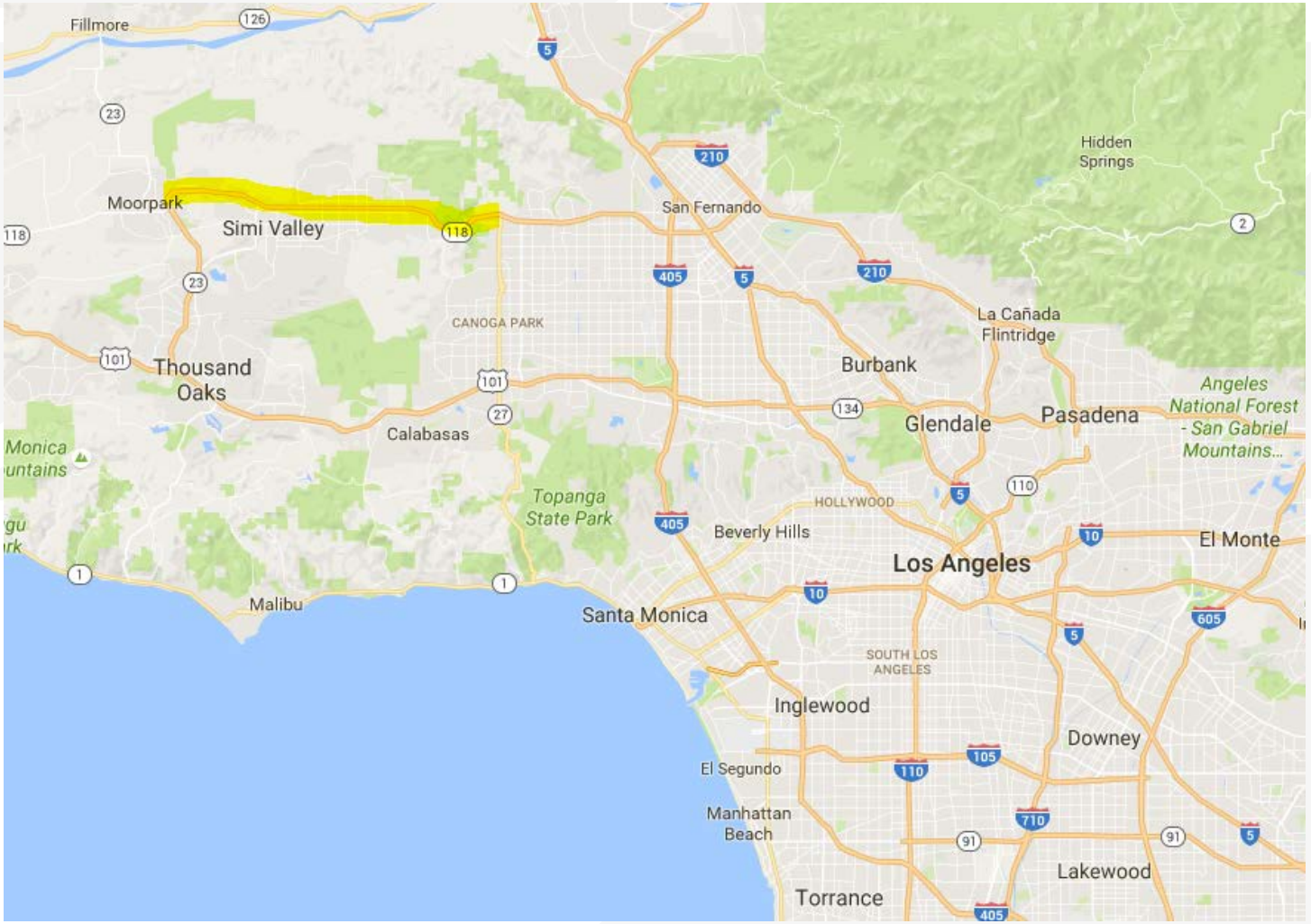
Sean McAtee & Chao Wang

November 1st and 2nd of 2016

Agenda

- Data Extraction for the Air Quality Analysis (Day 1)
  - Overview
  - Input and Output
  - Demonstrations and Exercises
  - Discussions on improving the tool
- Transportation Concept Reports (Day 2)
  - Discussions on TCR report needs
  - Discussions on designing the tool

SR - 118



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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

Input

- The input file contains
  - Project link number
  - TransCAD link ID
  - Topological direction
  - Link length
  - Route number
  - Facility type
  - Post Mile etc.
- The order of the records

Output

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

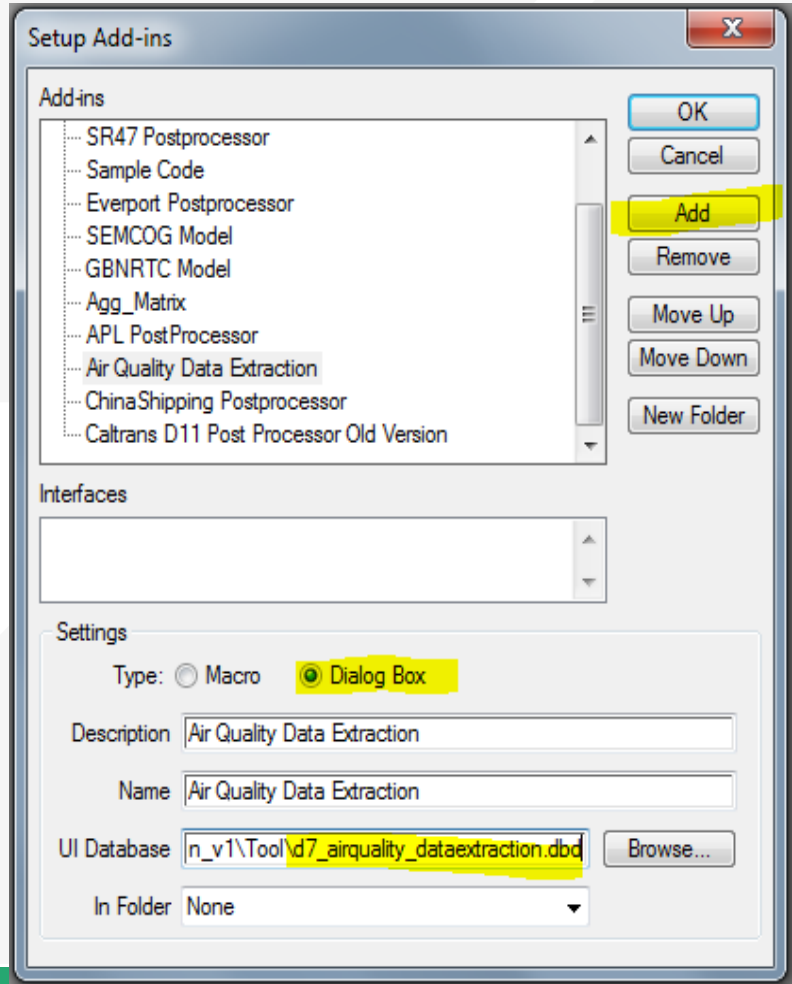
- Copy to the Excel Template File
  - Copy values only

Exercise 1: Run the AQ Tool

- Install the AQ Tool (TransCAD Add-ins)
- Run the tool
- Examine the results

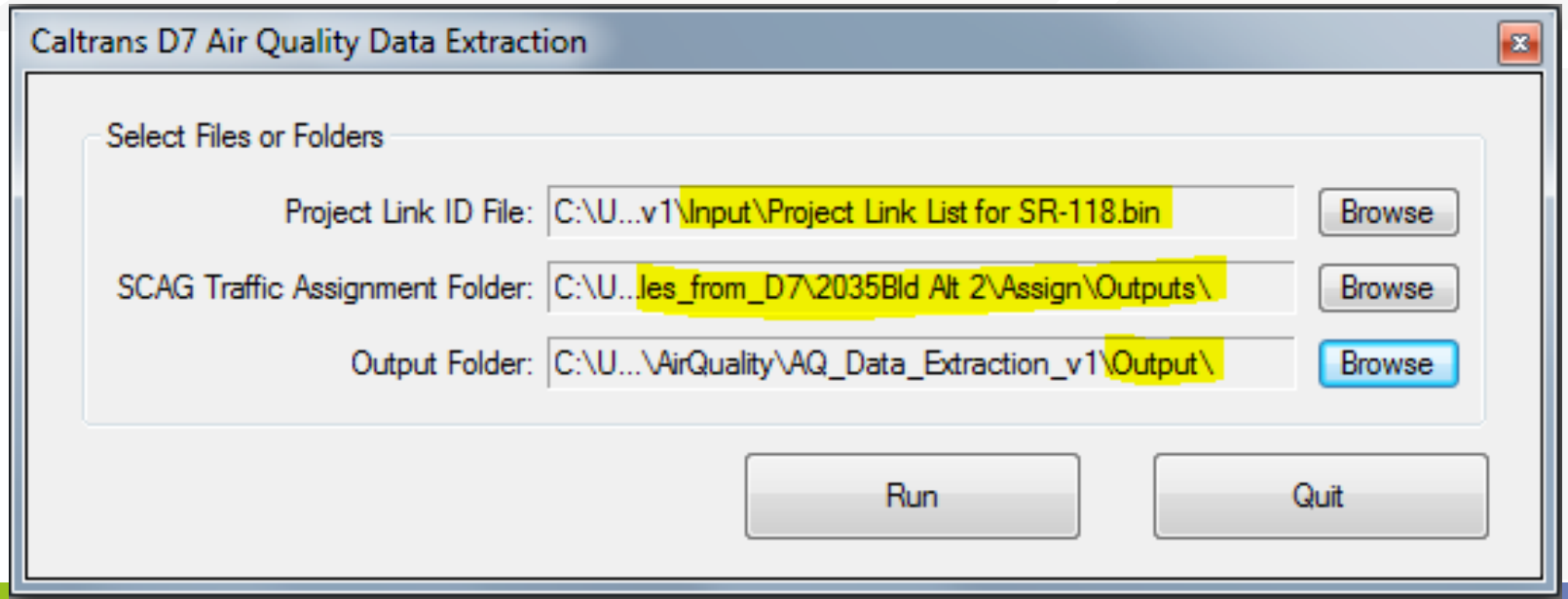
Exercise 1-1: Install the AQ Tool

- 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 the AQ Tool

- Step 3: Select the tool from Tools → Add-Ins
- Step 4: Specify the inputs and output folder, and click “Run” to run the tool
  - Project Link ID file is “\Input\Project Link List for SR-118.bin”
  - SCAG Traffic Assignment Folder is “\Files_from_D7\2035Bld Alt 2\Assign\Outputs\”
  - Output Folder is “\Output\”



Exercise 2: Create the Final Output

- Copy the results to the template
- Check the results

Exercise 2: Create the Final Output

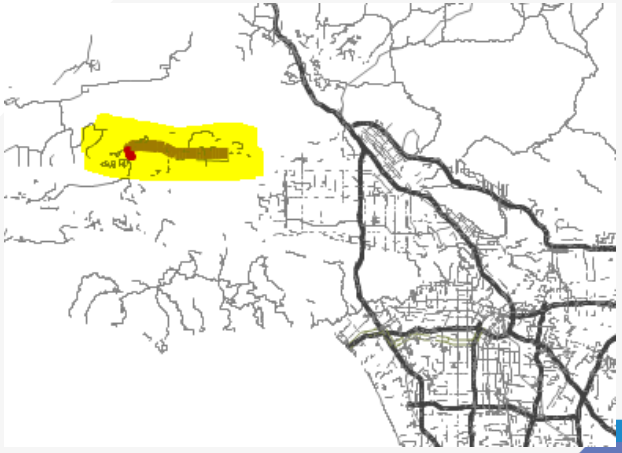
- Step 1: Make a copy of the template and rename it
  - The template file is \Input\Air Quality with Soundwall Data1_Template.xlsx
- Step 2: Open the csv files* in Excel and copy **values** to the corresponding spreadsheet in the Excel file from Step 1
  - E.g. copy the content (without the first row) in “Project Link List for SR-118_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.

Exercise 3: Prepare Input Files

- 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

Exercise 3-1: Add Records

- Step 1: In Excel, open the project list file and go to the spreadsheet “Fwy+Arterial-Sort”
  - The project list file is \Input\Preparation\Project Link List for SR-118 Working File.xlsx
- Step 2: In TransCAD, open the highway network, navigate to the east end of SR-118
  - The highway network is \Files_from_D7\2035Bld Alt 2\networks\Inputs\15t35nb_links.dbd



Exercise 3-1: Add Records

- Step 3: add the two highlighted links to the end of the Excel file opened in Step 1. The critical attributes are: SCAG_Link_ID, Facility_Type and Direction, which are shown below. Try and see if you can get such information from the TransCAD network.

ID	Project_Link_Number	Topology	SCAG_Link_ID	Length	Route_Number_Street_Name	Facility_Type	Direction
300	300	AB	2667607	0.682121	118	Fwy --MF	Eastbound
301	301	AB	2679024	0.136594	COCHRAN ST	Secondary Arterial	Eastbound

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Exercise 3-2: Drop Records

- Step 1: Open the warning message file
  - This file was generated by the AQ tool, and it is \Output\Air Quality Data Extraction Warning Message.txt
- Step 2: Based on the warning message file, remove duplicate records in the project list Excel file, which is the file opened at Step 1 of Exercise 3-1.
  - We should investigate why we have duplicate records in the project list. But as an exercise, just keep the first record of each group of duplicate records.

Exercise 3-3: Re-order Records

- Re-order the records in the project list Excel file opened at Step 1 of Exercise 3-1. The project link list should be ordered to facilitate the communication. Some general rules are:
  - For freeway links, list the links following the flow direction. For example, for the west bound of SR-118, list the farthest east link first, then links to its west.
  - For ramp links, group the links by the interchange they serve. List the ramp links for the farthest west interchange first if the ramps are serving a east-west bound freeway, or the farthest south interchange first if the ramps are serving a north-south bound freeway. Within each group, list the ramp links following a clockwise order with the ramps to the north listed first.
  - For street links, group the links by street. List the farthest west street first if the streets are intersecting with a east-west bound freeway, or the farthest south street first if the streets are serving a north-south bound freeway. Within each group, list the links following the west to east order, or the south to north order.
  - Users can create new fields in the project list Excel file to help order the records.

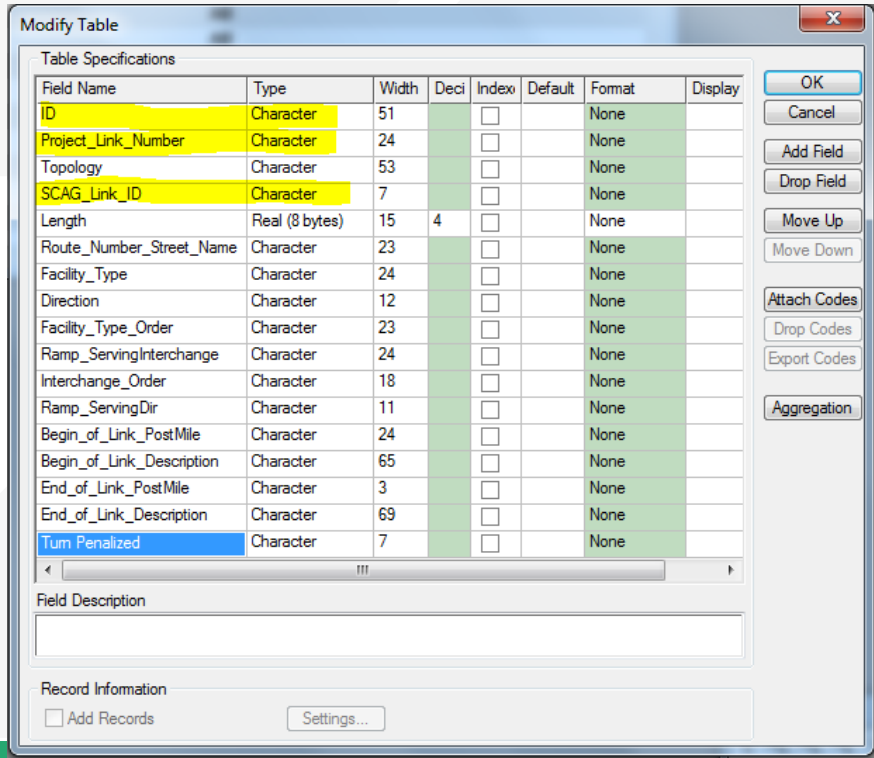
Exercise 3-4: Export to CSV Files

- Step 1: Save the spreadsheet “Fwy+Arterial-Sort” as a CSV file (Comma-delimited)
- Step 2: In Notepad++, open the CSV file from Step 1, and modify the file so that each line starts with the ID number
  - In the example shown below, delete the line breaks that are highlighted

```
25,136,AB,100213,0.148957,First St.,Secondary Arterial,Northbound,0,,,,,"Off Ramp from Eastbound SR-118/ Northbound
/Northbound First St. Onramp to Eastbound SR-118",,"Southbound First St. Onramp to
 Eastbound SR-118",FALSE
26,137,AB,100214,0.026584,First St.,Secondary Arterial,Northbound,0,,,,,Southbound First St. Onramp to Eastbound SR-118,,"Southbound First St. Onramp to
Westbound SR-118",FALSE
27,138,AB,100216,0.08549,First St.,Secondary Arterial,Northbound,0,,,,,"Southbound First St. Onramp to
Westbound SR-118",,Northbound First St. OnRamp to Westbound SR-118,FALSE
28,139,AB,126629,0.032878,First St.,Secondary Arterial,Northbound,0,,,,,Northbound First St. OnRamp to Westbound SR-118,,Offramp from Westbound SR.-118,FALSE
29,140,AB,126625,0.008892,First St.,Secondary Arterial,Northbound,0,,,,,Offramp from Westbound SR.-118,,Innovators Way/Simi Town Center Way,FALSE
```

Exercise 3-5: Export to BIN Files

- Step 1: In TransCAD, open the CSV file created in Exercise 3-4
- Step 2: Save it as a BIN file
- Step 3: Close all files in TransCAD
- Step 4: In TransCAD, open the BIN file generated at Step 2.
- Step 5: Click Dataview → Modify Table to bring up the "Modify Table" window.
- Step 6: Change the type for fields "ID", "Project_Link_Number" and "SCAG_Link_ID" from Character to Integer (4 bytes)



Exercise 3-5: Export to BIN Files

- Reference for data type

Type	Contents
Real (8 bytes)	Numbers (with decimals) ranging from -1.7E+308 to1.7E+308; the smallest absolute value being 2.3E-308
Real (4 bytes)	Numbers (with decimals) ranging from -3.4E+38 to3.4E+38; the smallest absolute value being 1.2E-38
Integer (4 bytes)	Whole numbers between -2,147,483,646 and 2,147,483,647
Integer (2 bytes)	Whole numbers between -32,766 and 32,767
Integer (1 byte)	Whole numbers between 0 and 254
Character (string)	Letters, symbols, and numbers

Discussions

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Think Forward

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Agenda

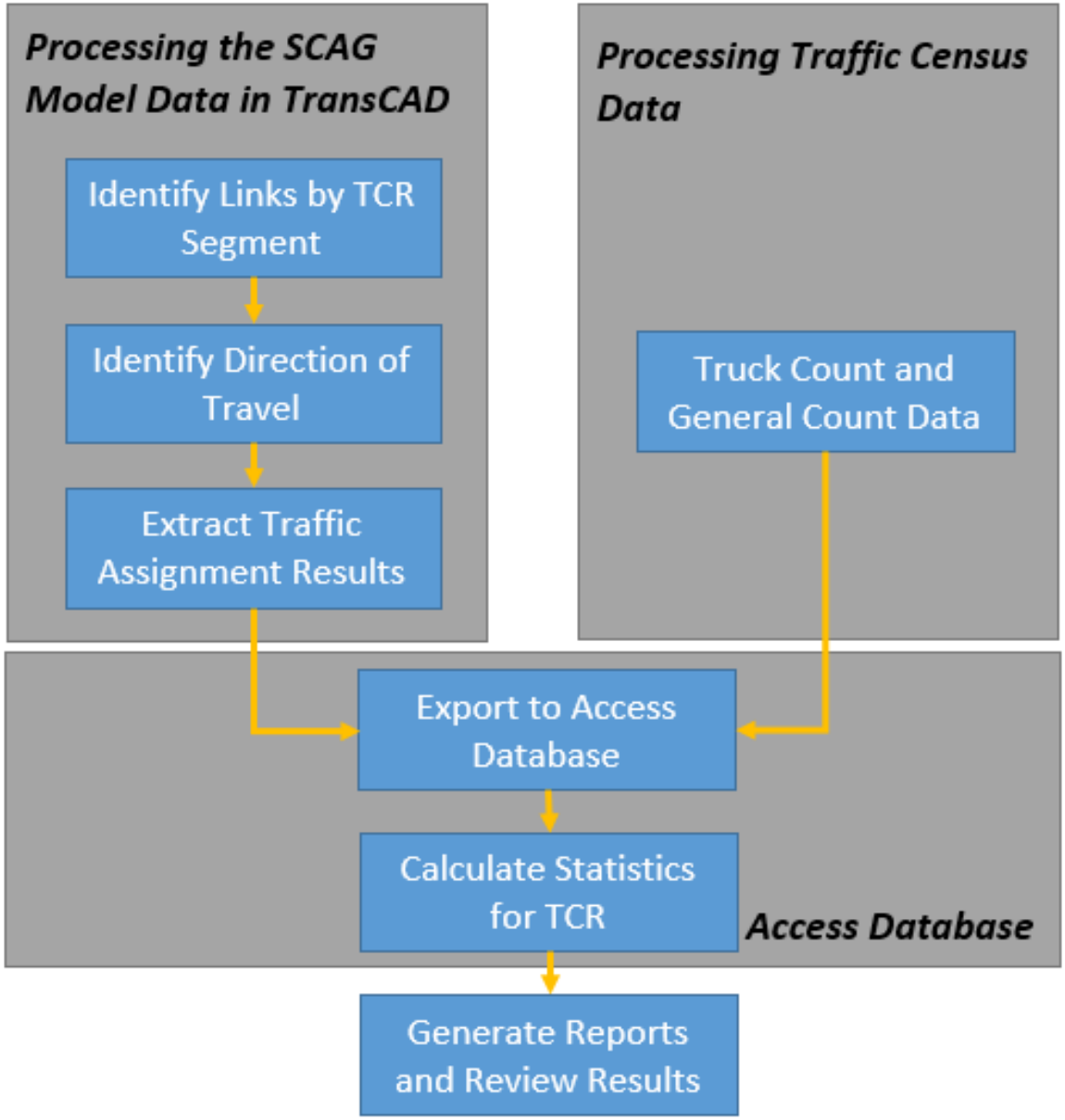
- Improvements to the AQ Tool
- Access Database for Transportation Concept Reports (TCRs)
  - Discussions on TCR report needs
  - Discussions on designing the tool

Improvements to the AQ Tool

- Automate the process to select project links
  - Fully automated, or
  - Interactive
- Extract link information from the network automatically, such as the length, and facility type etc.
- Check for errors

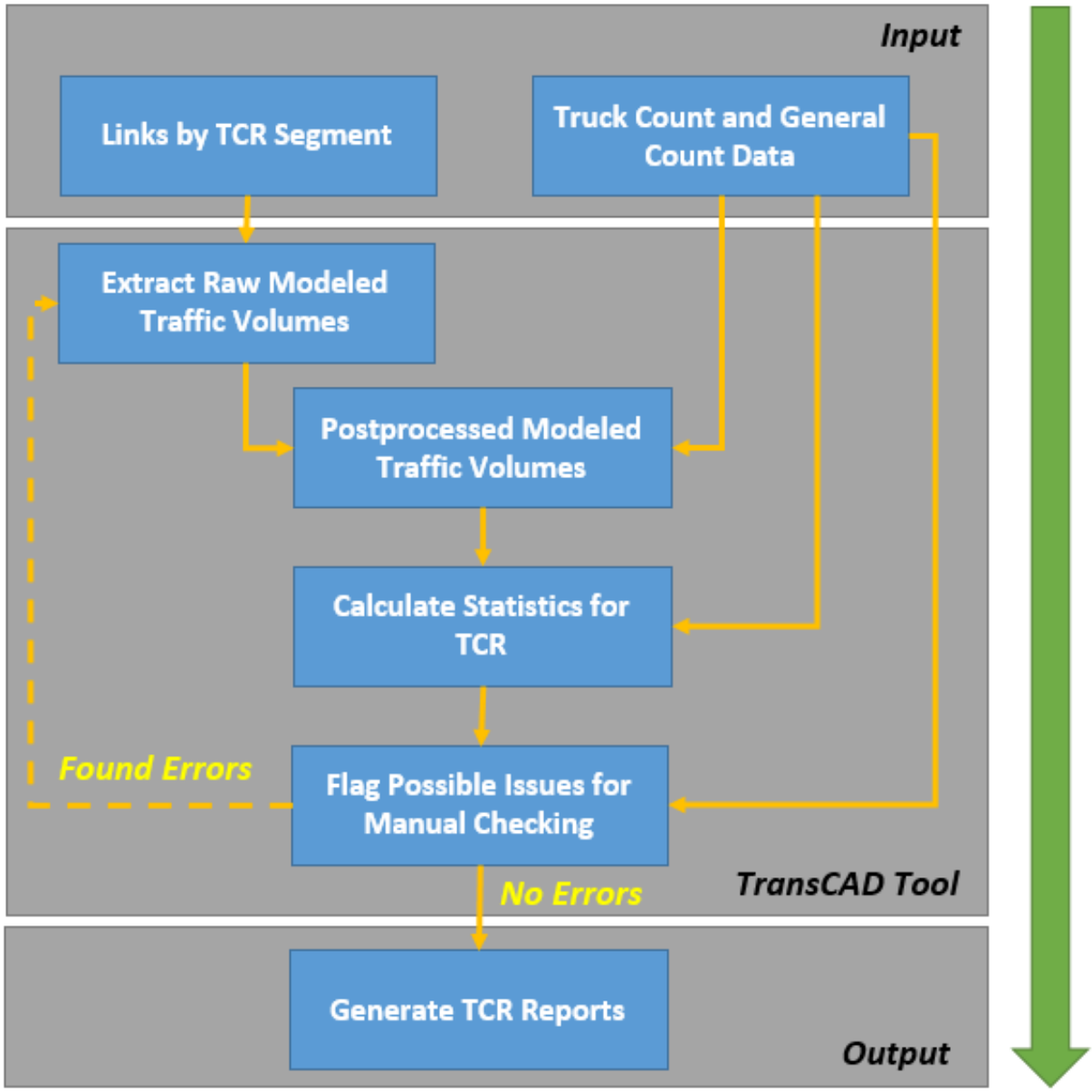
Flow Chart

Access Database for TCRs



Flow Chart

TranCAD Tool for TCRs



TCR Output

1 Basic System Operations

- For Model Base Year and Model Plan Year
  - Daily total vehicle flow
  - Level of Service (LOS)
  - Daily vehicle miles traveled (VMT)

TCR Output

2 Model Plan Year Concept Summary

- For Model Plan Year Only
  - Daily total vehicle flow
  - Peak hour directional split
  - Peak hour total flow (both directions)
  - Peak hour truck vehicle flow (both directions)
  - Peak hour truck percent
  - V/C ratio and LOS
  - Total lanes
  - Lanes required to achieve LOS D and LOS F0

TCR Output

3 Base Year Truck Volumes by TCR Segment

- From Counts, not from Model
  - Total Vehicle Annual Average Daily Traffic (AADT)
  - Total truck AADT
  - Truck percent
  - 5+ Axle truck AADT
  - 5+ Axle truck percent

Base Year 2008 Truck Count Data

TCR Segment Number	Total AADT	Truck ADT	Daily Truck Percent	5+ Axle Truck ADT	5+ Axle Trucks as Pct of All
1	193,667	16,216	8.4%	6,394	39.4%
2	221,200	17,713	8.0%	7,201	40.7%
3	238,750	17,129	7.2%	7,339	42.8%
4	235,250	15,654	6.7%	7,917	50.6%
5	241,250	14,980	6.2%	8,780	58.6%
6	256,250	15,587	6.1%	9,366	60.1%

TCR Details

- Conventional Highway vs. Freeway State Routes
- Determination of Peak Hour and Peak Direction
- Average Travel Demand Volumes weighted by Link Length

$$V = \frac{\sum_{i=1}^{n} l_i \cdot v_i}{\sum_{i=1}^{n} l_i}$$

Discussions