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Think ➤ Forward

The SCAG 2016 RTP Model

presented to

Caltrans District 7

presented by

Cambridge Systematics, Inc.
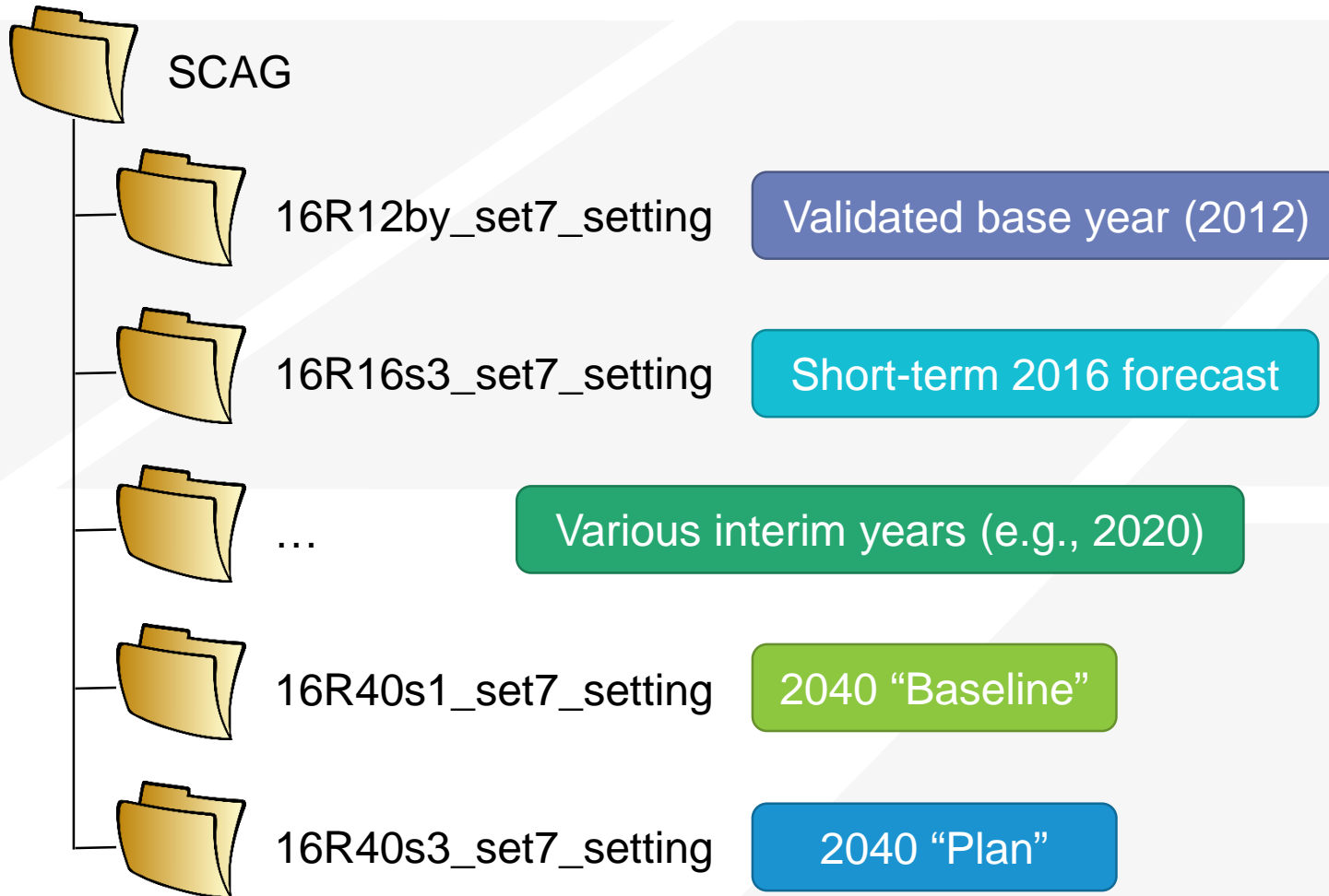
Chao Wang

May 24th, 2017

Outline

➤ Brief review of the SCAG model runs that has been completed

➤ Orientation on the training exercises that involve each of Caltrans D7 staff becoming intimately familiar with one of the stages of the SCAG model
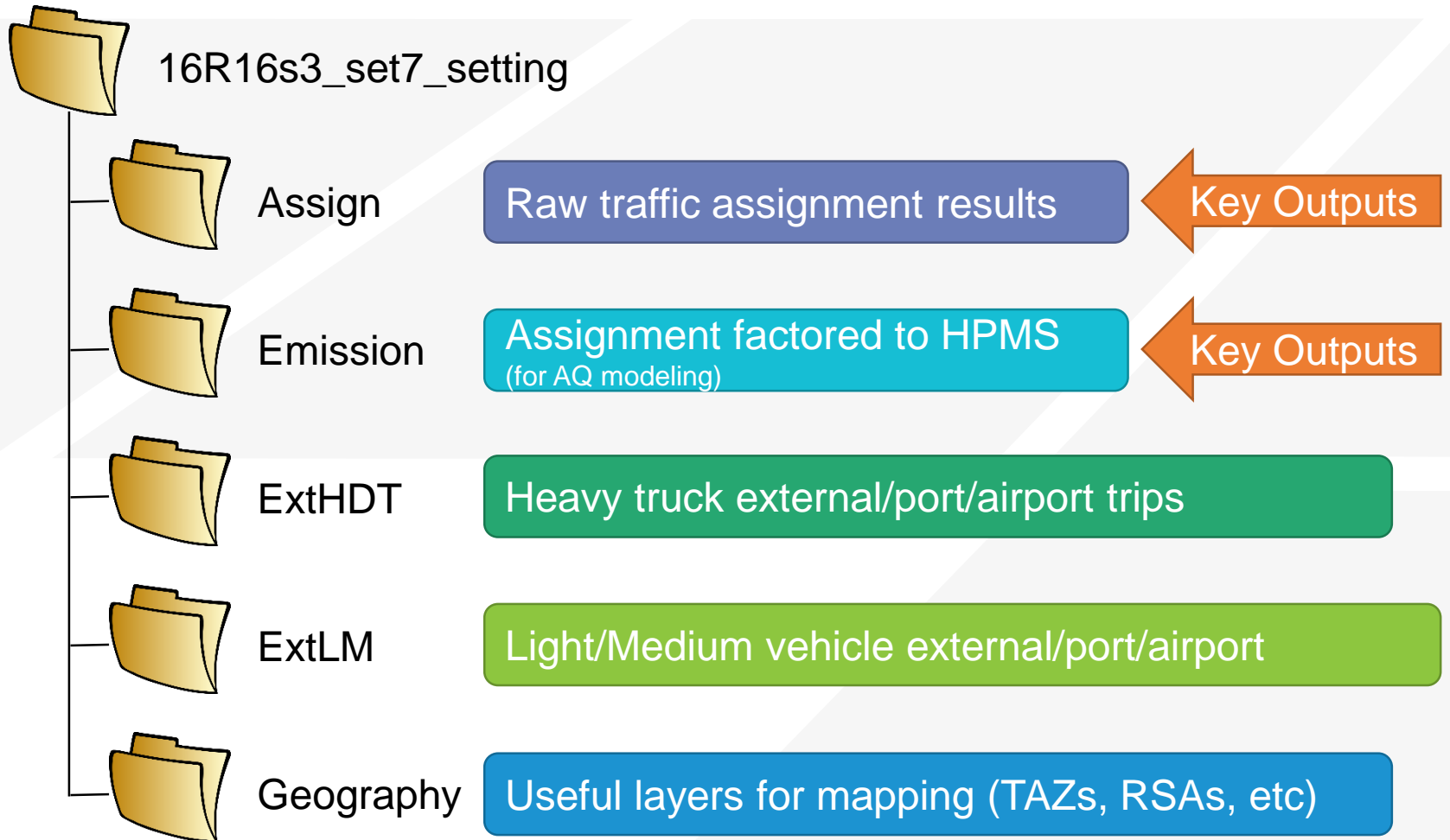
➤ Modeling HOT lanes

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Brief Review of SCAG Model Runs

SCAG Model File Structure

SCAG

16R12by_set7_setting — Validated base year (2012)

16R16s3_set7_setting — Short-term 2016 forecast

… — Various interim years (e.g., 2020)

16R40s1_set7_setting — 2040 "Baseline"

16R40s3_set7_setting — 2040 "Plan"

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SCAG Model File Structure

16R16s3_set7_setting

- **Assign** — Raw traffic assignment results ← Key Outputs
- **Emission** — Assignment factored to HPMS (for AQ modeling) ← Key Outputs
- **ExtHDT** — Heavy truck external/port/airport trips
- **ExtLM** — Light/Medium vehicle external/port/airport
- **Geography** — Useful layers for mapping (TAZs, RSAs, etc)

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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

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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

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SCAG Model File Structure

📁 16R16s3_set7_setting   *(Continued)*

📁 Truck   Internal Heavy Duty Truck Model

📁 User   For troubleshooting / SCAG use

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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

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SCAG Model Scenarios

- **Start the Add-In**
  - » Tools → Add-Ins → SCAG Model v 6.3

- **Setup a Scenario**
  - » Click "Setup"
  - » Find the scenario to run
    - Example: 16R16s3
    - Make a copy or work in place – But **KEEP TRACK**
  - » Set the correct directory on your system
    - Check to make sure Input files are shown as "Exists"
  - » Click 'OK' (be patient while the system responds)

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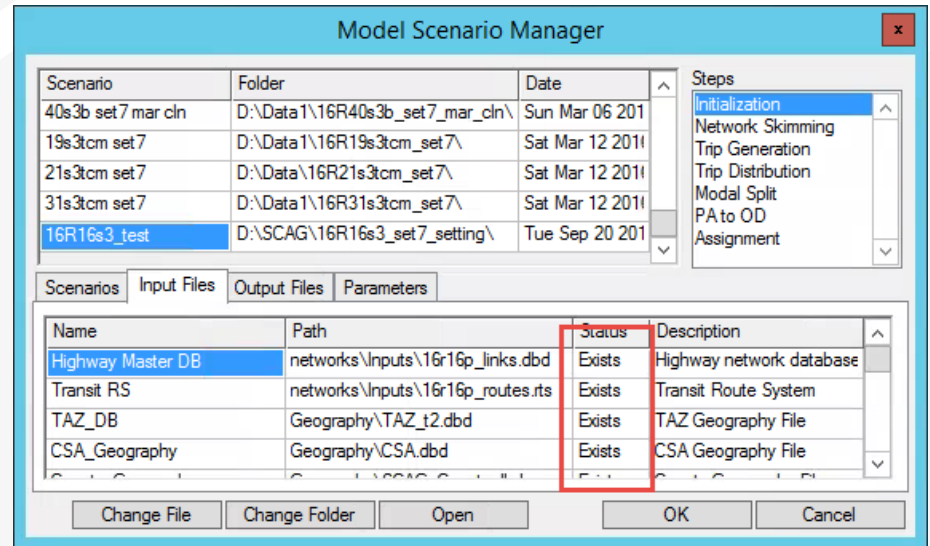
SCAG Model Scenarios
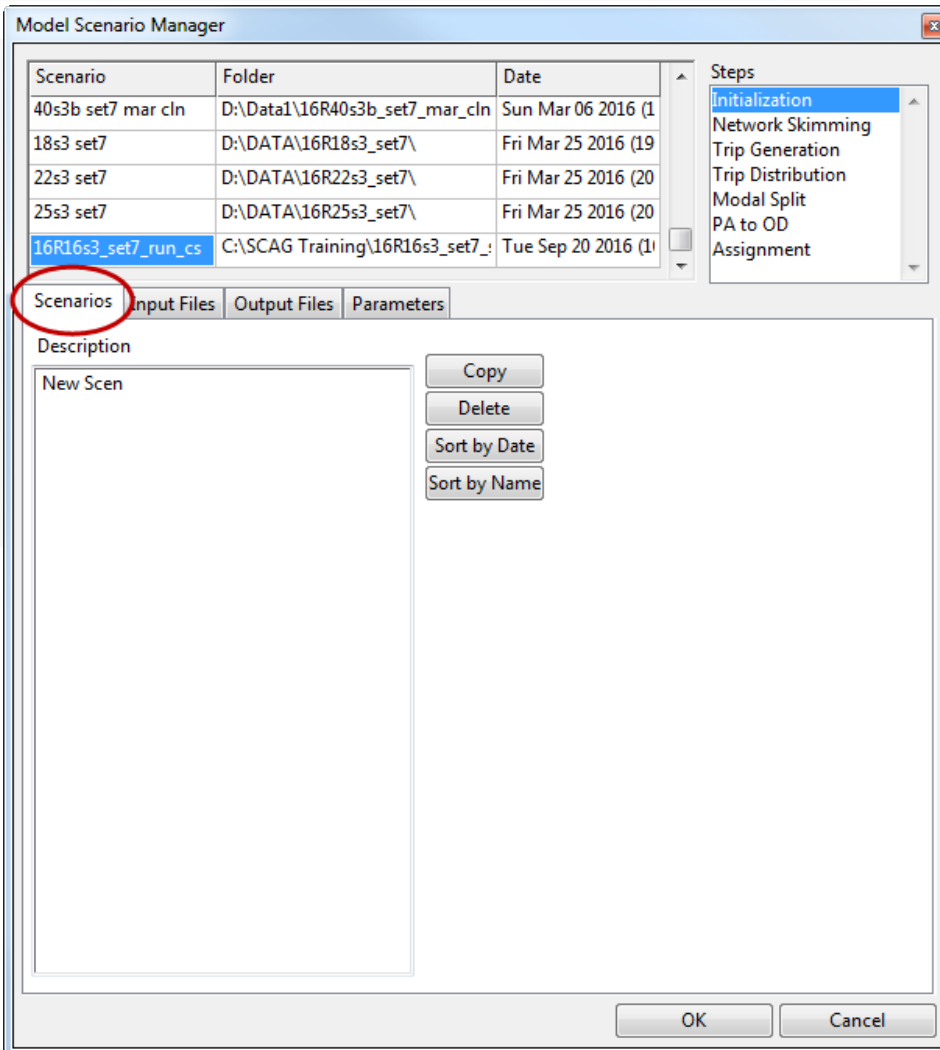
- Scenarios
  - » Manage scenario list
  - » Enter a description

- Input, Output, Parameters
  - » Check/modify filenames and parameters

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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

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Example: When to run a full 5-loop run

- Receive new model inputs from SCAG
  - » We have input files from SCAG, but no outputs
  - » We want to generate outputs for further use

- **Run when people could change their decisions on:**
  - » Where to work or shop
  - » Where to make typical daily trips

- Example: High Desert Corridor
  - » Creates a **large new freeway**
  - » People could choose to make different trips

Example: When to run a full 1-loop run

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

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Example: When to run assignment only

➤ Network alternatives that include general purpose roadway changes

➤ Initial screening and alternatives comparison

➤ **This is the most common way the SCAG model is currently run**

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Orientation on SCAG Model Components

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What is a Travel Model?

➤ Analysis tool

» Series of mathematical programs

Inputs

- Transportation Networks
- Socioeconomic Data
- Model Parameters
- …

Outputs

- Trip by Mode
- Traffic Volumes
- Congested Speeds
- Transit Volumes
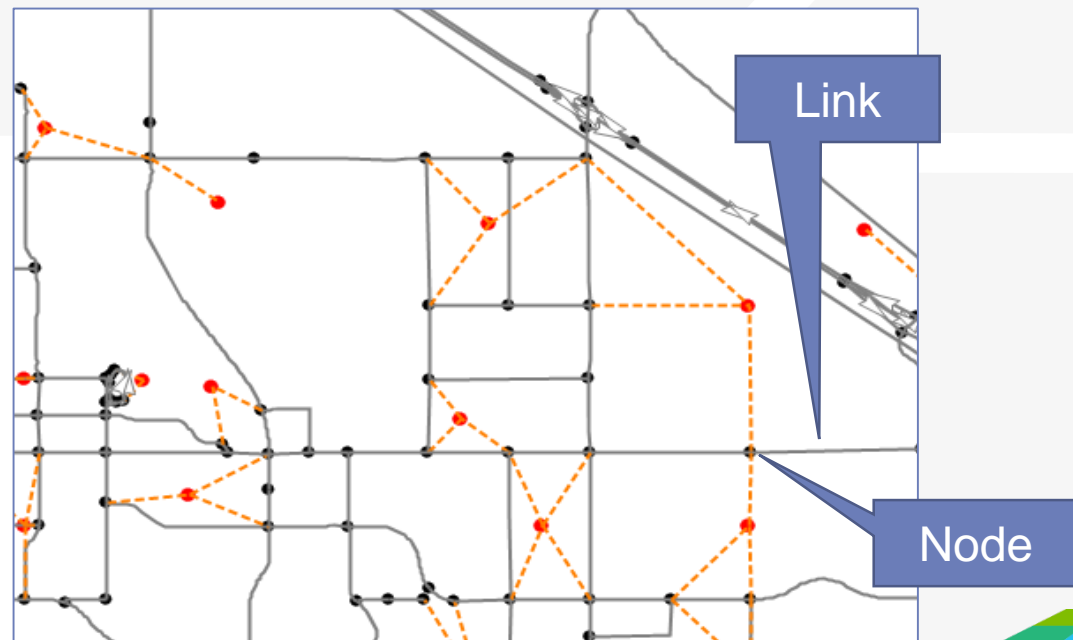- Summary Information

Model Inputs and Outputs

Inputs

Transportation Networks

Socioeconomic Data

Model Parameters

…

➤ Identifies **supply** for travel

➤ Transportation system is represented in the model as a network – which is made out of Links & Nodes

Link

Node

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Model Inputs and Outputs

Inputs

- Transportation Networks
- Socioeconomic Data
- Model Parameters
- …

➤ Identifies **demand** for travel

➤ Household data

» Average household **size**

» Median household **income**

» Number of resident **workers**

» **Age** of household residents

» And more…

➤ Employment data

» By 13 industries

» By Wage level

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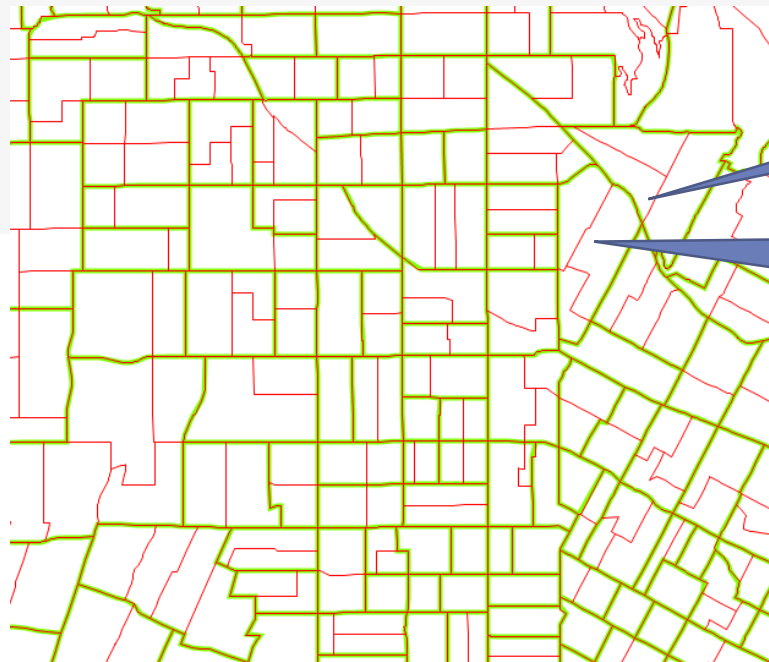
Model Inputs and Outputs

Inputs

> Transportation Networks

> Socioeconomic Data

> Model Parameters

> …

➤ Socioeconomic data are defined for each Transportation Analysis Zones (TAZ)

➤ SCAG uses a tiered zone system structure

Green: Tier 1 TAZ Boundary

Red: Tier 2 TAZ Boundary

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Model Inputs and Outputs

Inputs

> **Transportation Networks**

> **Socioeconomic Data**

> **Model Parameters**

> **…**

➤ Represent the way people behave

» How many trips are made?

» How far will people travel?

» What impacts decisions about travel mode?

» How does congestion impact travel?

➤ Source Data

» SCAG / Caltrans Household Travel Survey

» On-Board Transit Surveys

» Speed Surveys

» Big Data

» Validated to traffic counts

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Model Inputs and Outputs

➤ Information about each trip

  » Start/end

  » Time of day

  » Mode of travel

  » Purpose of trip

  » Trip time and distance

Outputs

Trips by Mode
Traffic Volumes
Congested Speeds
Transit Volumes
Summary Information

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Model Inputs and Outputs

- **By Time of Day**
  - » Daily
  - » AM, PM, Mid-Day, Evening, Night
  - » AM and PM Peak Hours

- **Turn Movements**
  - » Better estimated with assistance of base-year counts

- **Congested speed based on volume**

Outputs

Trips by Mode

Traffic Volumes

Congested Speeds

Transit Volumes

Summary Information

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Model Inputs and Outputs

➤ Performance Report
  » Summaries of model results
  » Useful for planners and engineers

➤ Planning Tools
  » Maps and charts
  » Results presented for general understanding
    ▪ VMT, VHT, Delay
    ▪ Level of Service
    ▪ Trip Lengths
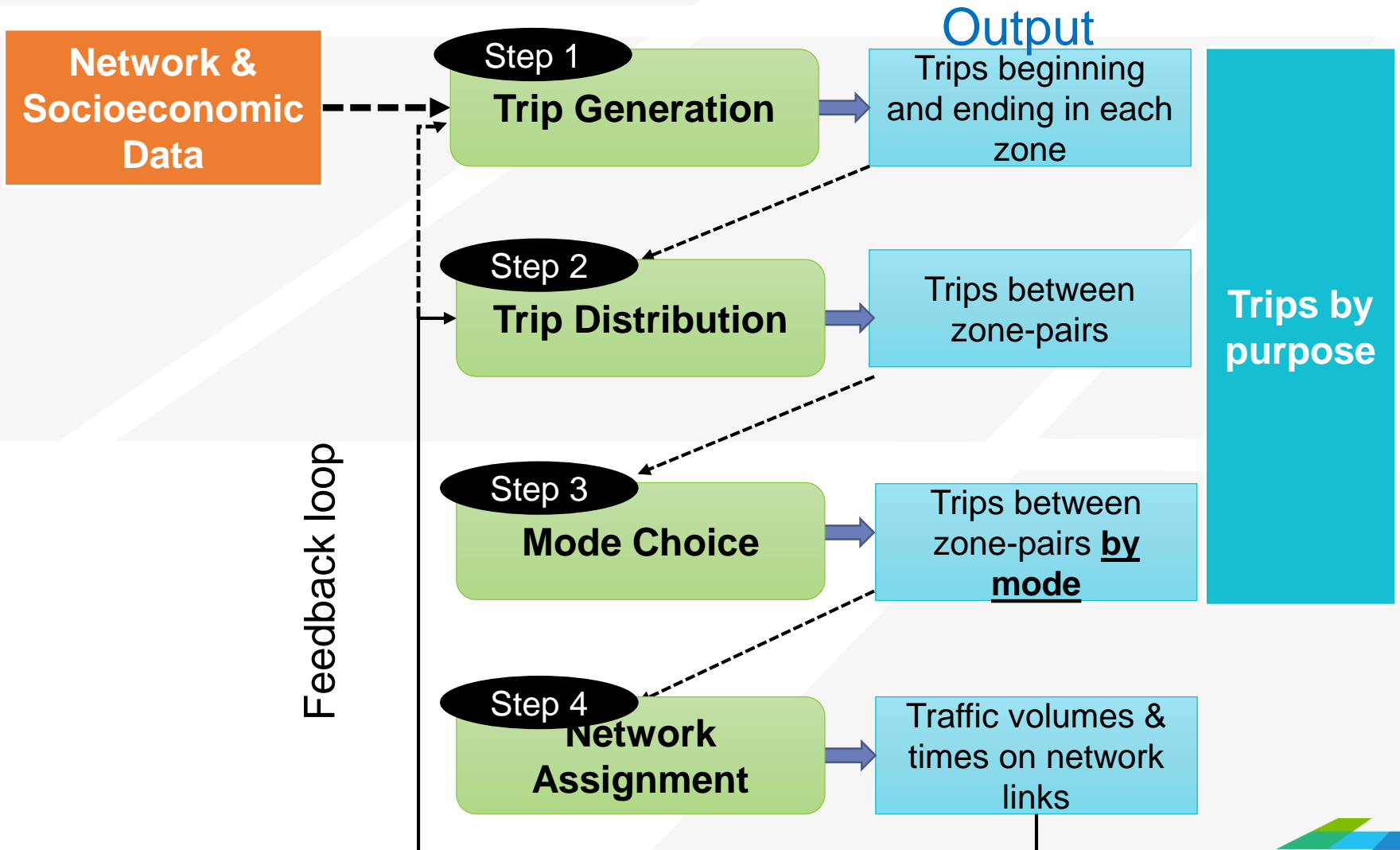   ▪ Trip Patterns

Outputs

Trips by Mode
Traffic Volumes
Congested Speeds
Transit Volumes
Summary Information

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The four-step process

Network & Socioeconomic Data

Output

Step 1
Trip Generation
Trips beginning and ending in each zone

Step 2
Trip Distribution
Trips between zone-pairs

Step 3
Mode Choice
Trips between zone-pairs **by mode**

Step 4
Network Assignment
Traffic volumes & times on network links

Trips by purpose

Feedback loop

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Trip Generation: *How Many Trips?*

➤ Based on household survey

➤ Yield trip productions and attractions by trip purpose

➤ Generate all trips
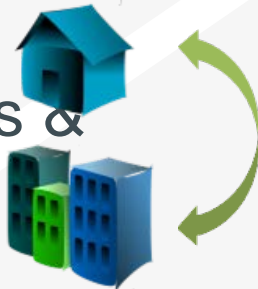- Walk
- Bike
- Transit
- Auto

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Trip Generation: *How Many Trips?*

➤ Cross-classified production rates

» Household size & income

» Household Workers & Income

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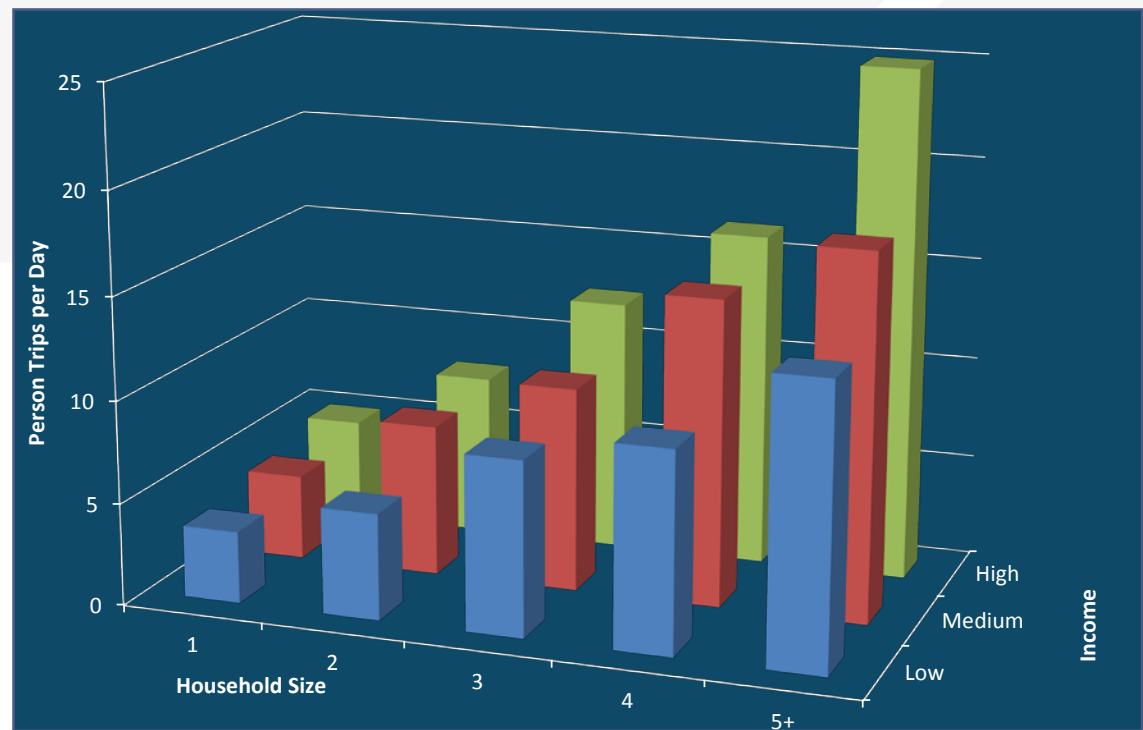
Trip Distribution:
Where will they go?

➤ Match
  » Productions & attractions

➤ Survey Data
  » Trip length distributions
  » Subregion to subregion patterns

The *Gravity* concept can be used to model travel!
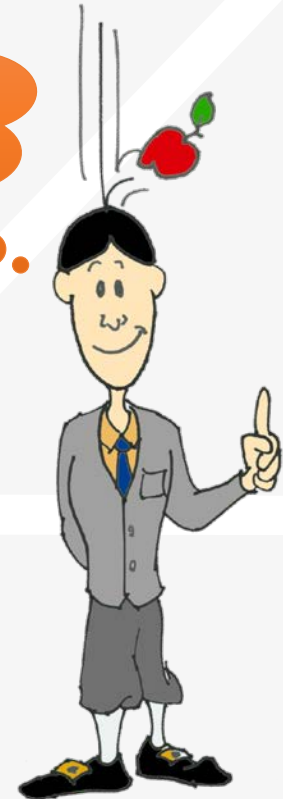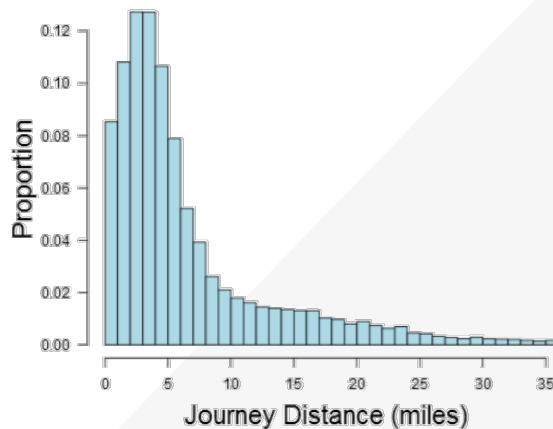
Mode Choice: *Which Mode?*

➤ Nested Logit Model

   » Consider all modes each zone pair

Can I get a ride?
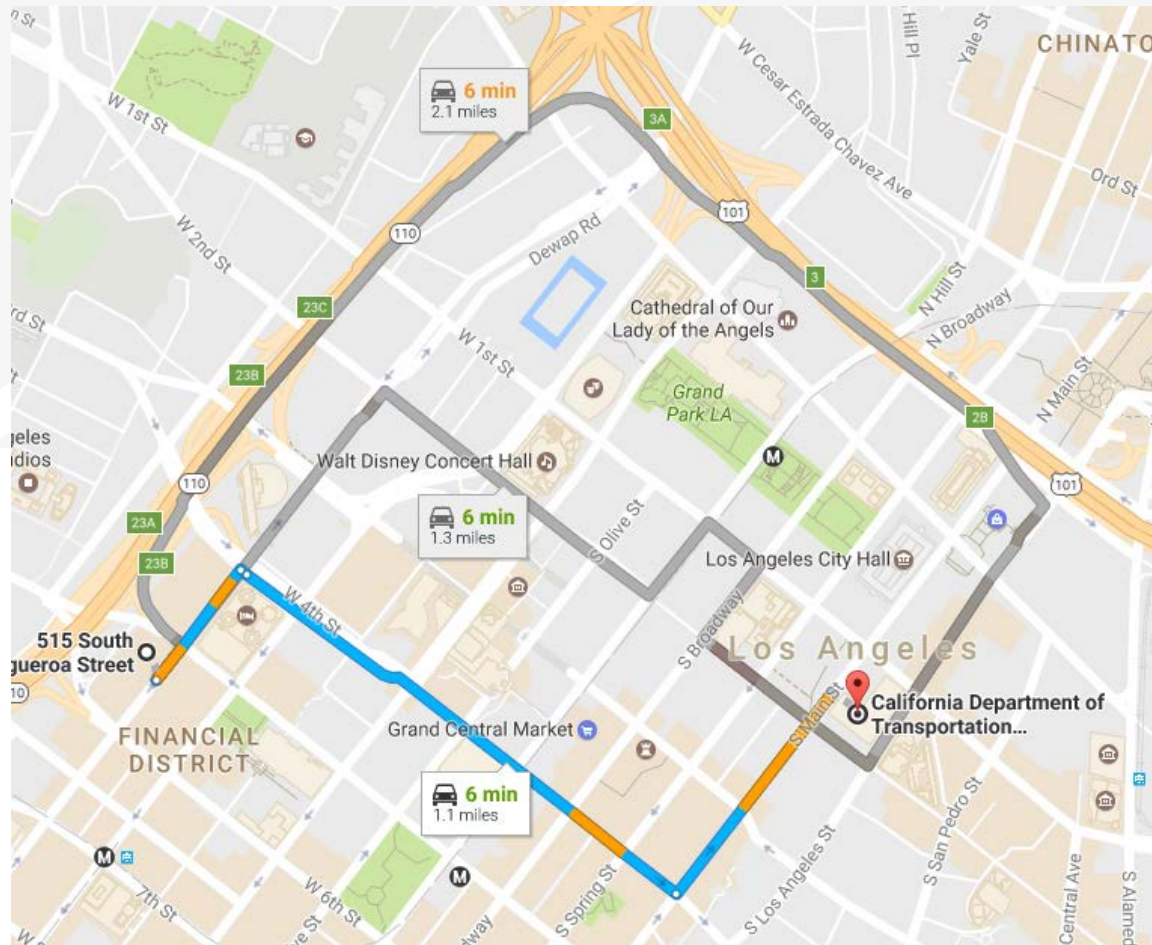Is it close enough to bike?
How much $ is parking?
How about the bus?

Choice
Motorized
Non-Motorized
Auto
Transit
Walk
Bike
Drive Alone
Carpool
Bus
Rail
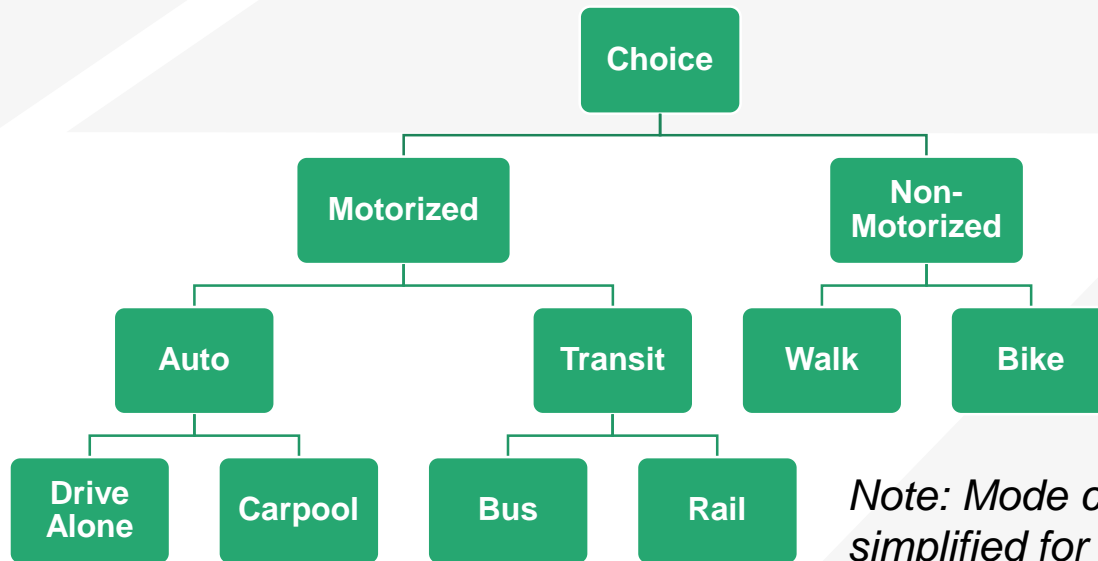
Note: Mode choice diagram is simplified for explanatory purposes

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Traffic Assignment: *Which Route?*

➤ Travelers choose routes based on traffic congestion

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List of Model Components to Study

- Highway network and TAZ system

- Socio-economic data and trip generation

- Traffic assignment

- Network skimming and trip distribution

- Mode Choice

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Main features of SCAG model components

Model Components	Features
Highway network and TAZ system	More than 200 link attributes; Three tiers of TAZ system
Socio-economic data and trip generation	PopGen is used for population synthesis; An auto availability model is available (MNL); Cross-classification model is used for trip production; Regression model is used for trip attraction
Traffic assignment	Eight vehicle classes are assigned
Network skimming and trip distribution	Destination choice model is used for trip distribution
Mode Choice	Nested logit model is used for mode choice

What needs to be completed for each model component

→ The goal of the model stage

→ The Methodology for implementing the stage (what calculations are required, and an explanation of how they relate to the stage's goal)

→ Presenting the results of the stage using tools in Caliper TransCAD

→ Identification of alternate sources of data to either validate or compare against model data

→ Document model stage for presentation to modeling staff and publish as record of Caltrans' analysis of SCAG 2016 RTP Model

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Assignment of model components

Model Components	Assigned to
Highway network and TAZ system	
Socio-economic data and trip generation	
Traffic assignment	
Network skimming and trip distribution	
Mode Choice	

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Modeling HOT Lanes

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Outline

➤ Types of toll in the SCAG Model

➤ Adding tolls to the model
  » Coding HOT lanes
  » Changing Number of lanes
  » Editing toll rates
  » Filling toll values in the highway network

➤ Run SCAG Model
  » One-loop run
  » Five-loop run

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SCAG Toll Types
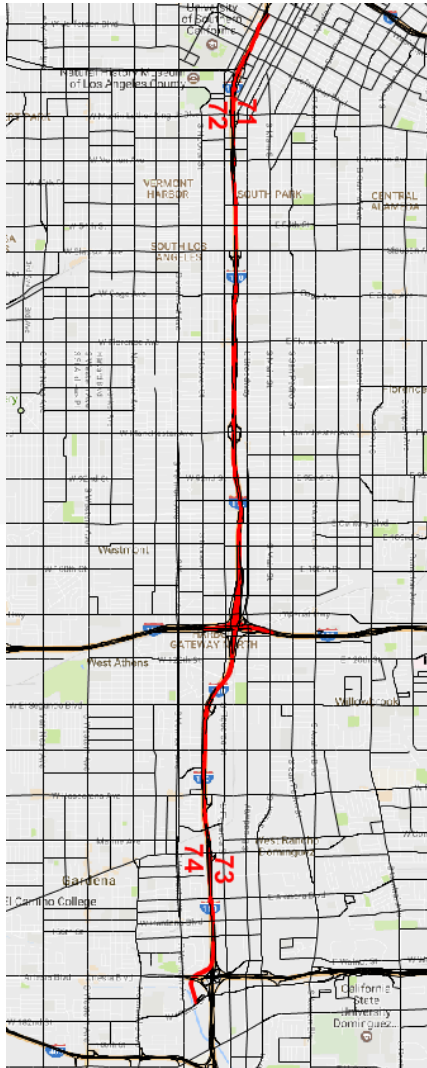
➤ Distance Based Toll

- » Toll = [Toll Rate] x Distance
  - ■ Example: Existing toll lane on I-110 between LAX and downtown

➤ Flat-rate Toll (also called Fixed-rate Toll, Toll Gates or Toll Plaza)

- » Tolls are not distance based
  - ■ Example: SR-91, SR-73, SR-133 etc.

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Coding HOT Lanes

Coding HOT lanes

» **Assumption**

1. Convert existing HOV Lanes to HOT Lanes (no geographic changes, just change link attributes)
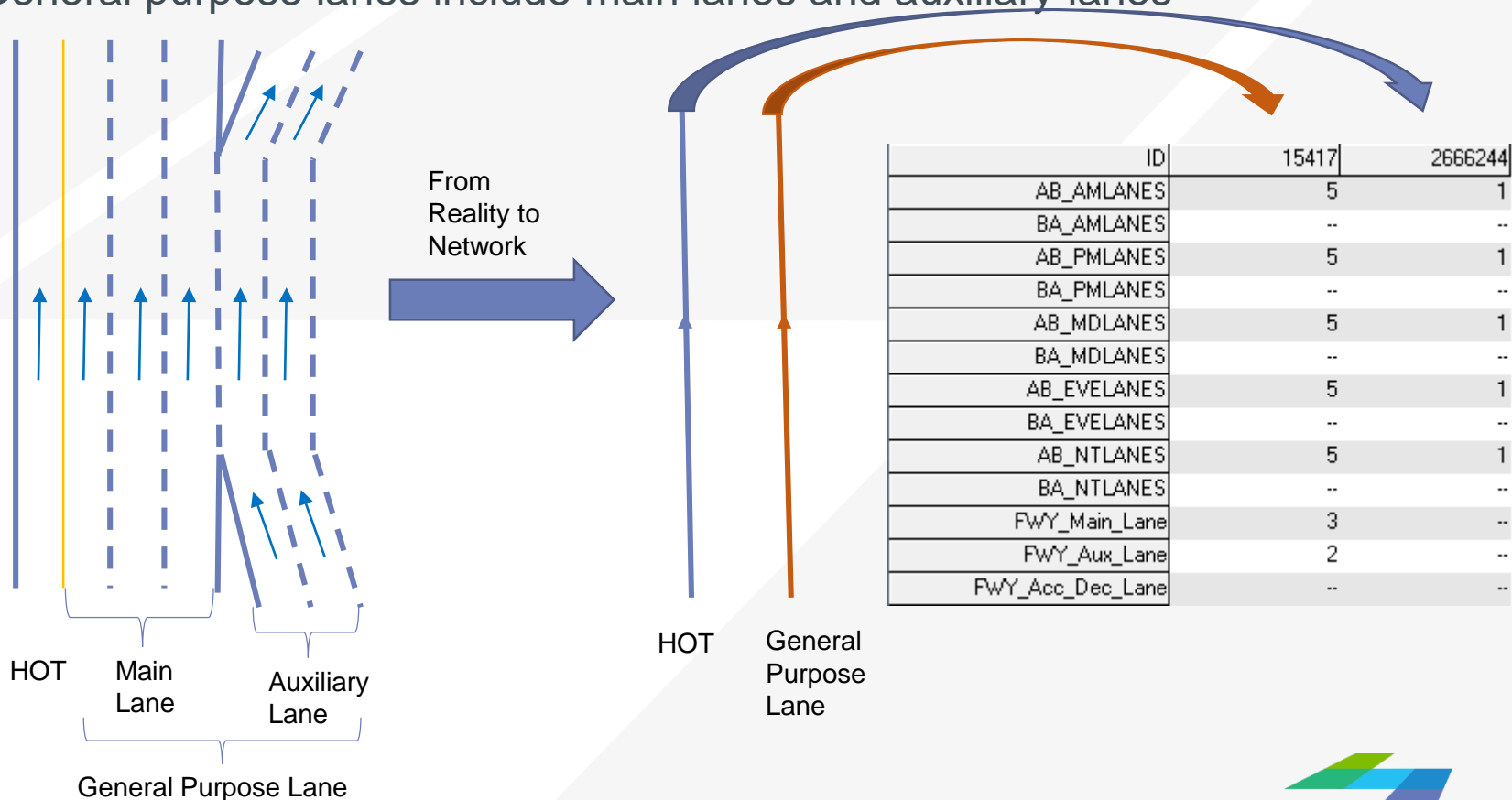
2. Toll is distance based

» **Steps**

1. Change *facility type* from 20 (the facility type for HOV lanes is 20) to 10 (freeway) or 80s (ramps)

2. *Toll_flag* = 22 (distance based toll)

3. *Per mile toll group* for autos and trucks should be 1 to 108 or null, these numbers are used to lookup toll rate from Toll_PerMile.csv. If trucks are not allowed to use the HOT lane, make *Per mile toll group for trucks* as empty.

4. Change *number of lanes (*make sure *FWY_Main_Lane* is filled).

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Changing Number of Lanes

➤ HOV lanes, general purpose lanes and auxiliary lanes

» HOV or HOT lanes and general purpose lanes are coded as different links

» General purpose lanes include main lanes and auxiliary lanes

From Reality to Network

ID	15417	2666244
AB_AMLANES	5	1
BA_AMLANES	--	--
AB_PMLANES	5	1
BA_PMLANES	--	--
AB_MDLANES	5	1
BA_MDLANES	--	--
AB_EVELANES	5	1
BA_EVELANES	--	--
AB_NTLANES	5	1
BA_NTLANES	--	--
FWY_Main_Lane	3	--
FWY_Aux_Lane	2	--
FWY_Acc_Dec_Lane	--	--

HOT Main Lane Auxiliary Lane

General Purpose Lane

HOT General Purpose Lane

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How to code "number of lanes"

» Need to fill and check all 13 fields shown to the right

» AB/BA_<Period>LANES is the number of one-directional lanes by time period including all main, auxiliary and other lanes

» FWY_Main_Lane is the number of freeway main lanes. It could be empty for links with facility type not equal to 10.

» FWY_Aux_Lane is the number of reeway auxiliary lanes. It could be empty for links with any facility types.

ID	General Purpose Lane 15417	HOT Lane 2666244
AB_AMLANES	5	1
BA_AMLANES	--	--
AB_PMLANES	5	1
BA_PMLANES	--	--
AB_MDLANES	5	1
BA_MDLANES	--	--
AB_EVELANES	5	1
BA_EVELANES	--	--
AB_NTLANES	5	1
BA_NTLANES	--	--
FWY_Main_Lane	3	1
FWY_Aux_Lane	2	--
FWY_Acc_Dec_Lane	--	--

» FWY_Acc_Dec_Lane is the number of other freeway lanes. It could be empty for links with any facility types.

» AB/BA_<Period>LANES = FWY_Main_Lane + FWY_Aux_Lane + FWY_Acc_Dec_Lane

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How to code "number of lanes" for HOT lanes

➤ HOT lanes have facility type of 10, so for HOT lanes:

» FWY_Main_Lane = AB/BA_<Period>LANES

» FWY_Aux_Lane is empty

» FWY_Acc_Dec_Lane is empty

	General Purpose Lane	HOT Lane
ID	15417	2666244
AB_Facility_Type	10	10
BA_Facility_Type	--	--
AB_PostedSpeed	65	65
BA_PostedSpeed	--	--
AB_AMLANES	5	1
BA_AMLANES	--	--
AB_PMLANES	5	1
BA_PMLANES	--	--
AB_MDLANES	5	1
BA_MDLANES	--	--
AB_EVELANES	5	1
BA_EVELANES	--	--
AB_NTLANES	5	1
BA_NTLANES	--	--
FWY_Main_Lane	3	1
FWY_Aux_Lane	2	--
FWY_Acc_Dec_Lane	--	--

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Editing Toll Rates

➤ Setting the Toll Rates for Distance Based Toll

  » Link Attribute for Toll Group
    ▪ [AB/BA]_Per_Mile_Toll_Group_[Auto/Truck]

  » Update or review the toll group csv file
    ▪ [SCAG scenario folder]\TOD\Inputs\Toll_PerMile.csv
   ▪ Make sure to check and modify the multiplicative factors for Shared-Ride 2 (SR2) and SR3+

	A	B	C	D	E	F	G	H	I	AF	AG	AH	AI	AQ
1	Toll_Link_Group	Toll_Group_Number	AM0600	AM0630	AM0700	AM0730	AM0800	AM0830	MD0900	EV2030	NT2100	FAC_SR2_AM	FAC_SR3_AM	FAC_SR3_NT
2	TLG_1	1	0.279	0.279	0.279	0.279	0.279	0.279	0.279	0.279	0.279	1	0	0
3	TLG_2	2	0.642	0.642	0.642	0.642	0.642	0.642	0.324	0.324	0.324	1	0	0
104	TLG_103	103	0.002	0.002	0.002	0.002	0.002	0.002	0	0	0	1	0	0
105	TLG_104	104	0.002	0.002	0.002	0.002	0.002	0.002	0	0	0	1	0	0
106	TLG_105	105	0.002	0.002	0.002	0.002	0.002	0.002	0	0	0	1	0	0
107	TLG_106	106	0.001	0.001	0.001	0.001	0.001	0.001	0	0	0	1	0	0
108	TLG_107	107	0.03	0.03	0.03	0.03	0.03	0.03	0	0	0	1	0	0
109	TLG_108	108	0.12	0.12	0.12	0.12	0.12	0.12	0	0	0	1	0	0
110														

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Filling the Toll Values in the Highway Network

➤ Utility - Calculate Network Tolls

» This utility updates the following network attributes

- [AB/BA] TOLLV [AM/MD/PM/EVE/NT] [DA/SR2/SR3], such as "AB TOLLV AM DA". There are 30 fields.

- HOT lanes usually exclude trucks, so the fields for truck tolls (there are 10 such fields) are all 0

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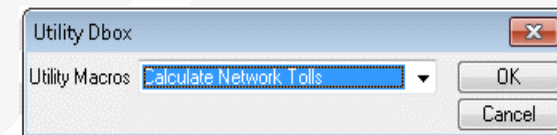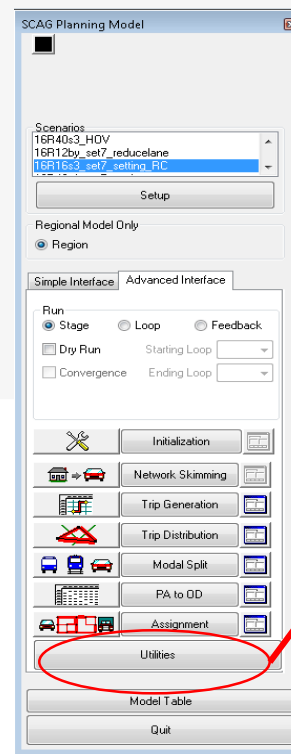
Filling the Toll Values in the Highway Network

➤ Utility Interface - Calculate Network Tolls

» Input files

  ▪ Network geographic file (\networks\Inputs*.dbd)

  ▪ Length based toll rates: Toll_PerMile.csv

  ▪ Location based toll rate: Toll_Fix.csv

Do not change default values.

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One-loop Run of the SCAG Model

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Introduction of One-loop Run

➤ 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

Steps for One-loop Run

➤ Copy your entire model scenario folder

➤ Modify the highway network file

  » The input highway network in the folder of "\networks\Inputs"

➤ Optional: Run the **Check Network Attributes** utility

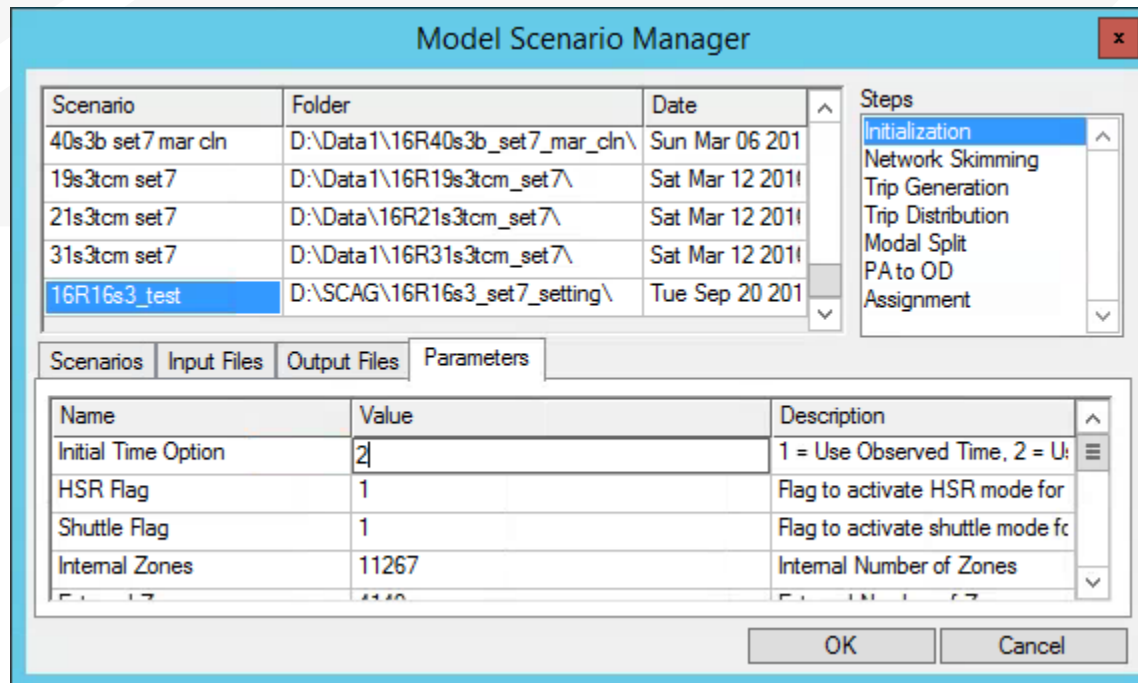# Steps for One-loop Run

➤ Run the **Mergenet Run** utility

   » This merges speed feedback results (in the folder of "\networks\Outputs") with the modified network (in the folder of "\networks\Inputs")

   » To get the value of time and auto cost, open the Model Scenario Manager" and get the values from "Parameters" for the "Initialization" Steps
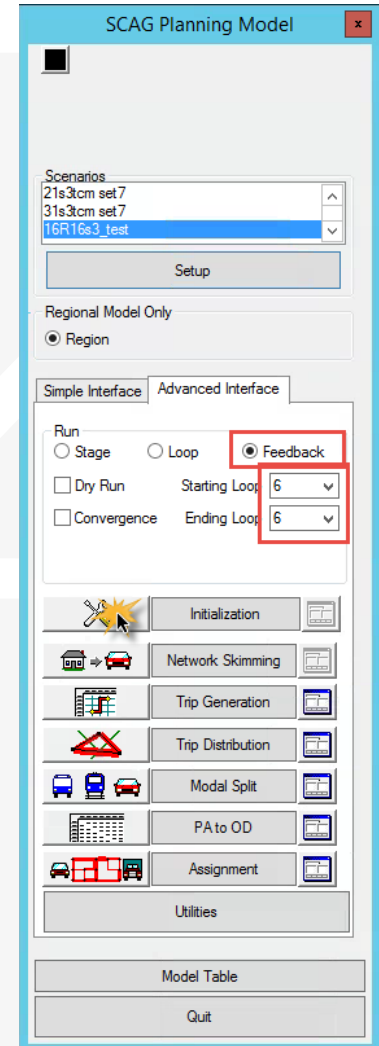
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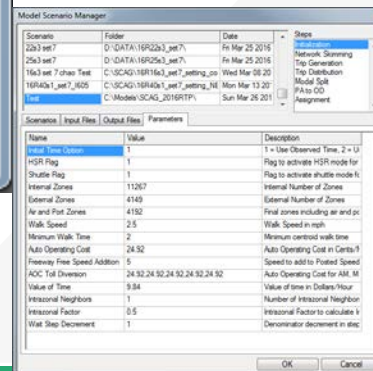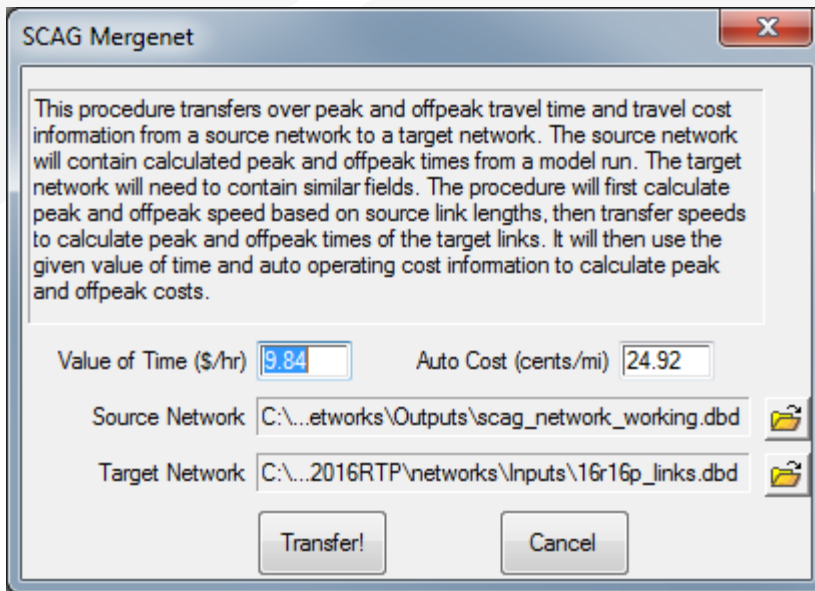
One-Loop run

➤ 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

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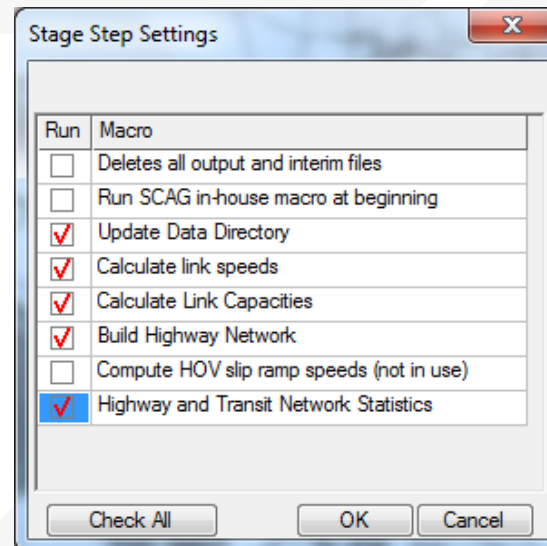
One-Loop run

➤ 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

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How to Code Toll in the SCAG RTP Model

TO: Caltrans D7

FROM: Cambridge Systematics Inc.

DATE: May 23, 2017

RE: How to Code Toll in the SCAG 2016 RTP Model (**DRAFT**)

This technical memorandum describes how to code toll in the SCAG 2016 RTP Model. It covers the following topics:

- Distance based toll

  There are two types of toll roads coded in the SCAG network. One type is distance based toll, in which a toll is charged based on the distance traveled on a toll facility. Examples include the I-10 and I-110 ExpressLanes. Distance based toll is described in Section 1.

- Flat-rate toll

  Another type is flat rate toll, in which a flat-rate toll is charged for passing through a toll barrier, despite of the distance traveled on a toll facility. Examples include SR-73, SR-133, SR-241 and SR-261. Flat rate toll is described in Section 2.

- HOT lanes

  The only difference between toll roads and High Occupancy Toll (HOT) lanes is that in HOT lanes, High Occupancy Vehicles (HOV) can travel for free and Single Occupancy Vehicles (SOV) have to pay a toll. An example of HOT lanes are SR-91 Express Lanes[1]. HOT lanes are coded in the SCAG network in a similar way as the toll roads, but with tolls for HOVs lower than SOVs. HOT lanes are described in Section 3.

- Utilities to update the toll values on each link

  The SCAG 2016 RTP Model user interface include a utility, "Calculate Network Tolls", to calculate the toll values for each toll link. This utility is described in Section 4.

---

[1] On SR-91 Express Lanes, the toll varies by time of day and day of week. But for a given time of day and day of week, the toll is fixed despite of the distance traveled on the toll facility. Carpools with three people travel toll-free during most hours (except when traveling Eastbound, Monday through Friday between the hours of 4:00 p.m. and 6:00 p.m.), and carpools with two people and SOV vehicles have to pay the same toll. Trucks are prohibited.

1.0   Distance Based Toll

In a closed toll system (also called a ticket toll system), a toll is charged based on the distance traveled on a toll facility. An example of distance based toll facility in the SCAG network is the I-10 and I-110 ExpressLanes[2].
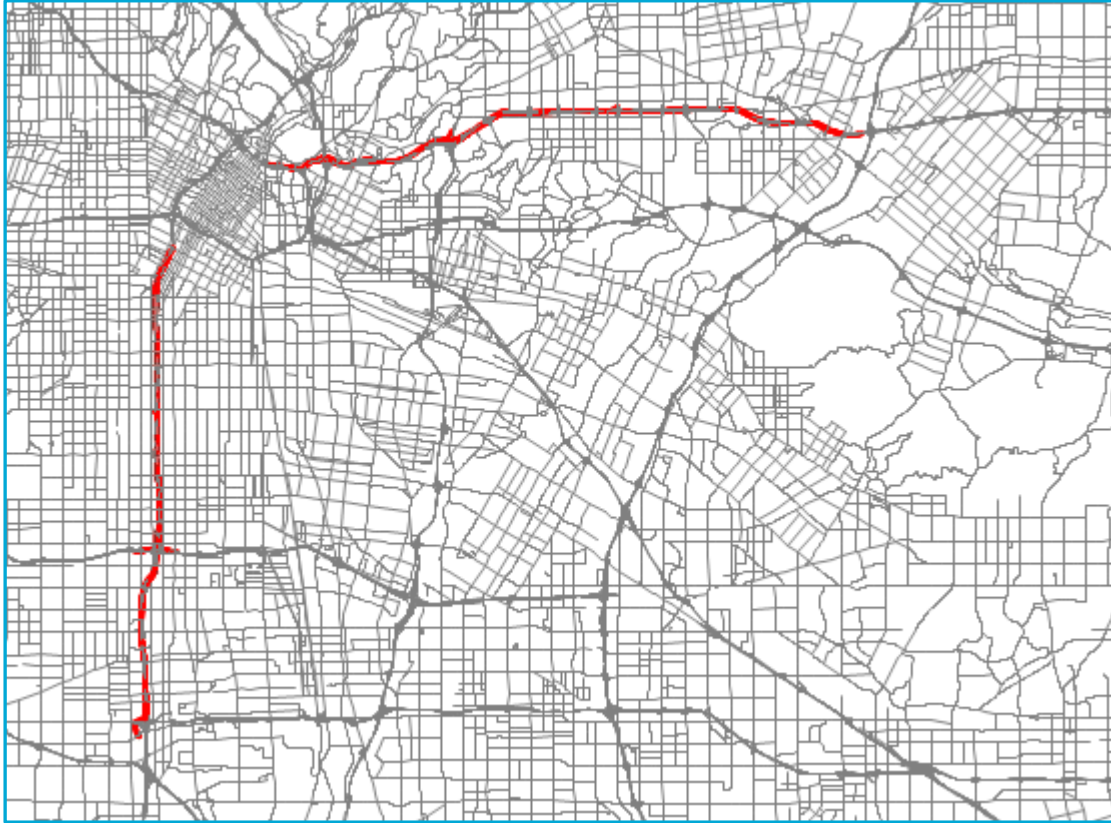

Figure 1. I-10 and I-110 ExpressLanes

Here are the key link attributes for distance based toll:

1. Link attribute "Toll_flag" is equal to 22 for all distance based toll links.

2. Link attributes "AB_Toll_Entrance" and "BA_Toll_Entrance" are all 0.

3. Link attribute "LocationID" are all null.

4. Link attributes "AB_Per_Mile_Toll_Group_Auto" and "BA_Per_Mile_Toll_Group_Auto" are within the 1 to 108. They are used to look at the auto toll value for distance based toll links

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[2] On the I-110 Express Lanes, carpools with two or more people, vanpools and motorcycles travel toll-free. The toll for SOV vehicles is varying from $0.25 per mile to $1.40 per mile, depending on the traffic condition. For more details, please refer to https://www.metroexpresslanes.net/en/home/index.shtml.

from file "Toll_PerMile.csv" in the folder of "\TOD\Inputs". This process is described in Section 4.

5. Link attributes "AB_Per_Mile_Toll_Group_Truck" and "BA_Per_Mile_Toll_Group_Truck" are within the 1 to 108. They are used to look at the truck toll value for distance based toll links from file "Toll_PerMile.csv" in the folder of "\TOD\Inputs". This process is described in Section 4.

Table 1 summaries the link attributes that must be specified to code distance based toll links.

Table 1. Link Attributes for Distance Based Toll Links

Attribute	Description	Value for Distance Based Toll Links
Toll_flag		22
[DIR]_ Toll_Entrance	Toll gate link indicator	0
LocationID	Used to look up toll for flat-rate toll links	null
[DIR]_Per_Mile_Toll_Group_Auto	Used to look up auto toll for distance based toll links	1 - 108
[DIR]_Per_Mile_Toll_Group_Truck	Used to look up truck toll for distance based toll links	1 - 108

Note: [DIR] is to be replaced by "AB" or "BA".

2.0   Flat-rate Toll

In an open toll system (also called a barrier toll system), a flat-rate toll is charged for passing through a toll barrier, despite of the distance traveled on a toll facility. Examples of flat-rate toll in the SCAG model region include SR-73, SR-133, SR-241 and SR-261[3], as shown in Figure 2.

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[3] Please refer to https://www.thetollroads.com/ for more details
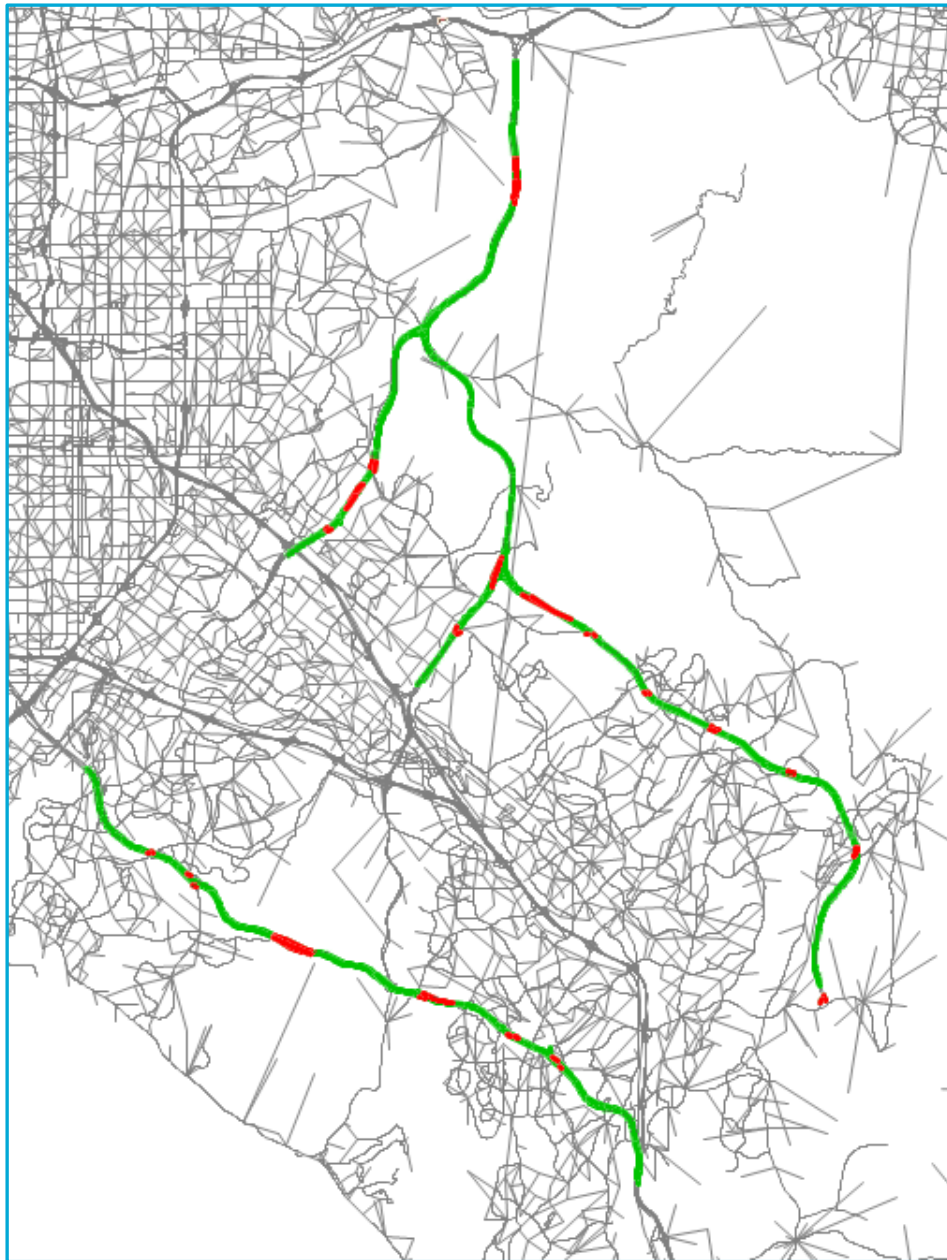
Figure 2. SR-73, SR-133, SR-241 and SR-261

Here are the key link attributes for flat-rate toll:

1. Tolls are only coded on "toll gate" links (where tolls are charged, either on ramps or on freeway segments) and they are equal to zero on other toll links.

2. Link attribute "Toll_flag" is equal to 11 for all flat-rate toll links.

3. Link attributes "AB_Toll_Entrance" and "BA_Toll_Entrance" for "toll gate" links are 32, and they are 0 for "non toll gate" links.

4. Link attribute "LocationID" for "toll gate" links is within the range of 1 to 108. "LocationID" is used to look at the toll value from file "Toll_Fix.csv" in the folder of "\TOD\Inputs". This process is described in Section 4.

5. Link attributes "AB_Per_Mile_Toll_Group_Auto" and "BA_Per_Mile_Toll_Group_Auto" are all null.

6. Link attributes "AB_Per_Mile_Toll_Group_Truck" and "BA_Per_Mile_Toll_Group_Truck" are all null.

Table 2 summaries the link attributes that must be specified to code flat-rate toll links.

Table 2. Link Attributes for Flat-rate Toll Links

Attribute	Description	Value for "Toll Gate" Links	Value for "Non Toll Gate" Links
Toll_flag		11	11
[DIR]_ Toll_Entrance	Toll gate link indicator	32	0
LocationID	Used to look up toll for flat-rate toll links	1 to 108	null
[DIR]_Per_Mile_Toll_Group_Auto	Used to look up auto toll for distance based toll links	null	null
[DIR]_Per_Mile_Toll_Group_Truck	Used to look up truck toll for distance based toll links	null	null

Note: [DIR] is to be replaced by "AB" or "BA".

3.0   High Occupancy Toll Lanes

The only difference between toll roads and HOT lanes is that in HOT lanes, HOV can travel for free and SOV have to pay a toll. HOT lanes are coded in the SCAG network in a similar way as the toll roads, but with tolls for HOVs lower than SOVs.

In both look up tables for distance based toll ("Toll_PerMile.csv") and flat-rate toll ("Toll_Fix.csv"), there is a multiplier for HOV2. When this multiplier is 1, HOV2 pays the same toll as SOV; and when it is 0, HOV2 pays no toll. Similarly, there is a multiplier for HOV3. For HOT lanes, these multipliers are normally 0.

 Therefore, to code HOT lanes,

- Link attributes described in Section 1 and Section 2 should be used. Actually I-10 and I-110 ExpressLanes shown in Section 1 are HOT lanes.

One exception is SR-91 Express Lanes[4]. It has "Toll_flag" of 21, instead of 22.

- The per mile toll group should be defined carefully in "Toll_PerMile.csv" to reflect that HOV pays less toll than SOV on distance based toll links

- The LocationID should be defined carefully in "Toll_Fix.csv" to reflect that HOV pays less toll than SOV on flat-rate toll links

4.0 Toll Look-up Tables and Toll Calculations

4.1 Toll look-up tables for distance based toll

File Name: Toll_PerMile.csv

File Directory: \TOD\Inputs

Sample View:

	A	B	C	D	E	F	G	H	I	AF	AG	AH	AI	AQ
1	Toll_Link_Group	Toll_Group_Number	AM0600	AM0630	AM0700	AM0730	AM0800	AM0830	MD0900	EV2030	NT2100	FAC_SR2_AM	FAC_SR3_AM	FAC_SR3_NT
2	TLG_1	1	0.279	0.279	0.279	0.279	0.279	0.279	0.279	0.279	0.279	1	0	0
3	TLG_2	2	0.642	0.642	0.642	0.642	0.642	0.642	0.324	0.324	0.324	1	0	0
104	TLG_103	103	0.002	0.002	0.002	0.002	0.002	0.002	0	0	0	1	0	0
105	TLG_104	104	0.002	0.002	0.002	0.002	0.002	0.002	0	0	0	1	0	0
106	TLG_105	105	0.002	0.002	0.002	0.002	0.002	0.002	0	0	0	1	0	0
107	TLG_106	106	0.001	0.001	0.001	0.001	0.001	0.001	0	0	0	1	0	0
108	TLG_107	107	0.03	0.03	0.03	0.03	0.03	0.03	0	0	0	1	0	0
109	TLG_108	108	0.12	0.12	0.12	0.12	0.12	0.12	0	0	0	1	0	0
110														

Notes:

1. In the sample view, Rows 4 to 103, Columns J to AE, and Columns after AQ are hidden.

2. There are 108 toll group numbers. This limit can be changed at the setting table (Parameter "TOD NumTollGroups" in the "PA to OD" Step).

3. Columns C to AG specifies the SOV toll rate (dollars per mile) for each toll group and for each 30-min interval from 6:00 to 21:00.

4. Columns AH to AQ specifies the multiplicative factors to convert the SOV toll rate to HOV2 and HOV3+ toll rate by time period. In these fields SR2 means shared ride with two persons in the car (equivalent to HOV2), and SR3 means shared ride with three or more

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[4] On SR-91 Express Lanes, the toll varies by time of day and day of week. But for a given time of day and day of week, the toll is fixed despite of the distance traveled on the toll facility. Carpools with three people travel toll-free during most hours (except when traveling Eastbound, Monday through Friday between the hours of 4:00 p.m. and 6:00 p.m.), and carpools with two people and SOV vehicles have to pay the same toll. Trucks are prohibited. For more information, please refer to https://www.91expresslanes.com/.

persons in the car (equivalent to HOV3+). They are 0 if HOV2 and/or HOV3+ can use the facility for free (HOT lanes).

5. Column B "Toll_Group_Number" is used to look up the toll values.

6. The following fields from the highway link attribute table are used to match to Column B "Toll_Group_Number" in "Toll_PerMile.csv" for the look up process:

>   AB_Per_Mile_Toll_Group_Auto
>
>   BA_Per_Mile_Toll_Group_Auto
>
>   AB_Per_Mile_Toll_Group_Truck
>
>   BA_Per_Mile_Toll_Group_Truck

4.2   Toll look-up tables for flat-rate toll

File Name: Toll_Fix.csv

File Directory: \TOD\Inputs

Sample View:

|	A	B	C	D	E	I	J	K	L
1	LocationID	LocationName	LocationDir	DA AM Toll Auto	DA MD Toll Auto	SR2 toll multiplier	SR3 toll multiplier	AM Toll Truck	MD Toll Truck
2	1	Orange Grove	N	1.67	1.67	1	1	3.34	3.34
3	2	Orange Grove	S	1.92	1.67	1	1	3.85	3.34
4	3	Irvine Blvd - East	N	0.89	0.89	1	1	0.89	0.89
42	41	SR91 Express Lanes	E	2.18	2.72	1	0		
43	42	SR91 Express Lanes	W	4.61	2.4	1	0		
44	101	Oso Pkwy to Cow Camp Rd (RTP: ORA052)	N	2.72	2.46	1	1	4.55	4.55
45	102	Oso Pkwy to Cow Camp Rd (RTP: ORA052)	S	2.46	2.46	1	1	5.02	4.55
46	103	Cow Camp Rd NB OFF (RTP: ORA052)	N	2.1	1.9	1	1	4.55	4.55
47	104	Cow Camp Rd SB ON (RTP: ORA052)	S	1.9	1.9	1	1	5.02	4.55
48	105	Avenida Pico NB OFF (RTP: ORA052)	N	0.95	0.95	1	1	4.55	4.55
49	106	Avenida Pico SB ON (RTP: ORA052)	S	0.95	0.95	1	1	5.02	4.55
50	107	SR710 North Tunnel Extension (RTP: 1M0101)	N	0.5	0.4	1	1	0.5	1
51	108	SR710 North Tunnel Extension (RTP: 1M0101)	S	1	0.4	1	1	1	0.5
52									

Notes:

1. In the sample view, Rows 5 to 41, Columns F to H, and Columns after L are hidden.

2. There are 108 location IDs.

3. Columns D to H specifies the SOV toll values (dollars) for each location and for each time period (AM, MD, PM, EVE and NT).

4. Columns I and J specifies the multiplicative factors to convert the SOV toll rate to HOV2 and HOV3+ toll rate. They are 0 if HOV2 and/or HOV3+ can use the facility for free (HOT lanes).

5. Columns K to O specifies the truck toll values (dollars) for each location, for each time period (AM, MD, PM, EVE and NT).

6. Column A "LocationID" is used to look up the toll values.

7. Field "LocationID" from the highway link attribute table are used to match to Column A "LocationID" in "Toll_Fix.csv" for the look up process.
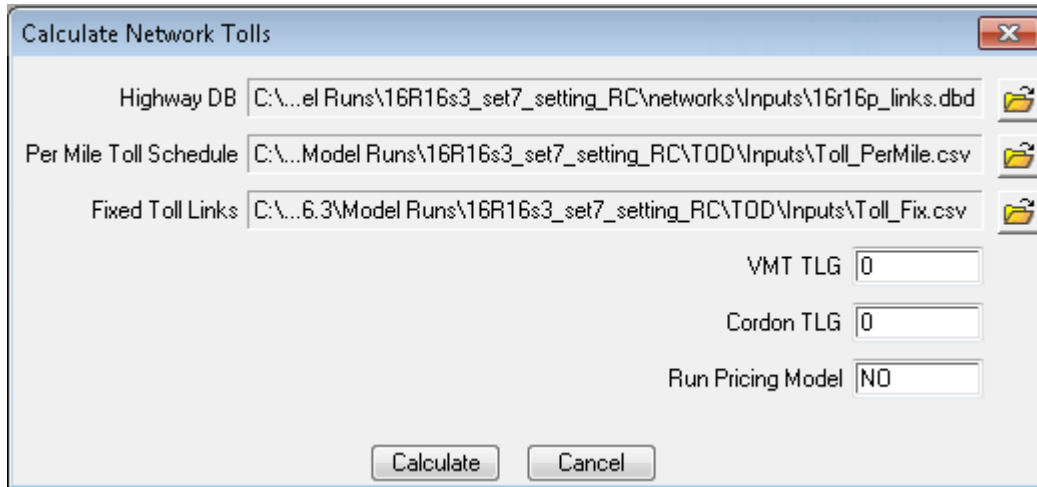
4.3   Utility to calculate network tolls

Steps to Run the Utility to Calculate Network Tolls:

1. On the SCAG user interface, click the "Utilities" button to open the "Utility Dbox" window.
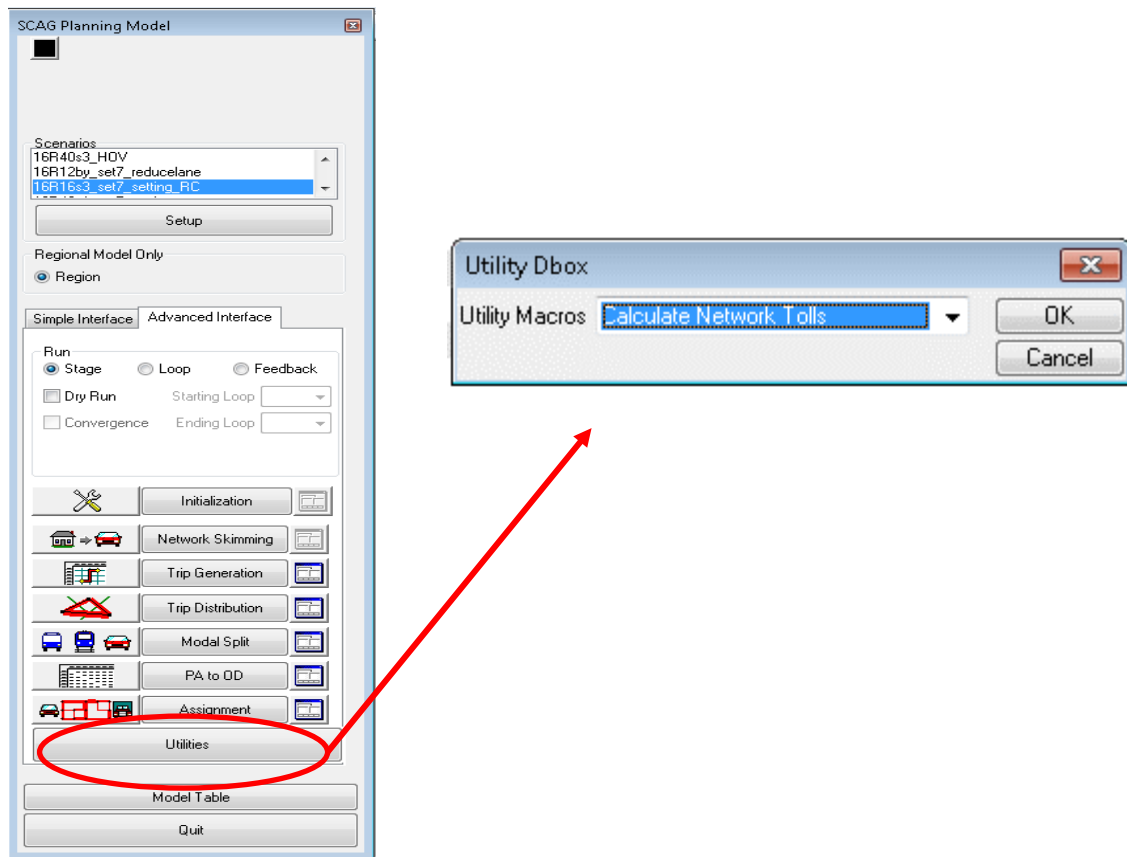
2. Select "Calculate Network Tolls" from the drop down list.

3. Click the "OK" button to open the "Calculate Network Tolls" window.

4. Choose the correct input files:

Highway DB: SCAG highway network file, such as "\networks\Inputs\16r16p_links.dbd".

Per Mile Toll Schedule: the look-up table for distance based toll, such as "\TOD\Inputs\Toll_PerMile.csv"

Fixed Toll Links: the look-up table for flat-rate toll, such as "\TOD\Inputs\Toll_Fix.csv"

5. Don't change the values for "VMT TLG", "Cordon TLG" and "Run Pricing Model".

6. Click the "Calculate" button to run the utility.

4.4   Fields filled by the utility to calculate network tolls

After running the utility "Calculate Network Tolls", this utility fills some fields in the SCAG highway network file (the Highway DB file specified when running this utility). Table 3 summaries these fields.

Table 3. Link Attributes filled by the Utility to Calculate Network Tolls

Attribute	Description	Value for "Toll Gate" Links or Distance Based Toll Links	Value for "Non Toll Gate" Links
[DIR] TOLLV [PER] DA	Toll for drive-alone vehicles by direction and time period (in dollars)	SOV toll	0
[DIR] TOLLV [PER] SR2	Toll for shared-ride-2 vehicles by direction and time period (in dollars)	HOV2 toll, which is SOV toll multiplied by the factor for HOV2	0
[DIR] TOLLV [PER] SR3	Toll for shared-ride-3 vehicles by direction and time period (in dollars)	HOV3+ toll, which is SOV toll multiplied by the factor for HOV3+	0
[DIR]_[PER]_FX_TOLL_TRK	Fixed toll for trucks by direction and time period (in dollars)	Truck toll	0
[DIR] TOLLV [PER] TRK	Toll for trucks	= [DIR]_[PER]_FX_TOLL_TRK	0

Note: [DIR] is to be replaced by "AB" or "BA"; [PER] is to be replaced by "AM", "PM", "MD", "EVE" or "NT".