9.3 Auto Operating Costs and Pricing User Guide Setup

9.3.1 Auto Operating Cost User Guide Setup

9.3.1.1 Step 1: Determine AOC for scenario year

Auto Operating Cost must be determined as a SACSIM19 user input. See section Auto Operating Costs section above on how to compute AOC based on scenario year.

9.3.1.2 Step 2: Set AOC in SACSIM19 Script (.s) file

Open SACSIM19 model run script to update the auto cost input variable *auto_cost_per_mile* as shown in Figure 9-3.

Figure 9-3 SACSIM19 Auto Cost and User Fee Inputs

```
;========================================================================

;Set per-mile auto operating cost here
auto_cost_per_mile = 0.162
userfee_per_mile =   0.014
```

9.3.2 Mileage Based User Fee User Guide Setup

9.3.2.1 Step 1: Determine Scenario Mileage Based User Fee

Determine mileage-based user fee for scenario. SeeAppendix D Fuel Tax and Mileage Fee Report for further description and examples. Must convert mileage-based fees back to 2000 dollars for SACSIM19 use.

9.3.2.2 Step 2: Set User fee in SACSIM19 (.s) file

Open SACSIM19 model run script to update the initial mileage-based user fee input variable *userfee_per_mile*. If not user fee is desired for the scenario, *userfee_per_mile* should be set to 0.00. For a flat user fee per mile, *userfee_per_mile* is the only input required. If time period or spatial adjustments are need additional inputs are required. Regardless, it is important to review other user fee inputs to confirm they are set on or off properly.

9.3.2.3 Step 3: Spatial and Time Period Fee Adjustments

Spatial and temporal components can be set using the *RAD_Userfee.csv* input file in the Scenario run folder. Table 9-3 describes the four inputs in the *RAD_Userfee.csv* required and an example with and without the mileage based fee adjustments. Figure 9-4 shows an example of the *RAD_Userfee.csv*.

Table 9-3 Spatial and Temporal Mileage-Based Fee Adjustment

Header (Not in actual file)	RAD	Multiplicative Factor	Peak Adjustment	Off Peak Adjustment
Required input description	Regional Analysis Distract Spatial Geography where factor will apply to roadways. **Default is all RAD Zones within region.**	Factor used to multiple userfee_per_mile input. **Default is 1.**	Peak congestion rate adjustment factor applied to AM (7am-10am) and (4PM – 6PM) peak hours. **Default is 0.**	Off Peak period discount rate during non-congested times applied to Evenings (7-9), Nighttime (10-5am) and Midday. **Default is 0**
Example Spatial Adjustment **Turned On**	1	2	0.007	-0.007
Example Spatial Adjustment **Turned Off**	1	1	0	0

Figure 9-4 RAD_Userfee.csv Example

26	26	1	0.007	-0.007
27	27	2	0.007	-0.007
28	28	1	0.007	-0.007

RAD_UserFee

9.3.3 Facility Pricing User Guide Setup

SACSIM19 requires two facility pricing inputs:

- Network Segment Identification
- Toll Input Cost
- Model Run Script *(only for adjusting all-lane toll facility)*

9.3.3.1 Step 1: Network Segment Identification

Open the base network, typically named **<scenario year>_base.net.** Every priced facility must have a TOLLID number associated. For parallel general purpose and auxiliary lanes. The same ID number must be assigned to GPID (general purpose lanes) and AUXID (auxiliary lanes). This is used to determine the cost of the managed facility relative to the congestion on the parallel "free" facilities. Depending on the type of managed lane, USECLASS must also be set with a value of 0, 2, or 3 to determine the allowed vehicle type on the managed facility. Zero allows all users to drive on the facility being priced. Note, USECLASS does not determine which vehicles are priced, the prices are set in the Toll Input File described below. Two refers to vehicle occupancy of 2+ and 3 allows vehicle with 3 or more passengers only to enter the facility. Figure 9-5Figure 2-8 shows an example of a managed lane facility coding on the base network. In this example all vehicle types are allowed on the managed lane facility. For more information on other network attributes that may influence the network toll segment see chapter 4 on Highway Network.

9.3.3.1.1 Define Network Toll Segment

Defining toll segment distance and extents is an important input to determine the cost and utilization of the priced facility. Each toll segment has multiple links, but only one TOLLID identifier, one GPID identifier, and one AUXID identifier (if auxiliary lane exists along segment). Travel time savings is taken as the total toll segment time minus the total general-purpose segment time, and if any V/C ratio link is greater than the level of service threshold, cost increases. Taking into consideration distance, number of lanes, interchanges, ramps, and speeds is important for a priced facility to work properly. Figure 9-6 shows an example where the number of lanes and demand of the highway facility changed for different toll segments were defined before and after the ramps.

Figure 9-5 Base Network Toll ID Coding

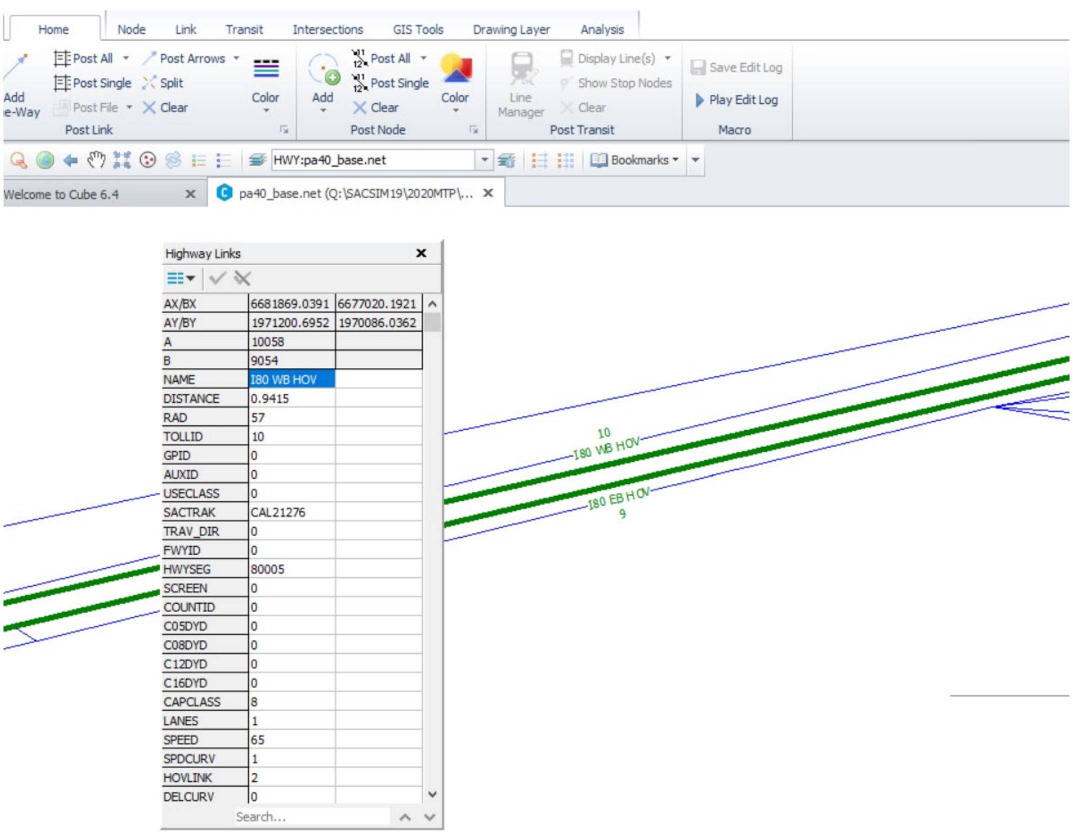
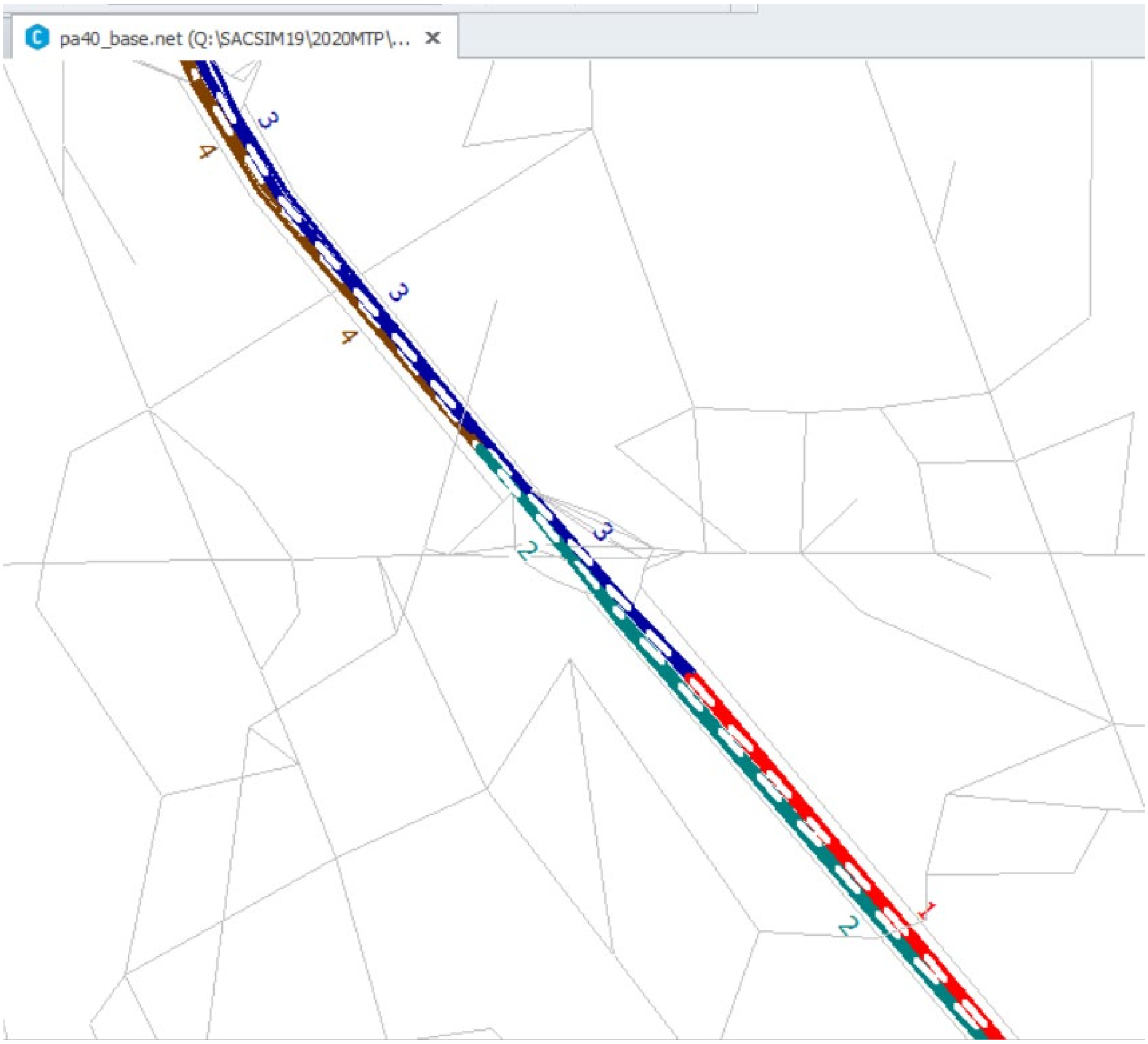


Figure 9-6 Multiple Toll Segments Identified on Network



9.3.3.1.2 Define Network General Purpose and Auxiliary Segment

Since the travel time from the general-purpose lane is needed to compare savings to the priced facility, the general purpose segment length must be the same distance as the priced facility distance. If these distances are too far off this will affect the travel time savings function. For this reason, if the total general-purpose distances less or greater than 0.25 miles different from the priced facility, SACSIM will immediately error out. These lengths can be checked in the tollseg_length.csv file created during SACSIM initial setup. Auxiliary lanes are not used in the pricing optimization algorithm and therefore do not require and maximum or minimum lengths. Auxiliary lanes need to be coded to ensure the vehicles do not skip the facility all together and allow the total volume across all lanes to be accounted for.

9.3.3.1.3 Define Network Segments for All-Lane Toll Facility

To define an all-lane toll facility. The TOLLID must be identified for all lanes, including what may have been previously coded as general-purpose lanes or auxiliary lanes. Additionally, the model run script input variable *AllLaneToll* must be set from 0 (default) to 1, as shown in Figure 9-7. Since the toll optimization loop is based off the travel time savings from the parallel free option, the dynamic pricing is not available for all toll facilities, instead users will have to specify the cost of the toll as an input in the toll cost file *toll.csv*.

Figure 9-7 SACSIM19 All-lane Toll Facility Input

```
; this block of code calculates the total length of each toll segments, which will later be used to apportion tolls to each link
   AllLaneToll = 0 ;1 True, 0 False. Turn true if all lane toll facilities exist.
   run pgm = hwynet  MSG='step 0 Calculate toll segment length'
```

9.3.3.2 Step 2: Toll Cost File

The TOLLID coded on the network identifies the toll segments. The costs by vehicle types then need to be associated and defined to the network toll segments. This is done in the Toll Input Cost File *tolls.csv***.** Each row represents a unique TOLLID segment by time period. For every tolled there will be nine additional rows added to the input file (1 tollid X 9 SACSIM time periods). Table 9-4 describes the columns required for the toll cost file. Table 9-5 Toll Cost Input Example shows an example of the Toll Input Cost File with one toll segment. The actual csv file does not have column headers and must be written in the same order as Table 9-4.

Table 9-4 Toll Cost Inputs

Input Order	Columns	Description	Value Type
1	Facility Index	unique ID for a link during a time period: toll_gp_id*100 + period	Unique Integer >100 (based on Segment Number and period)
2	Segment #	corresponds to TOLLID, GPID, and AUXID in model network	Unique Integer
3	period	SACSIM time period	1-9
4	adjustment	1/0 indicating if toll optimization algorithm is applied	Binary (0-1)
5	toll_da	starting toll value for drive-alone	2000 dollar
6	toll_s2	starting toll value for HOV2	2000 dollar
7	toll_s3	starting toll value for HOV3	2000 dollar
8	toll_cv	starting toll value for commercial vehicles	2000 dollar
9	mintoll_da	minimum toll value for drive-alone	2000 dollar
10	mintoll_s2	minimum toll value for HOV2	2000 dollar
11	mintoll_s3	minimum toll value for HOV3	2000 dollar
12	mintoll_cv	minimum toll value for commercial vehicles	2000 dollar
13	maxtoll_da	maximum toll value for drive-alone	2000 dollar
14	maxtoll_s2	maximum toll value for HOV2	2000 dollar
15	maxtoll_s3	maximum toll value for HOV3	2000 dollar
16	maxtoll_cv	maximum toll value for commercial vehicles	2000 dollar
17	Reversable Lane AM	add managed lane(s), remove opposite flow general purpose lane, during AM peak period (7-10am), general purpose removal should be on different toll segment ID.	positive integer to add managed lane(s), negative integer to remove general purpose lane(s)
18	Reversable Lane PM	add managed lane(s), remove opposite flow general purpose lane, during PM peak period (3-6pm), general purpose removal should be on different toll segment ID.	positive integer to add managed lane(s), negative integer to remove general purpose lane(s)

Input Order	Columns	Description	Value Type
19	Shoulder lane AM	add managed lane(s) during AM peak period (7-10am), assumption is shoulder space is converted to a managed or general purpose along the facility adding width for an additional managed lane.	positive integer to add managed lane(s)
20	Shoulder lane PM	add managed lane(s), during PM peak period (3-6pm)	positive integer to add managed lane(s)
21	Take a Lane AM	add managed lane(s), remove adjacent general-purpose lane, during AM peak period (7-10am)	positive integer to add managed lane(s), (will subtract value from general purpose lane(s))
22	Take a Lane PM	add managed lane(s), remove adjacent general-purpose lane, during PM peak period (3-6pm)	positive integer to add managed lane(s), (will subtract value from general purpose lane(s))

Table 9-5 Toll Cost Input Example

Fac. Index	Seg.	Per.	Fac. Type	Adjust	Toll DA	Toll S2	Toll S3	Toll CV	Min DA	Min S2	Min S3	Min CV	Max DA	Max S2	Max S3	Max CV	Reversable Lane AM	Reversable Lane PM	Shoulder lane AM	Shoulder lane PM	Take a Lane AM	Take a Lane PM
101	1	1	2	1	1	0	0	2	0.1	0	0	0.2	30	0	0	30	0	0	0	0	0	0
102	1	2	2	1	1	0	0	2	0.1	0	0	0.2	30	0	0	30	0	0	0	0	0	0
103	1	3	2	1	1	0	0	2	0.1	0	0	0.2	30	0	0	30	0	0	0	0	0	0
104	1	4	2	1	1	0	0	2	0.1	0	0	0.2	30	0	0	30	0	0	0	0	0	0
105	1	5	2	1	1	0	0	2	0.1	0	0	0.2	30	0	0	30	0	0	0	0	0	0
106	1	6	2	1	1	0	0	2	0.1	0	0	0.2	30	0	0	30	0	0	0	0	0	0
107	1	7	2	1	1	0	0	2	0.1	0	0	0.2	30	0	0	30	0	0	0	0	0	0
108	1	8	2	1	1	0	0	2	0.1	0	0	0.2	30	0	0	30	0	0	0	0	0	0
109	1	9	2	1	1	0	0	2	0.1	0	0	0.2	30	0	0	30	0	0	0	0	0	0

Referring to the Input Order Column of Table 9-4:

Inputs 1-3 are used to tie the network toll links identified to the cost per time period. Input 1 should be calculated by input 2 * 100 + input 3. If additional time periods or toll segments are added, these rows will need to be expanded on in the same format for every new toll segment added to the network.

If a scenario requires no toll pricing, Inputs 4-22 should all be set to zero.

Input 4 adjustment if the toll optimization algorithm is turned on or off. This must be turned on to use the dynamic pricing. There are a few reasons to turn off:

- User want toll prices fixed, may have already determined the optimal cost or running post processing assignments.
- All toll lane scenario or facility is being applied
- For testing purpose, user wants to reduce model run time.

Inputs 5-8 are user specified initial toll prices by four mode vehicle classifications. These values are put into model as part of the initial cost function and then adjusted during the toll optimization loop. If a fixed or all lane toll scenario is being ran, the initial inputs will also be the final cost. Based on default settings, the toll optimization loop is set to run a maximum of five iterations. If toll price curve results seem too high or too low based on no osculation occurring or not enough convergence in price, it is recommended to start the next run with a higher or lower initial toll to help convergence to occur within the 5 iterations.

- DA = drive alone or single occupancy vehicle
- S2 = Shared Occupancy Vehicle with two persons (SOV2)
- S3+ = Shared Occupancy Vehicle with three or more persons (SOV3+)
- CV = Commercial Vehicles, currently defined as SACSIM category CV 2 axle, 3+ axle CVs are not allowed access to managed lanes. This can be adjusted in the model run script.

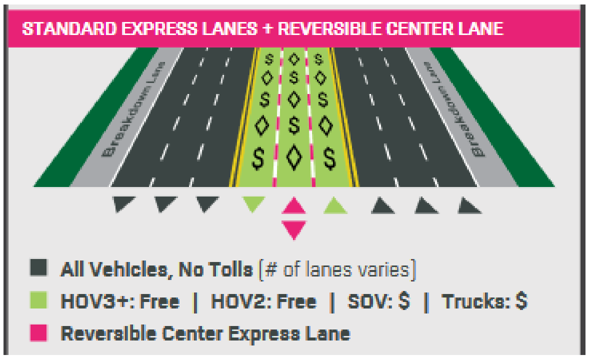
Inputs 9-16 are user specified toll prices constraints. Inputs 9-12 are the minimum by set price by mode. Input 13-16 are the maximum price by mode. For example, if a minimum toll price was set to $1.00 and a maximum to $10.00, the final price must be at or between these upper and lower bounded constraints regardless of demand, or lack thereof, along the facility. Since the toll optimization loop sets the price based on the vehicle demand, the more constraints added the less likely the algorithm can find the optimal price to set.

Inputs 17-22 are user specified lane configuration adjustments on both the general purpose or “free” lanes and the managed lanes or “priced” lanes.

Inputs 17 and 18 add reversable lanes to the priced facility to the peak period: 17: 3 AM peak hours 7-8, 8-9, 8-10 am, 18: 3 PM peak hour 3-4,4-5,5-6 pm. If positive value is entered to a toll segment, a priced lane(s) will be added. If a negative value is added a general-purpose lane(s) will be added.

Using this logic, to maintain the number of lanes defined in the scenario base network file, a negative value should always be assigned to the parallel opposite direction toll segment ID. If no negative number is specified, an additional lane is added to the network. Figure 9-8 shows an example of a reversable lane as an additional middle lane that can reverse directions based on the peak period traffic flow directional demand of travel.

Figure 9-8 Express Lane Configuration: Reversible Center Lane



Inputs 19 and 20 add a managed lane(s) during AM peak period (7-10am) and PM peak periods (3-6pm) respectively. SACSIM19 assumption is shoulder space is converted to a managed or general purpose along the facility adding width for an additional managed lane. Since SACSIM19 assignment is a "stick and ball" network, land configuration curvature and geometry is not accounted for at the demand level software. Nor is type of pricing facility implementation infrastructure design. Microsimulation or CAD software's may be used to determine if adding a shoulder lane scenario is realistic based on a roadway geometry. SACSIM19 simple provides the capability to add or remove the lane during assignment. Figure 9-9 shows an example of a shoulder or breakdown lane converted into an additional lane during peak periods.

Figure 9-9 Express Lane Configuration: Flexible Breakdown Lane

Inputs 21 and 22 add an additional managed during AM peak period (7-10am) and PM peak periods (3-6pm) respectively by removing a general-purpose lane during the defined time period. This allows scenarios with multilane express lanes during times of high demand to manage congestion, and "free" or general-purpose lanes during lower demand. An facility example of could be a highway with high morning peak congestion into downtown in the mornings, however, during the PM the traffic may be more evenly dispersed throughout the duration of the afternoon evening and not require as many managed lanes available. Figure 9-10 shows an example of a multi-lane express lane configuration where a "Take A Lane" may be applied.

Figure 9-10: Multilane Express Lane