

A photograph of a crowded transit station platform. A white and yellow train with the number 237 and the destination 'Downtown' is stopped at the platform. A large group of people is waiting on the platform, some standing and some sitting. The scene is set outdoors with trees and a building in the background.

SACSIM19: Transit Modeling

Presented at 2020 SACOG Model Users Conference

Feb 24-25, 2020



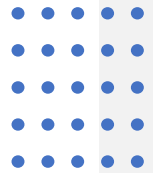
Workshop Goals

1. Explain concepts SACSIM uses to model transit service and demand
2. Review approaches to validating SACSIM's ability to model transit demand
3. Go through standard transit data outputs from model and specific use cases
4. Describe current developments and planned model updates
5. Host an open discussion for questions, ideas, and suggestions related to SACSIM's transit model.



Workshop Format

- We will pause to answer *clarifying* questions (e.g. defining a term used by the presenter or in a slide) during the presentation.
- More in-depth questions (e.g. how to do some modeling task, etc.) will be addressed during the open forum after the presentation.



Taking a SACSIM Transit Trip



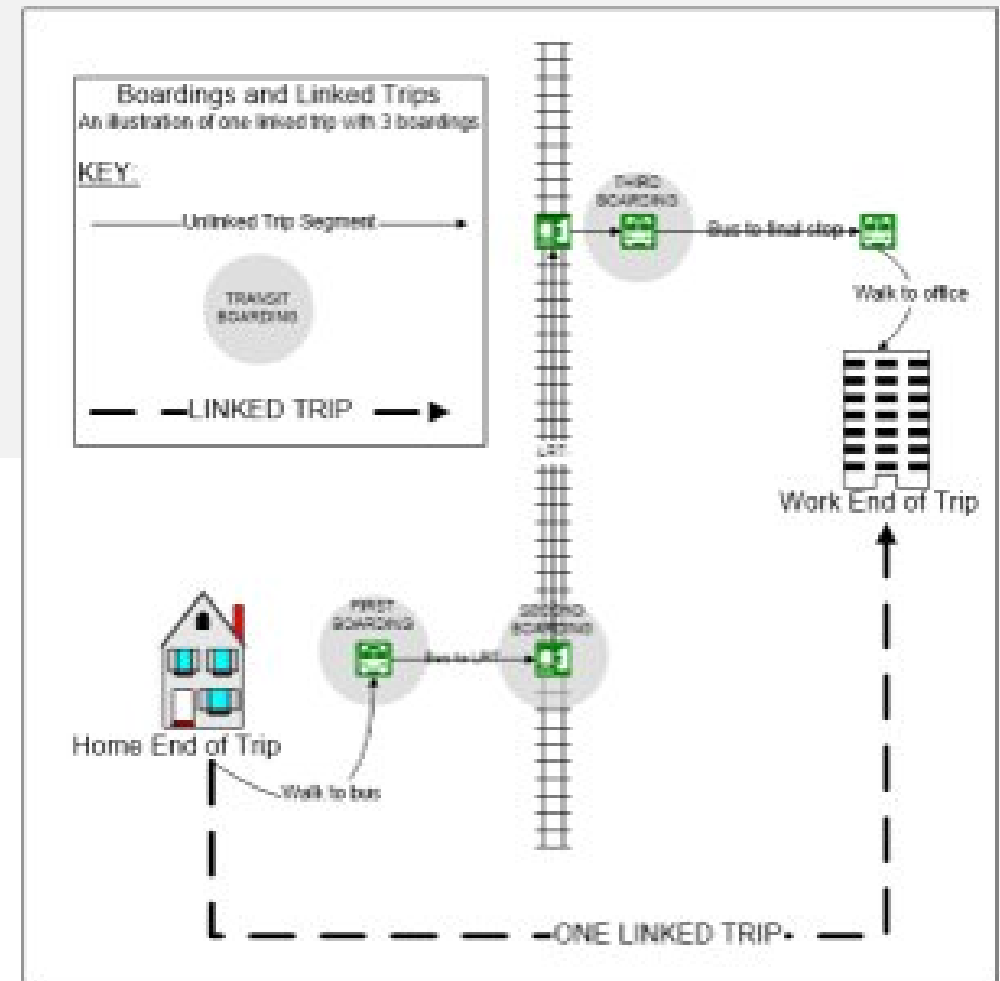


Deciding to Use Transit

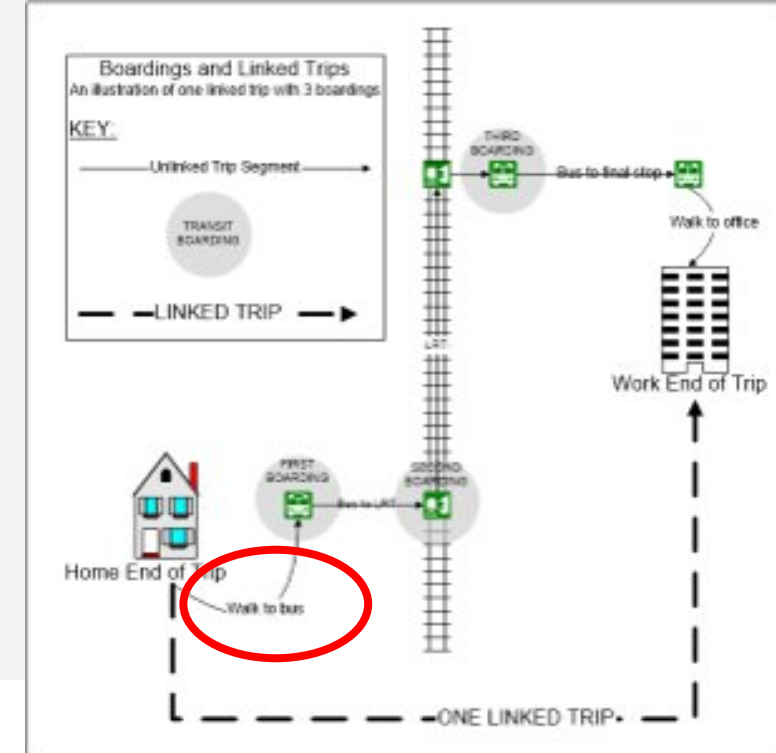
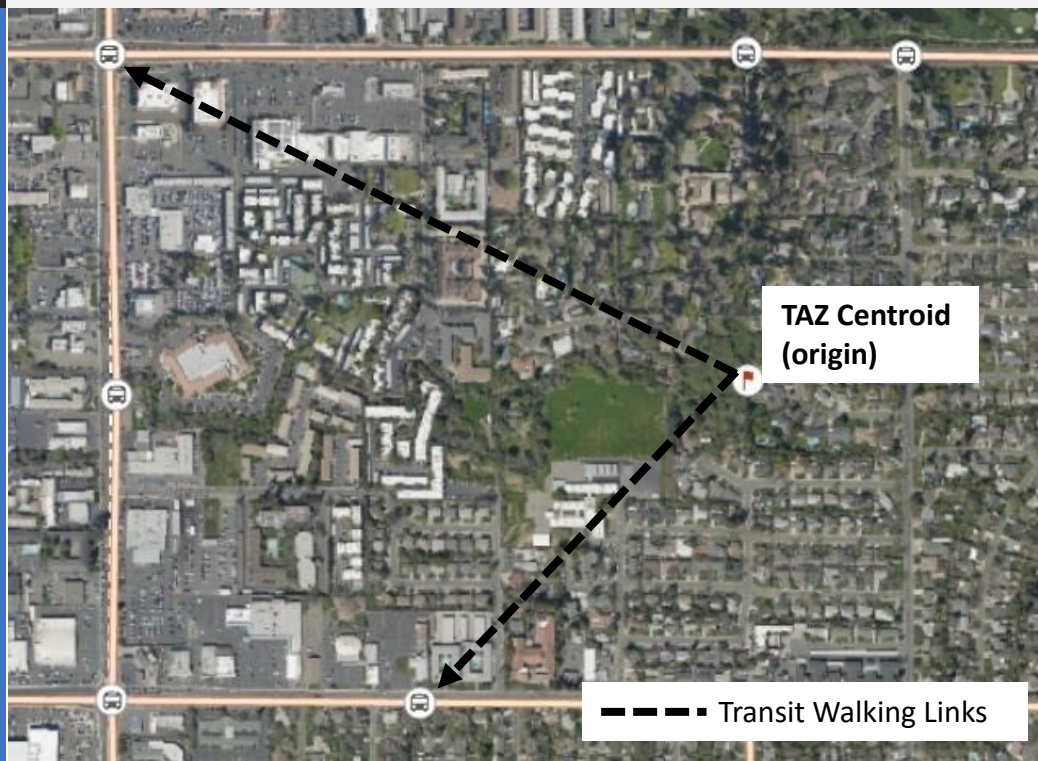
- Mode choice model determines which mode a traveler will use for a given trip
- Key factors (among others!) in deciding whether to use transit
 - Total travel time
 - Money cost (fare, fees at park-n-ride lots, etc.)

Parts of a SACSIM Transit Trip: Overview

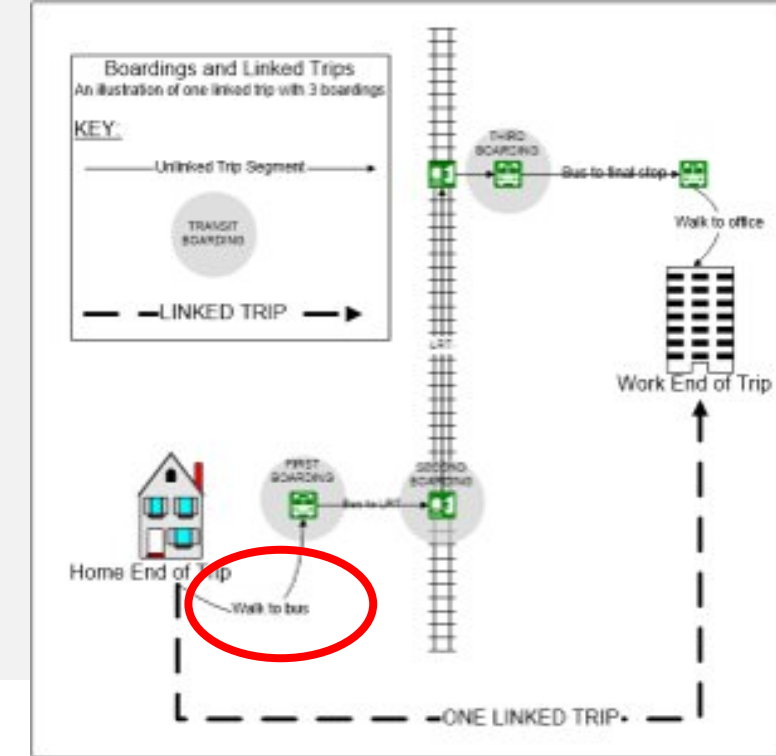
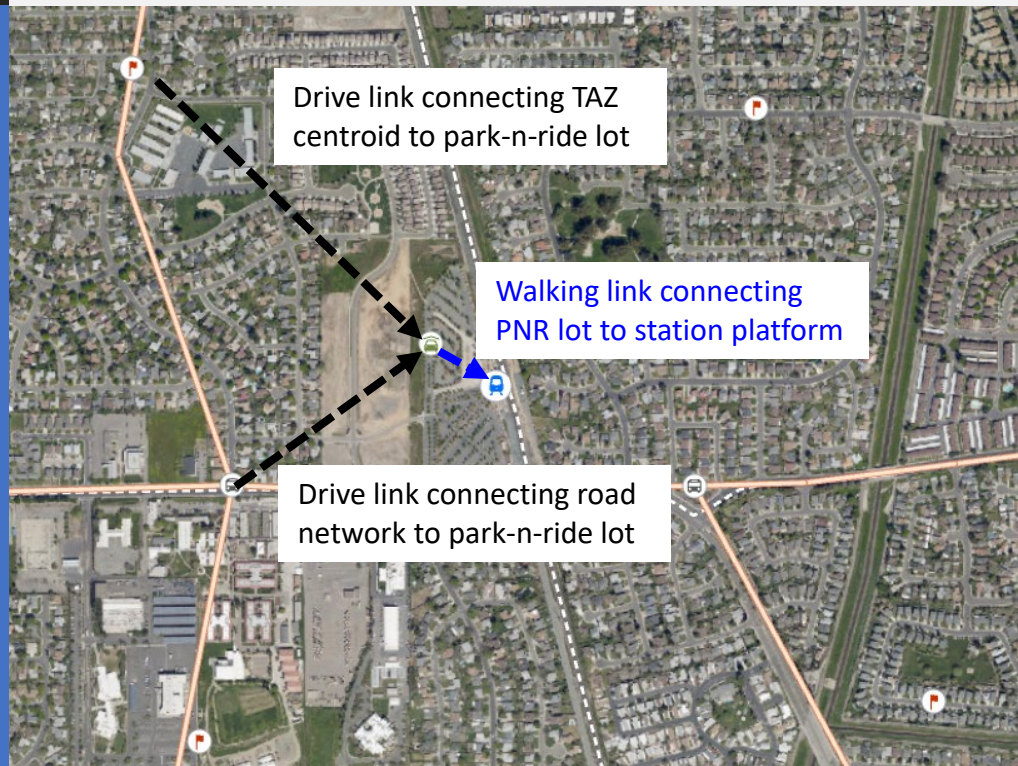
- Travel from origin to first transit stop
- Wait at transit stop
- Travel in vehicle to 2nd transit stop
- If transferring:
 - Travel to transfer stop if needed
 - Wait at transfer stop(s) for vehicle
 - Travel in vehicle to subsequent transfer stop(s) or final stop
- Travel from final stop to destination



Taking a SACSIM Transit Trip: Walking from origin to first transit stop

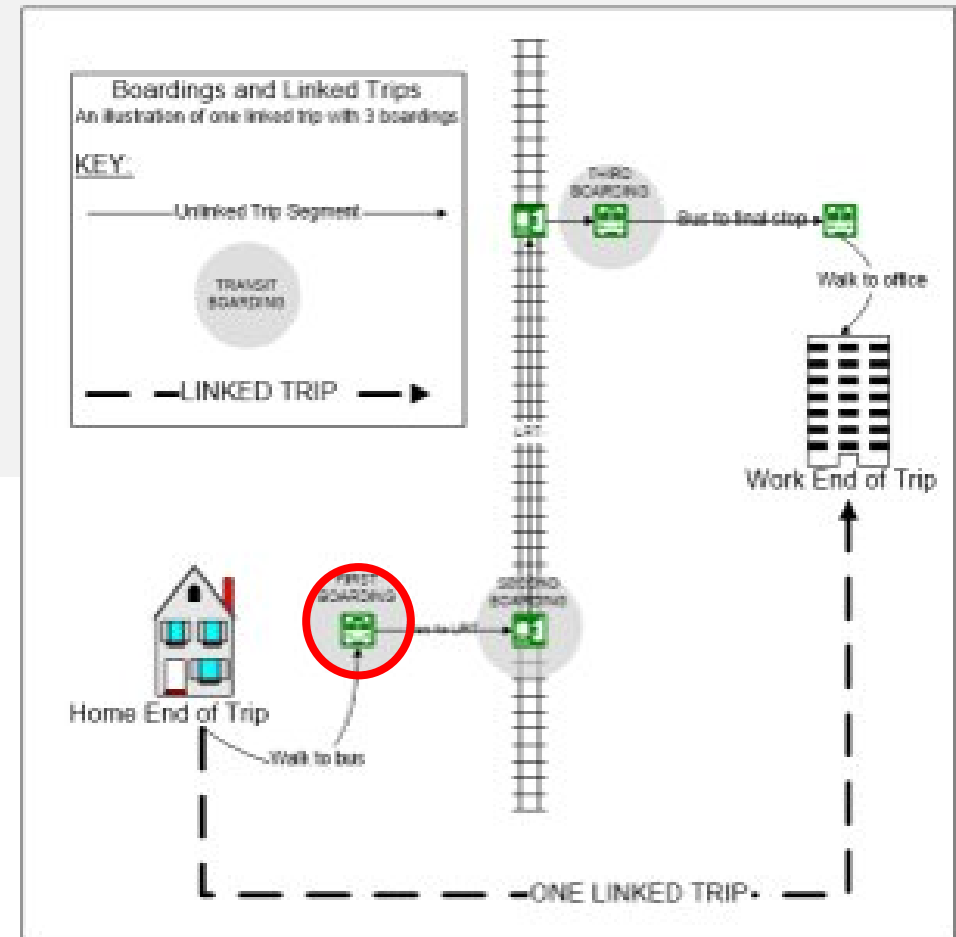


Taking a SACSIM Transit Trip: Driving from origin to Park-n-Ride Transit Stop



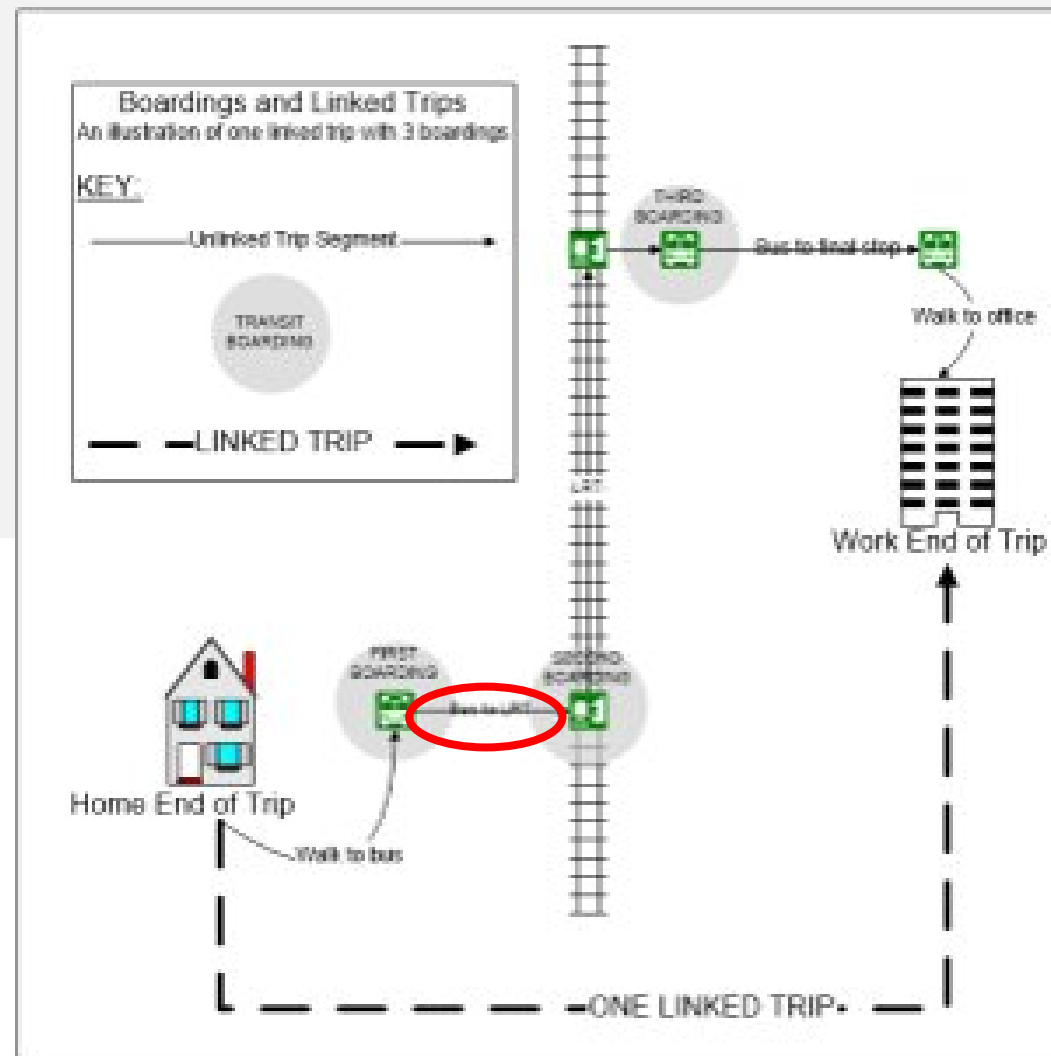
Taking a SACSIM Transit Trip: Waiting at the first stop

- Modeled wait time at the first stop is based on the headway as a "wait curve"
 - E.g., 15min headways assume a 7min wait, 60min headways assume 20min wait
- Headway depends on which of the 5 model time periods the trip starts in:
 - 5am-9am, 9am-3pm, 3pm-6pm, 6pm-8pm, or 8pm-11pm



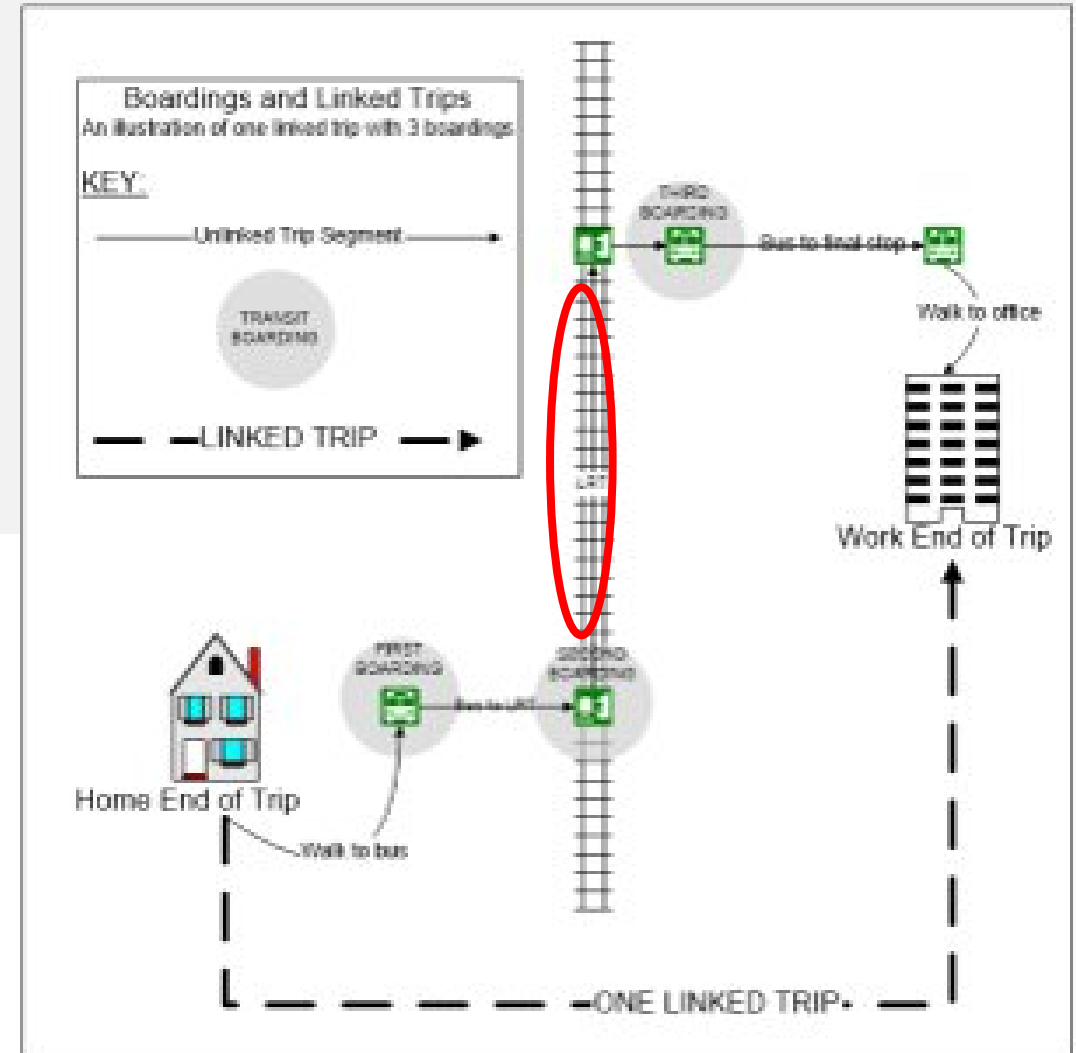
Taking a SACSIM Transit Trip: Local Buses

- Buses use the same model road network as cars
- Experience same congestion as cars, with "time factor" to account for stops and slower travel speeds.



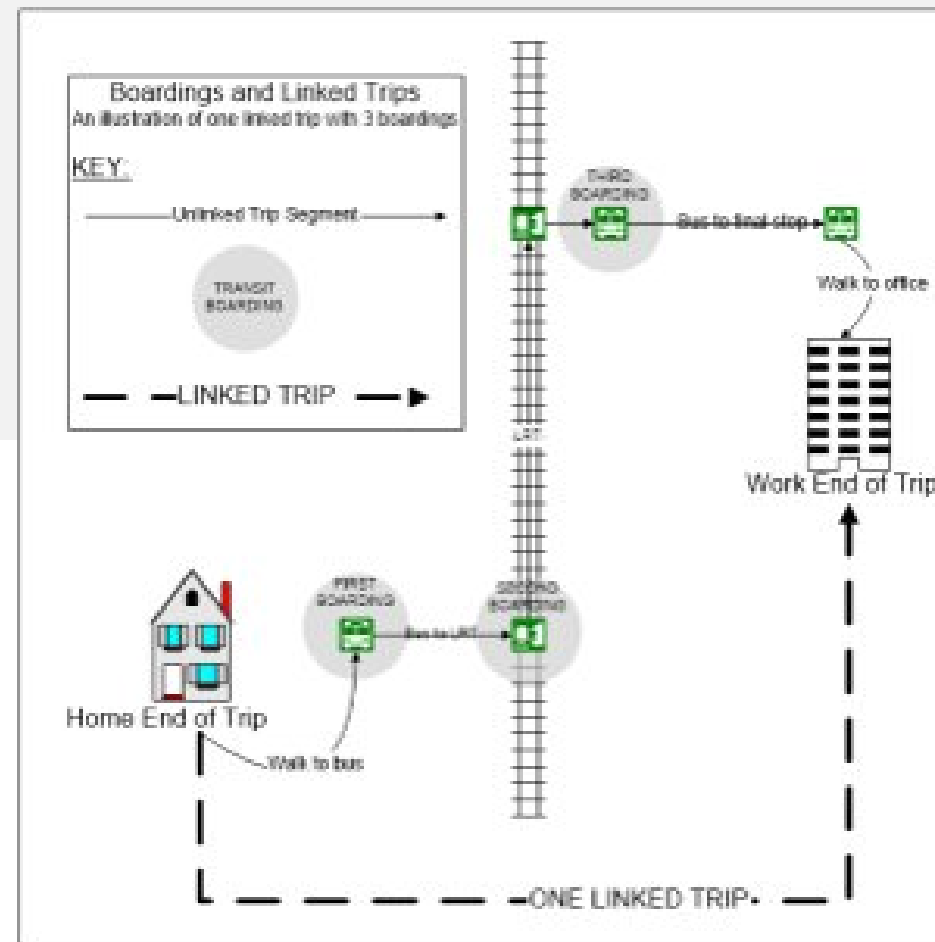
Taking a SACSIM Transit Trip: Rail

- Does not use cars' road network
- Rail links have hard-coded speeds, not affected by road congestion

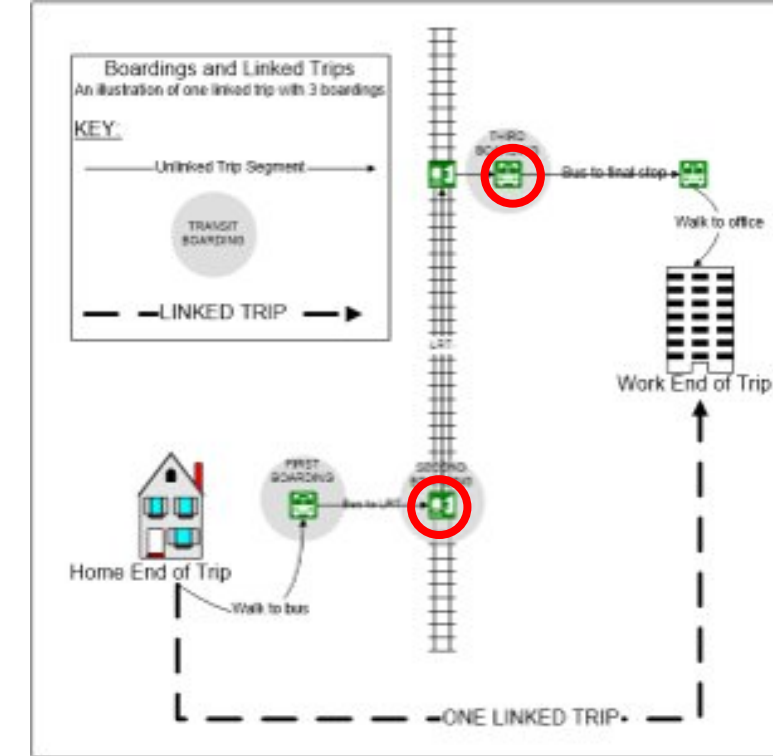


Taking a SACSIM Transit Trip: Commuter Bus

- Freeway commuter buses
- Function essentially like local buses
- Use HOV lanes where available
- <insert pic of commuter bus>

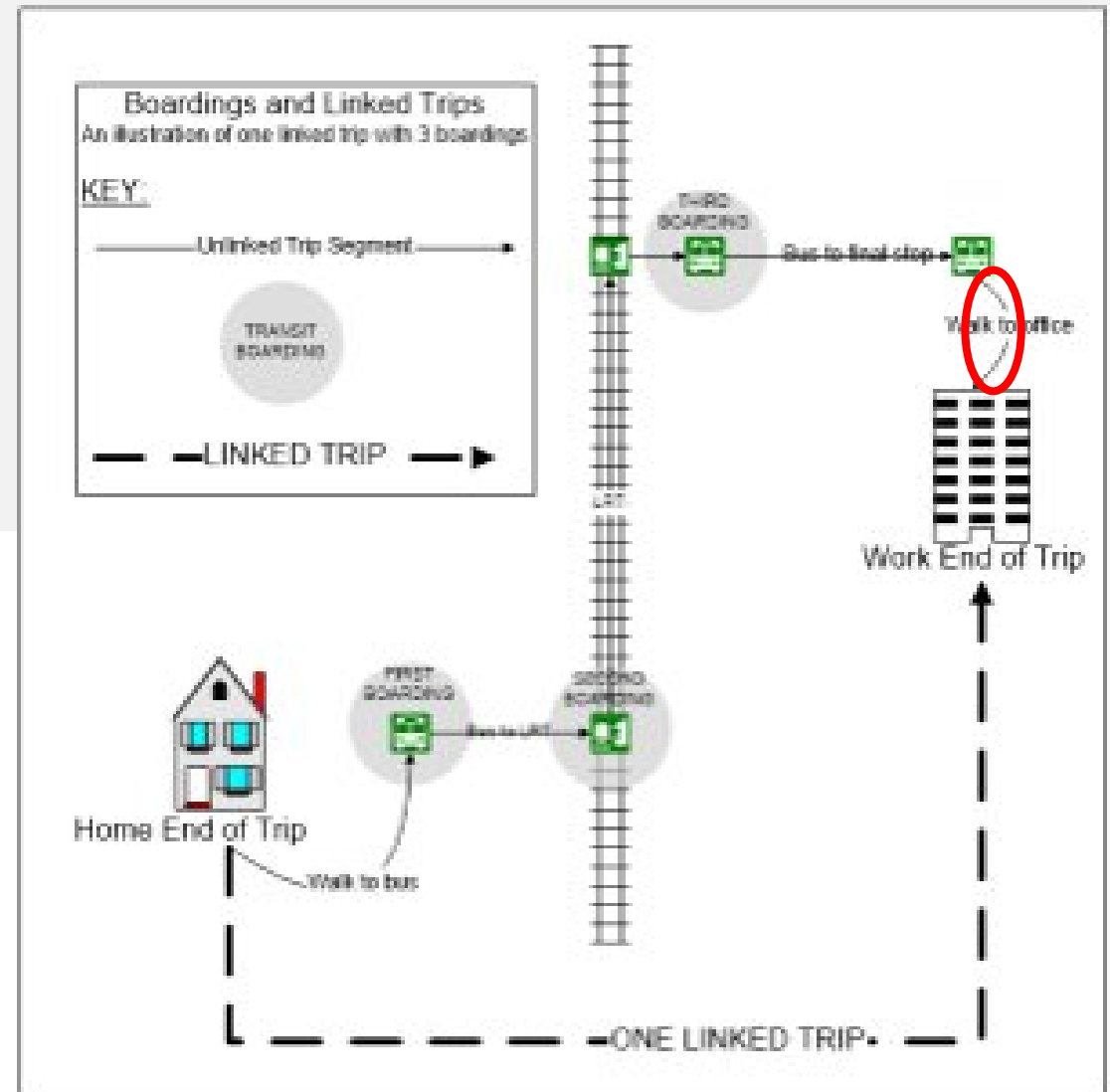


Taking a SACSIM Transit Trip: Transferring



Taking a SACSIM Transit Trip: Travel from last stop to destination

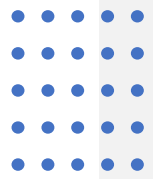
- Same concept as traveling from trip origin to first stop
- Mode of travel to destination constrained by which stop end you're at and how you accessed transit stop.





Taking a SACSIM Transit Trip: Paying Your Fare

Fare Function	SACSIM15	SACSIM19
Monthly transit passes	Flat cash fare for each agency, averaging full adult fare and discount fares.	Pass model predicts who holds a transit pass and makes trip free
Discounted fares for qualifying groups		User can specify groups eligible for discounted fare (e.g. seniors, youth)
Fare table	• Unchanged between SACSIM versions. • Calculates each operator's adult cash fare and applicable fares for transferring within and between agencies	



Representing Transit in the Model

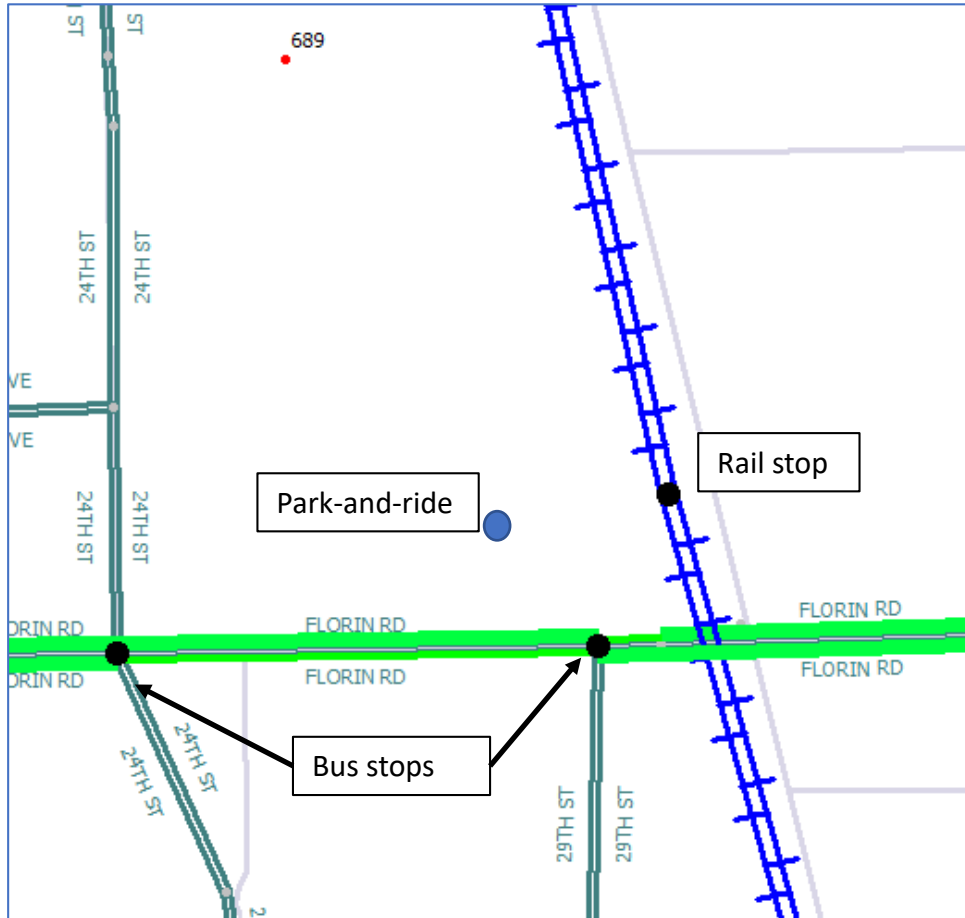




System-Level Configuration Files

- Normally text files
- Apply to whole transit system.
- Example files:
 - Fare table
 - Files to set wait curves, value of time, etc.

Creating and Editing Mixed-Traffic Transit Routes



The **Transit Route** editor window displays the following parameters for the route **SRTD81R_A**:

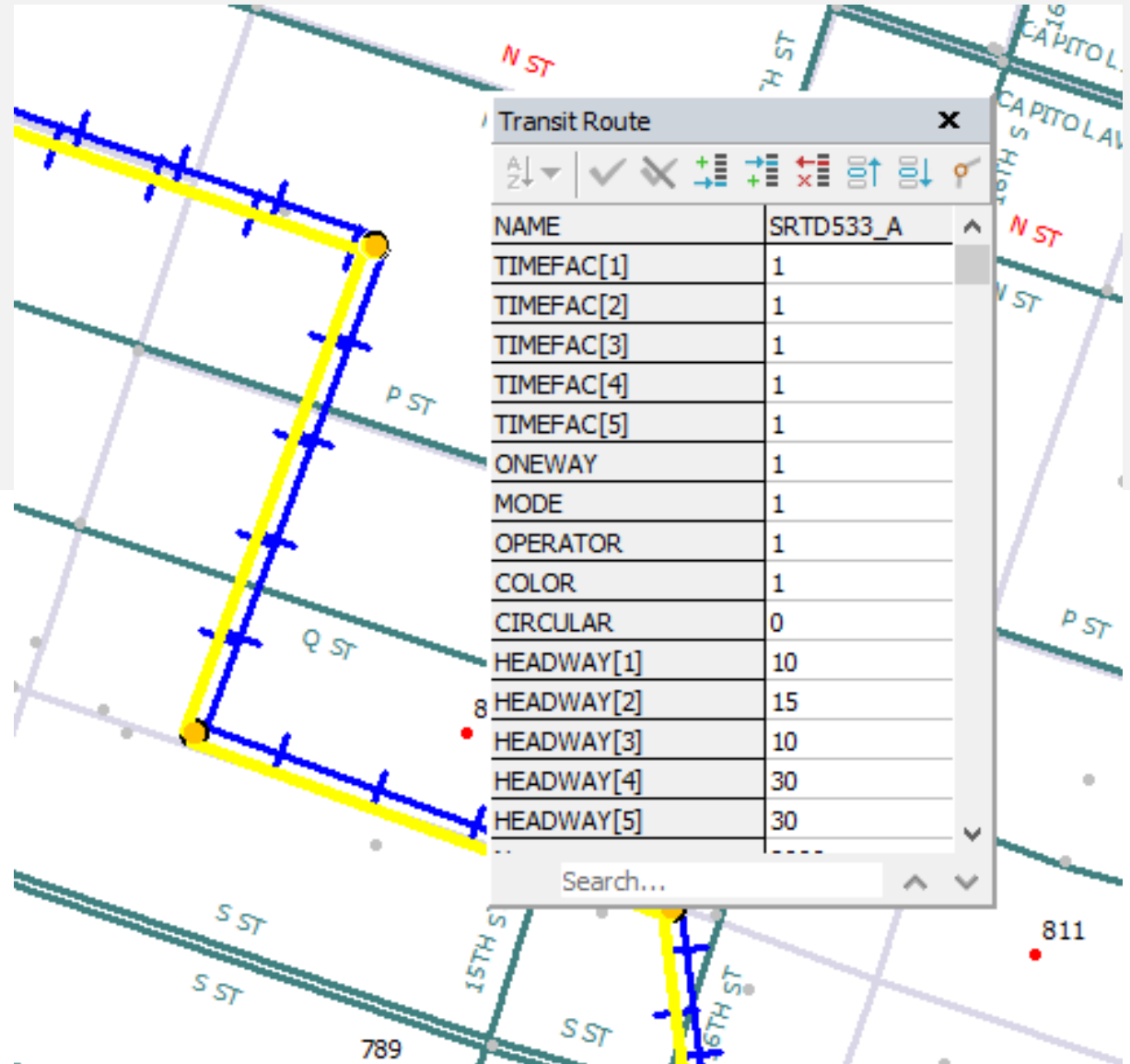
NAME	SRTD81R_A
TIMEFAC[1]	2.01
TIMEFAC[2]	2.01
TIMEFAC[3]	2.01
TIMEFAC[4]	2.01
TIMEFAC[5]	2.01
ONEWAY	1
MODE	3
OPERATOR	2
COLOR	5
CIRCULAR	0
HEADWAY[1]	10
HEADWAY[2]	10
HEADWAY[3]	10
HEADWAY[4]	10
HEADWAY[5]	30
N	3245
N	-3246
N	-4432
N	-3247

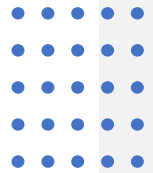
Annotations on the map view:

- Time factors for each time period**: Points to the TIMEFAC parameters in the table.
- Headways for each time period**: Points to the HEADWAY parameters in the table.

Creating and Editing Transit Routes with Dedicated ROW (e.g. LRT)

- Does not use nodes on highway network
- Must explicitly list out links in separate file, including assigning the speed at which transit vehicles travel on that link.





Validating and Testing SACSIM's Transit Model





Validation - How Well Does the Model Predict the Present?

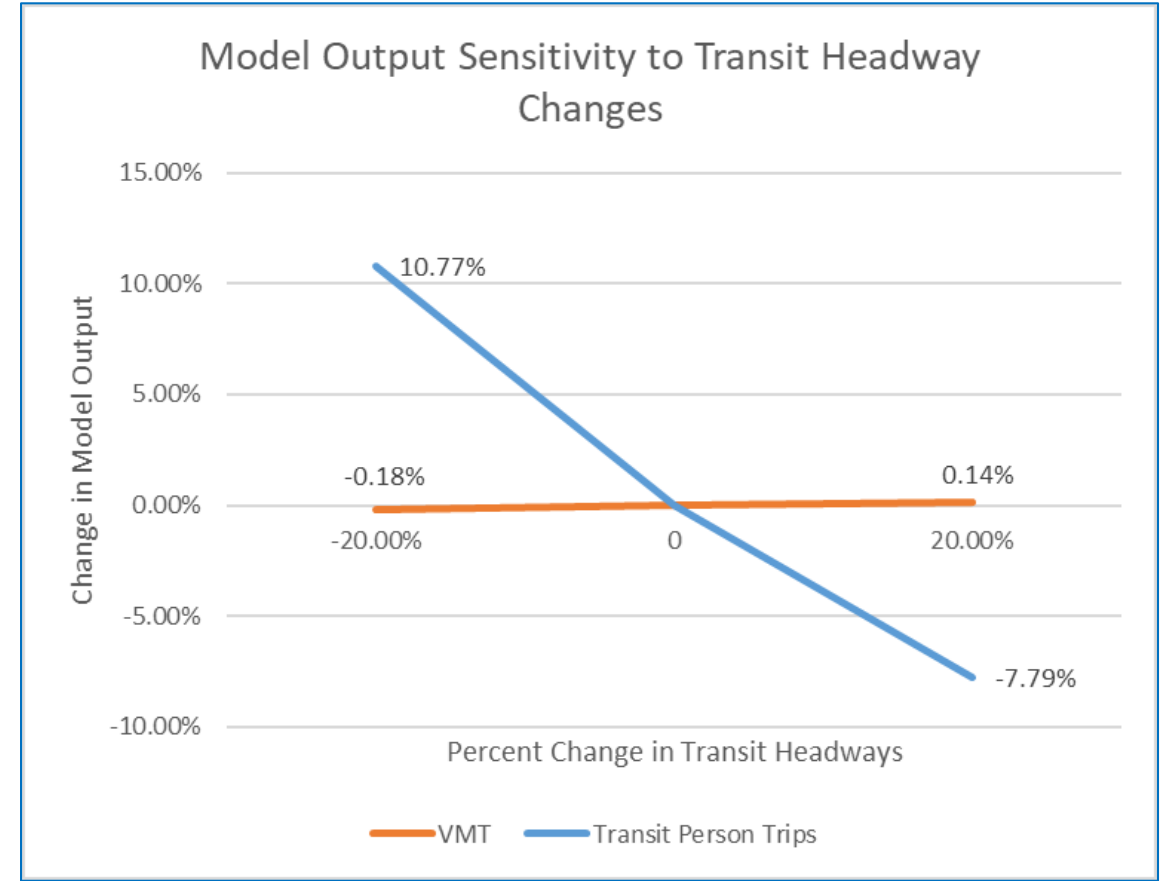
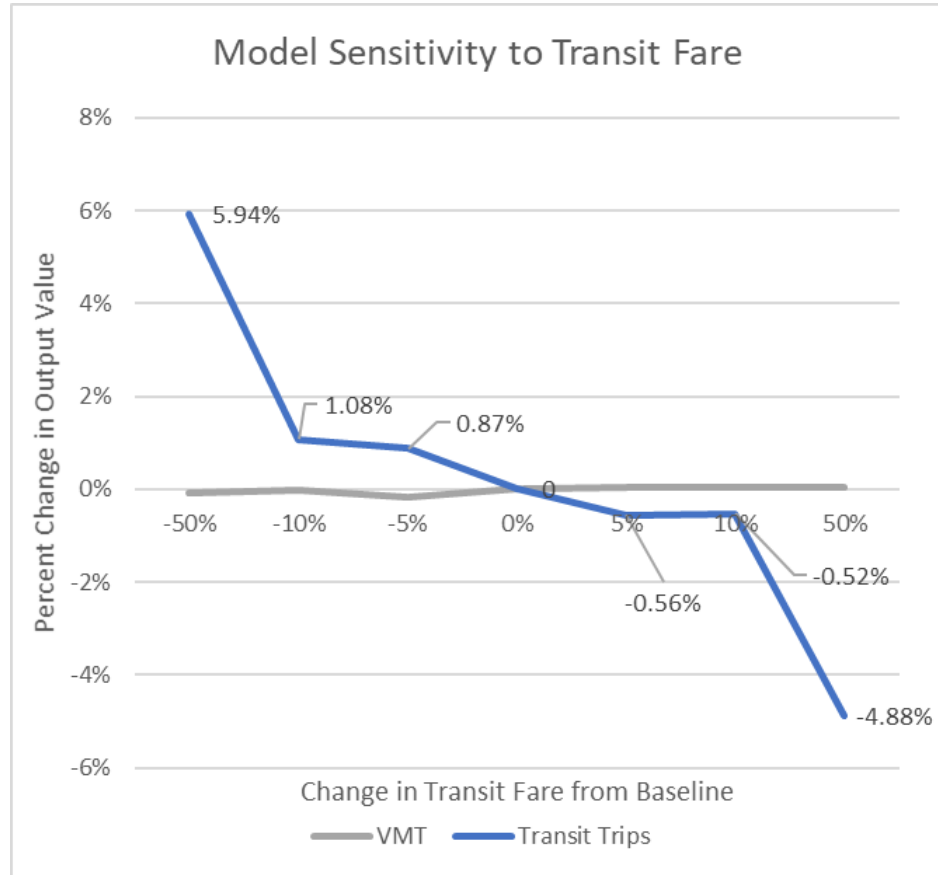
- Transit trip share – modeled versus observed in 2018 household travel survey
- Boardings – modeled versus observed in operators' ridership reports:
 - Regionwide
 - By operator
 - By service type (e.g. LRT, local bus, commuter bus, etc.)
 - Not important for calculating VMT, GHG emissions

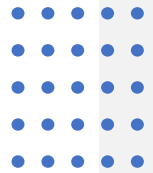


Sensitivity Testing - Does the Model Respond Reasonably to Changes in Inputs?

- "Reasonable" means that a change in model inputs (e.g. fare, headway, route) leads to a change in model outputs (e.g. transit trip share, boardings, etc.) that approximates what has been observed in the real-world. E.g.,
 - Increasing frequency should increase ridership
 - Raising fares should lower ridership

Sensitivity Testing Sample Results





Transit Model Outputs

Standard Output Data and Summaries



Boardings by Line

- Shows boardings for each modeled transit route
- Uses:
 - Compare how changing a line's route, headway, or service hours could affect ridership
 - Better pinpointing which line or lines could be responsible for significant systemwide changes



Boardings by Operator, Service Type, County, Etc.

- Gets total boardings by desired aggregation level.
- Uses:
 - Answer questions about transit ridership raised by county or transit agency staff.
 - Validate boarding data against observed data aggregated by operator or service type.



New SACSIM19 Feature: Transit Submodes

- SACSIM15 just had generic “transit” mode
- SACSIM19 travelers choose from among one of three submodes:
 - Local bus
 - Commuter bus
 - Rail
- Benefits of adding submodes
 - More accurate distribution of transit trips among transit modes
 - More granular reports (e.g. transit trips by submode)



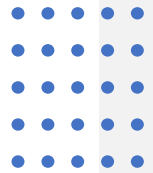
Transit Link Summary

- Estimates boardings, alightings, and vehicle load on every link of every transit line
- Uses:
 - Get total transit boardings within a custom geographic area (e.g. within a council district, city, neighborhood, etc.)
 - Estimate transit trips taken on a specific road segment



Transit Model Use Cases

- Transit and Intercity Rail Capital Improvement Program (TIRCP) application for Sac Valley Station
 - Predict ridership effects of:
 - Interlining Green and Gold Lines as single line connecting North Natomas to Folsom via Sac Valley Station
 - Increasing Green Line frequency from 30mins to 15mins
 - Moving LRT platform closer to Amtrak boarding platform
- Project Performance Assessment (PPA) Tool
 - Estimating transit trips on road segments with proposed projects, particularly HOV projects



Looking Ahead



Current and Forthcoming Transit Model Development Efforts

- Incorporating scooter/bike share services
- Modeling microtransit
- Replacing time factors with dwell time





Open Discussion

- Questions
- User stories—how have you used SACSIM or its outputs?
- Comments and suggestions for future development