

SCAG ABM Enhancement, Calibration, Validation, and Sensitivity Analysis: Summary of the SCAG ABM Peer Review Meeting

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September 27, 2023

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Contents

- Background to SCAG ABM
- Model Improvement and Enhancement
 - Sub-model refinement
 - New sub-model implementation
- Model Calibration and Validation
- Sensitivity Tests

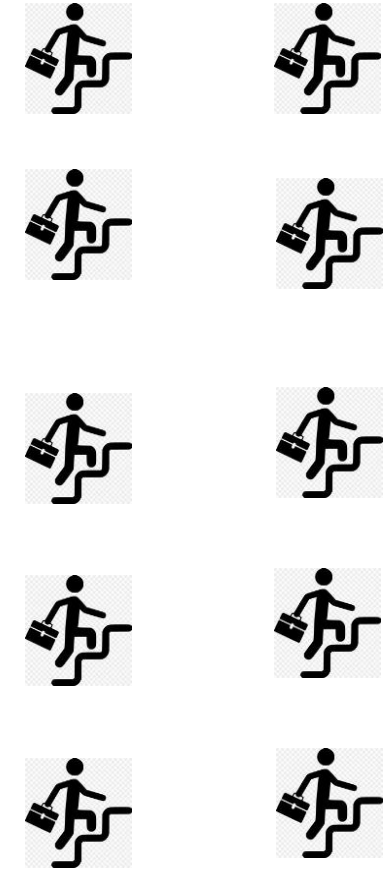
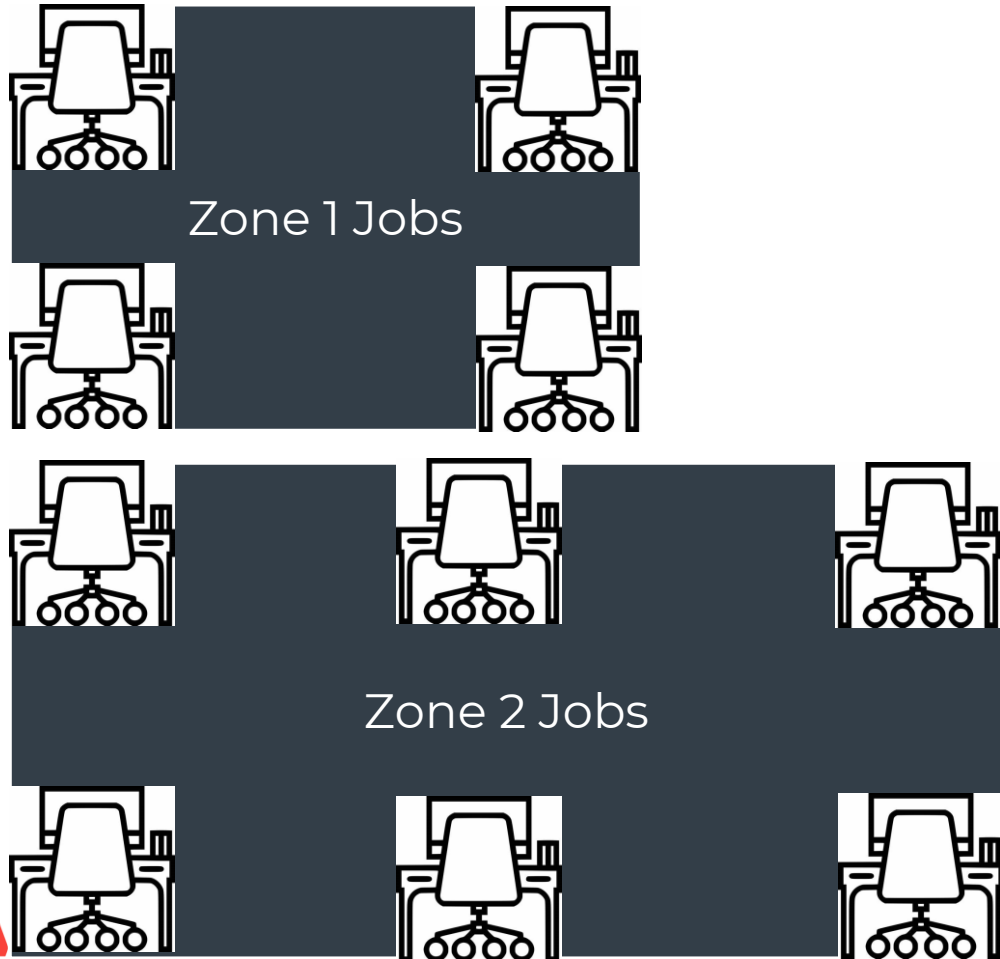
Background

- SCAG ABM of 2024 RTP/SCS builds upon the previous model
- Use local data in model estimation
- Improve model sensitivity
- Ability to model future changes in behavior
- Improve model performance

Background

- Builds upon SCAG ABM of 2020 RTP/SCS
- Coordinated Travel – Regional Activity Modeling Platform (CT-RAMP2) framework
 - Innovative Work Location Constraining Design
 - School Escorting Model
 - Tour Formation Models
 - Combinatorial Mode Choice Model

Innovative Work Location Constraining



School Escorting Model

- Predicts whether a child is escorted to/from school or not
- Identifies bundling of children for escorting
- Assigns chauffeur for each escorting task and identifies the type of escorting (ride-sharing vs. pure escort).
- The model is applied for each school half-tour (outbound and inbound direction) separately

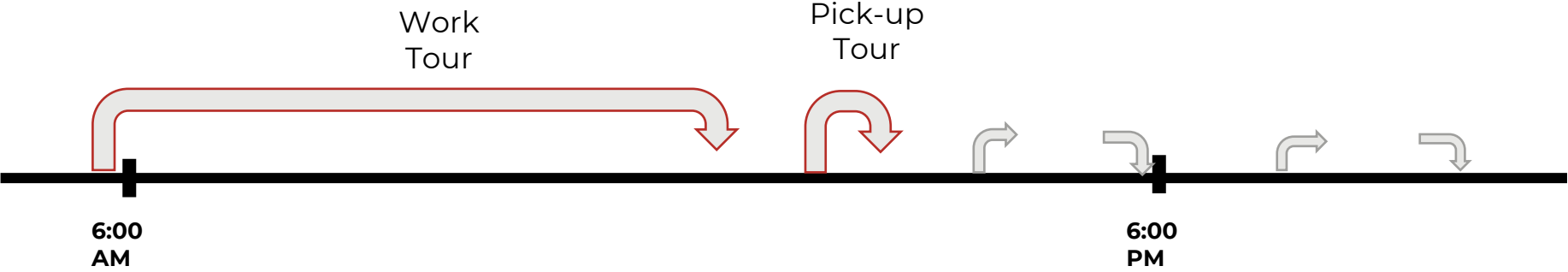
Non-mandatory Activity Generation and Tour Formation

- Activities are generated directly instead of tours like in the first-generation activity-based models
- Activities (at a person level) are allocated to tour segments based on person's prioritized tours.
- Interdependence among the activity sequence, spatial location and tour break choices captured with a simultaneous choice model

Non-mandatory Activity Generation and Tour Formation



Non-mandatory Activities



Combinatorial Mode Choice Model

- All the trip mode choices within a tour are simultaneously predicted
- Uses a network combinatorial representation
- Explicitly considers linkages between trips within a tour
- Tracks the car status of the person throughout the tour

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Sub-model refinement

- Mandatory destination choice models
 - *Work location*
 - *University location*
 - *School location*
- Discretionary task frequency model
- Mode choice model

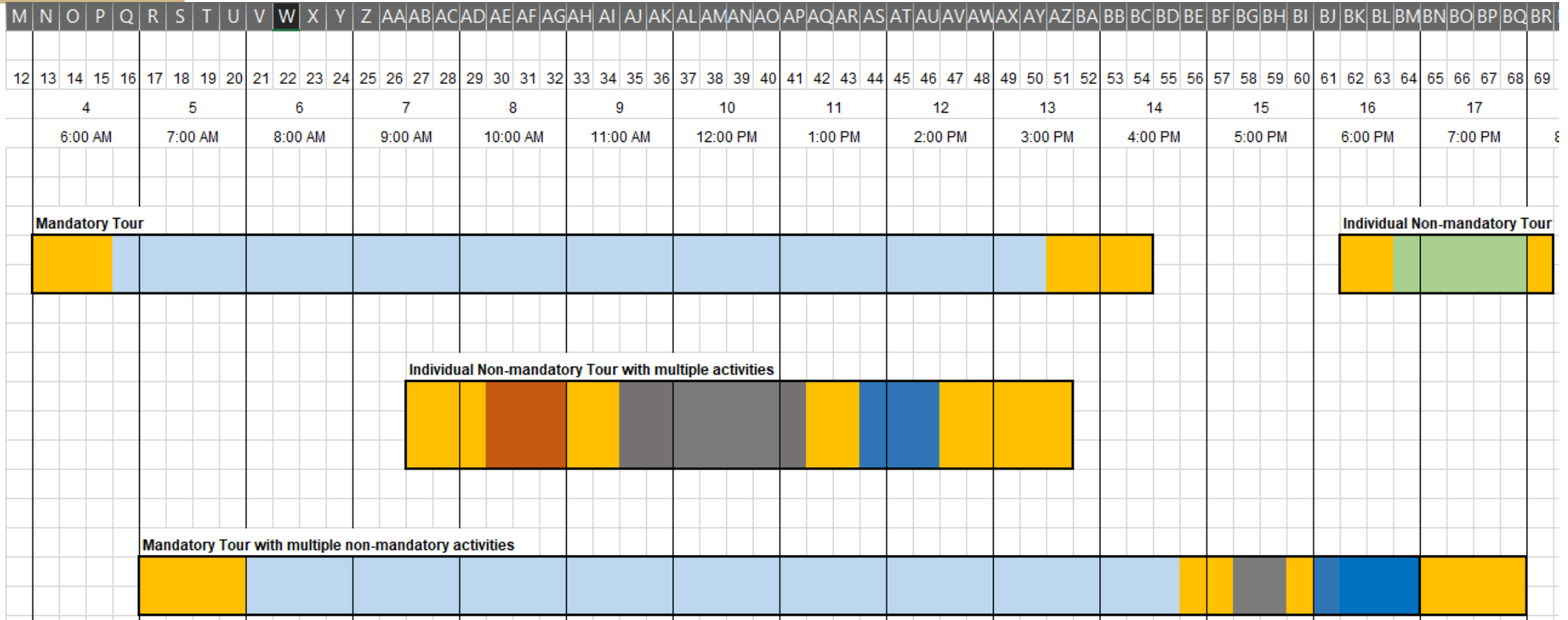
New sub-model implementation

- Trip Departure Time Choice
- In-home/Out-of-home choice for non-mandatory activities

Trip Departure Time Choice

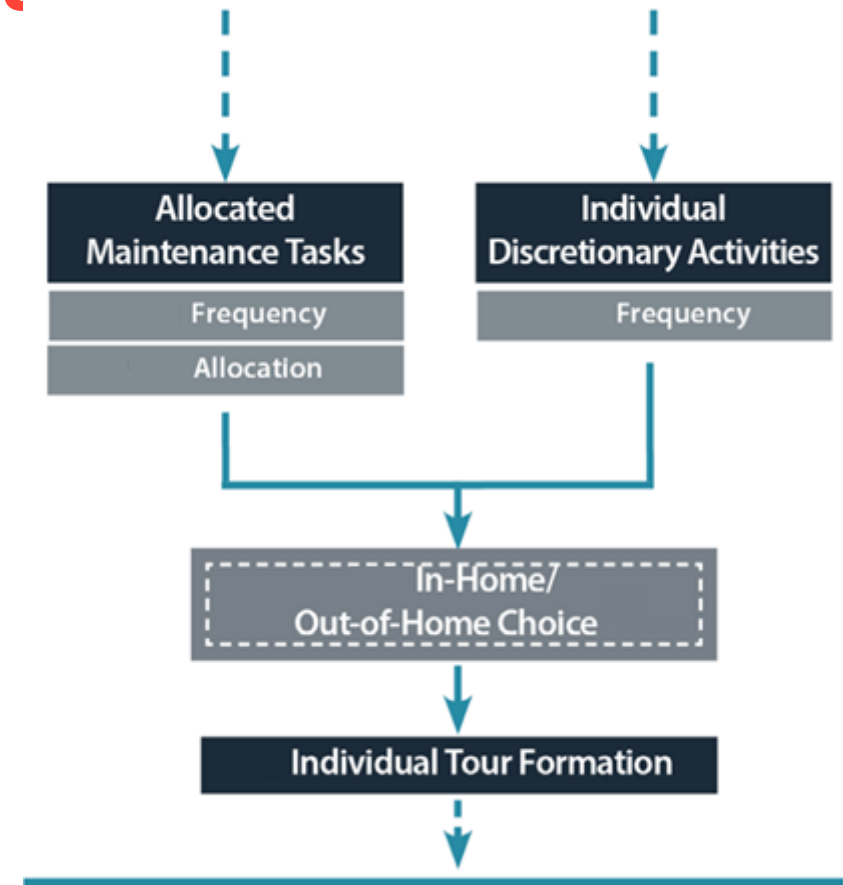
M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BMB	BN	BO	BP	BQ	BR
12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69
4				5				6				7				8				9				10				11				12				13				14				15				16				17					
6:00 AM				7:00 AM				8:00 AM				9:00 AM				10:00 AM				11:00 AM				12:00 PM				1:00 PM				2:00 PM				3:00 PM				4:00 PM				5:00 PM				6:00 PM				7:00 PM					
Mandatory Tour																Individual Non-mandatory Tour																																									
[Yellow block from column 12 to 16, then light blue blocks from column 17 to 60]																[Yellow block from column 62 to 63]				[Green block from column 64 to 68]				[Yellow block from column 69 to 70]																																	
																Individual Non-mandatory Tour with multiple activities																																									
																[Yellow block from column 25 to 28]				[Brown block from column 29 to 30]		[Yellow block from column 31 to 32]		[Grey block from column 33 to 36]				[Yellow block from column 37 to 38]		[Blue block from column 39 to 40]		[Yellow block from column 41 to 44]																									
Mandatory Tour with multiple non-mandatory activities																																																									
[Yellow block from column 12 to 15]				[Light blue block from column 16 to 20]				[Light blue block from column 21 to 25]				[Light blue block from column 26 to 30]				[Light blue block from column 31 to 35]				[Light blue block from column 36 to 40]				[Light blue block from column 41 to 45]				[Light blue block from column 46 to 50]				[Light blue block from column 51 to 55]				[Yellow block from column 56 to 57]		[Grey block from column 58 to 60]		[Yellow block from column 61 to 62]		[Blue block from column 63 to 67]				[Yellow block from column 68 to 70]											

Trip Departure Time Choice



In-home/Out-of-home choice for non-mandatory activities

- Motivated by increasing non-mandatory activities being done remotely
- Policy driven as opposed to Behaviorally Driven



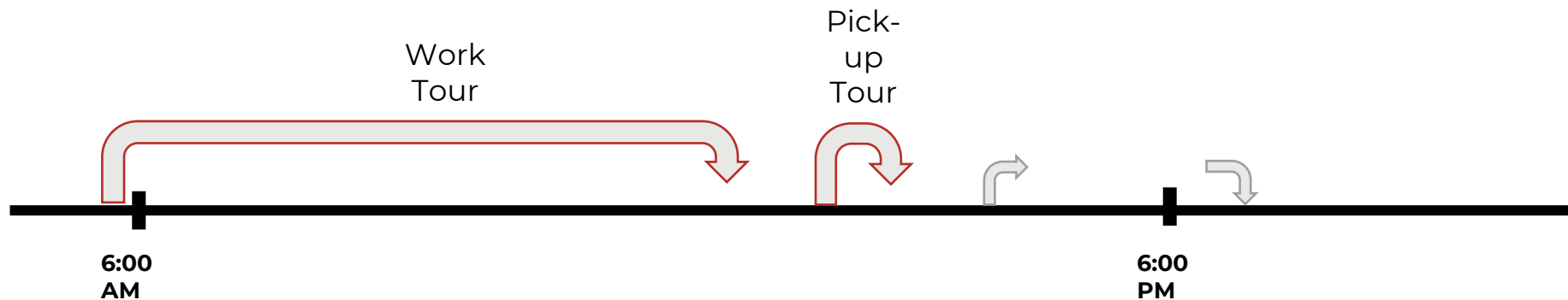
In-home/Out-of-home choice for non-mandatory activities

- Positioned between the discretionary task frequency sub-model and the tour formation sub-model
- Identify a portion of the non-mandatory tasks as at-home activities
- Activity substitution in shopping (due to online shopping) and maintenance (due to telemedicine)

In-home/Out-of-home choice for non-mandatory activities



Non-mandatory Activities

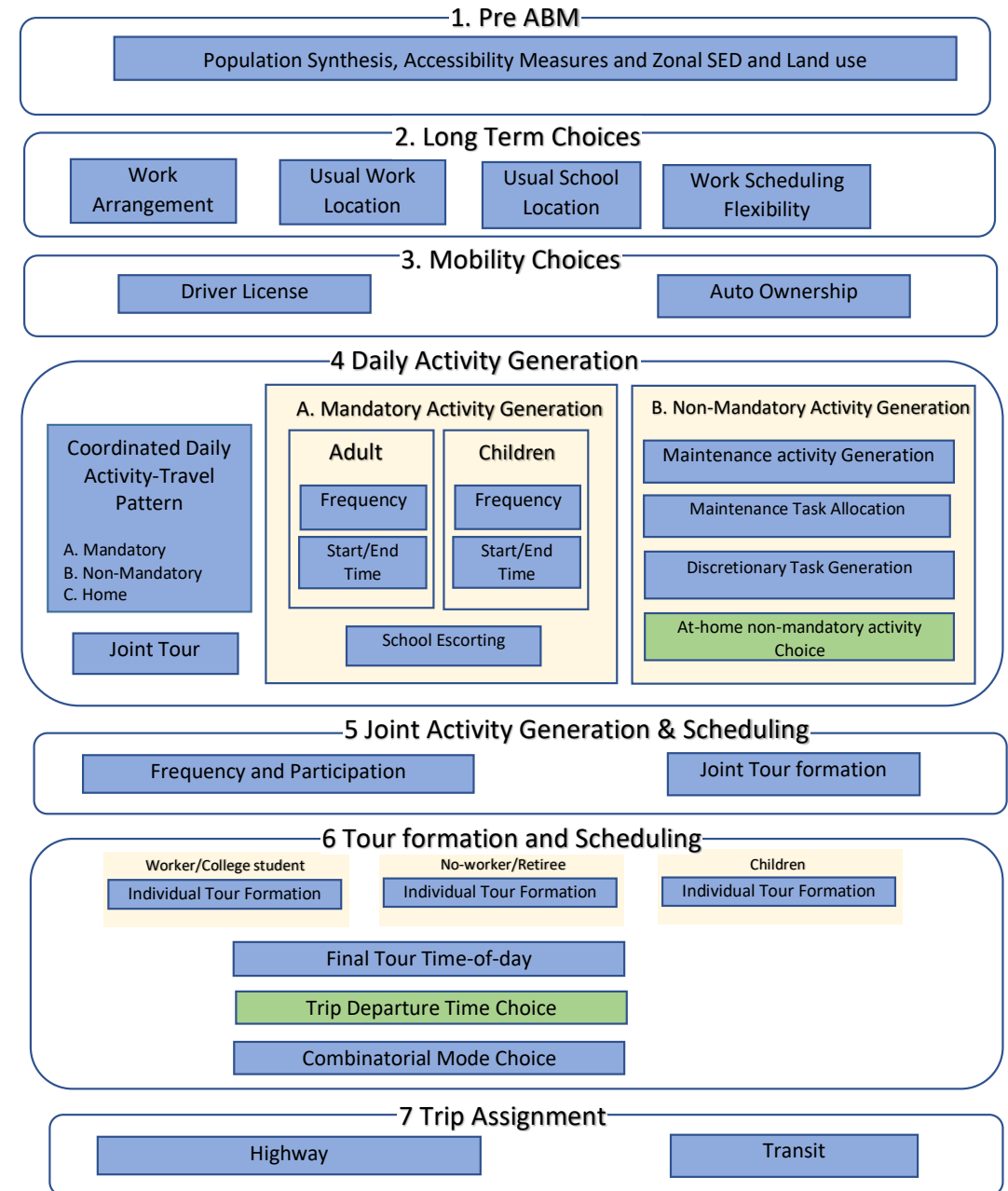


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Calibrated Models

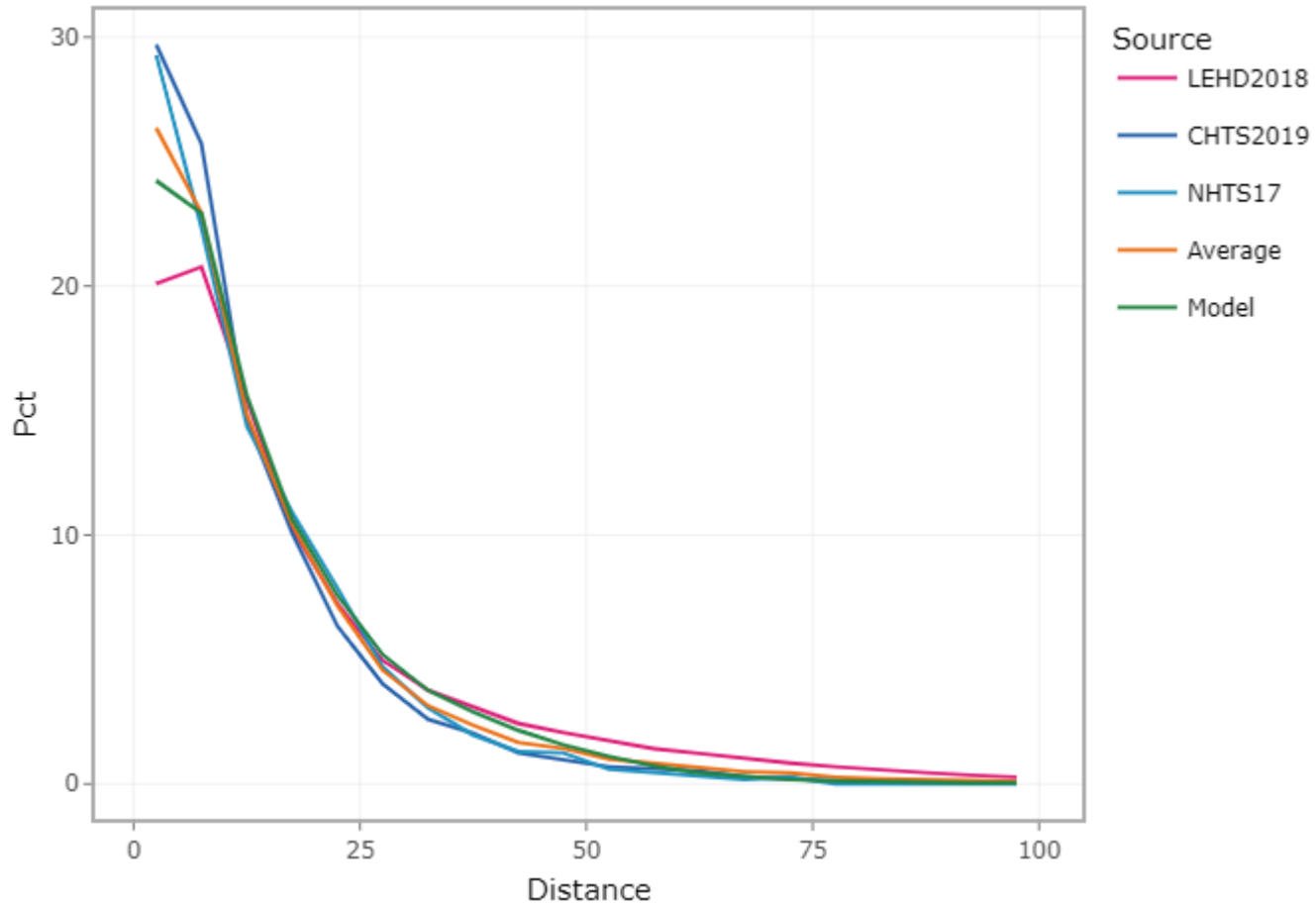
- Work arrangements
- Work and school location
- Work flexibility
- Driver's license and auto ownership
- Daily activity pattern
- Mandatory activity frequency, skeleton, and tour time
- School escorting
- Joint tours frequency, distance, party type, destination, and tour stop frequency and time of day
- Non-mandatory activity task and sub-task frequency, allocation to hh member, and tour time of day
- Tour allocation to day segments
- Mode choice



• Green sub-models were newly added as part of the SCAG RTP 2024 update

Distance to Work Location

Source	LEHD2018	CHTS2019	NHTS2017	Target	Model
Distance to Work (mi)	20.1	13.0	13.2	15.4	15.7



Home County/ Work County	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura
Imperial	91%	2%	1%	5%	1%	0%
Los Angeles	0%	91%	6%	1%	2%	1%
Orange	0%	16%	81%	2%	1%	0%
Riverside	0%	8%	10%	68%	13%	0%
San Bernardino	0%	19%	6%	9%	66%	0%
Ventura	0%	24%	1%	0%	0%	74%

Home County/ Work County	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura
Imperial	92%	0%	0%	8%	0%	0%
Los Angeles	0%	91%	6%	1%	2%	1%
Orange	0%	13%	83%	2%	1%	0%
Riverside	0%	8%	11%	66%	14%	0%
San Bernardino	0%	19%	6%	9%	65%	0%
Ventura	1%	26%	0%	0%	0%	73%

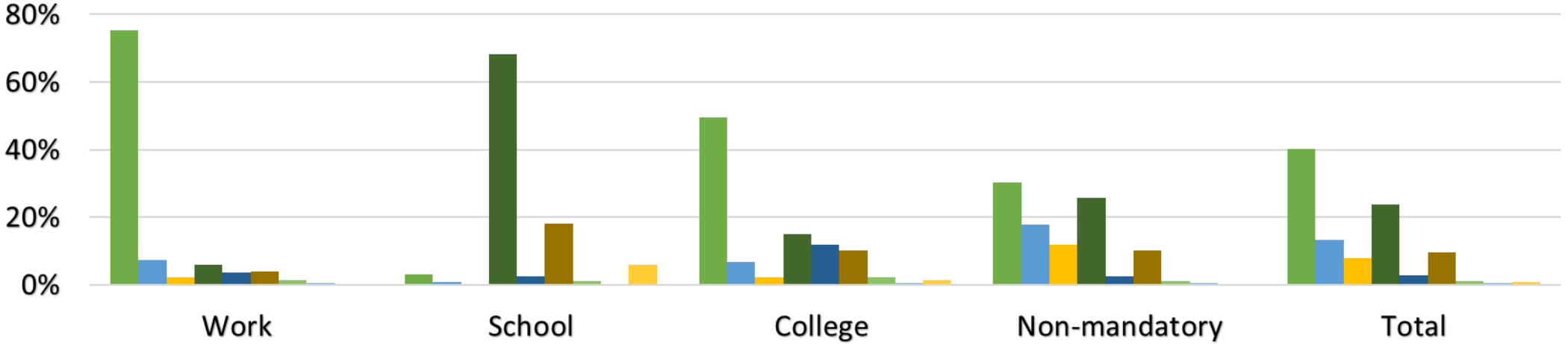
Auto Ownership by Household Income

Target = CHTS2019

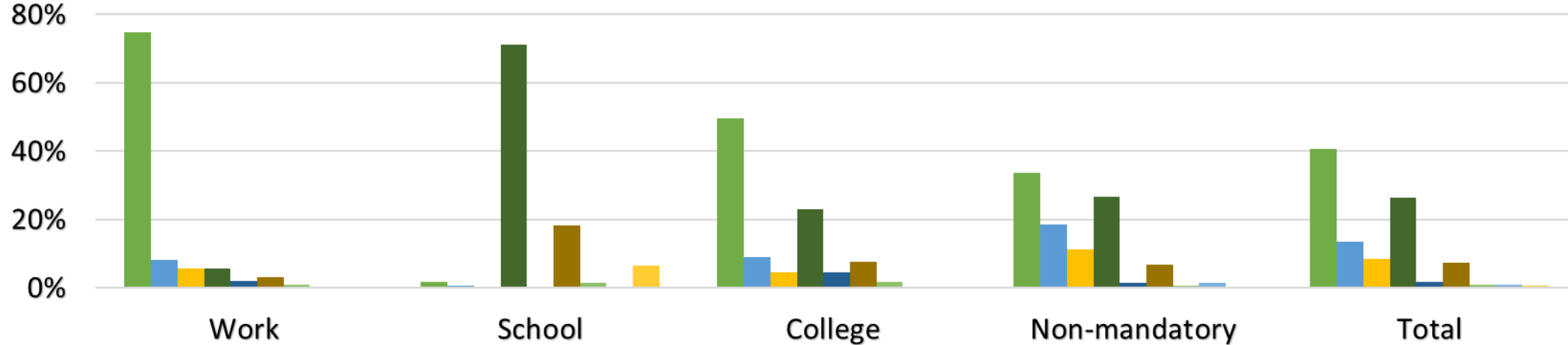


Mode Choice

Target



Model



■ SOV
 ■ HOV2_Dr
 ■ HOV3p_Dr
 ■ HOV pass
 ■ Transit
 ■ Walk
 ■ Bike
 ■ TNC
 ■ School bus



Model Validation Target Data Sources (Base year: 2019)

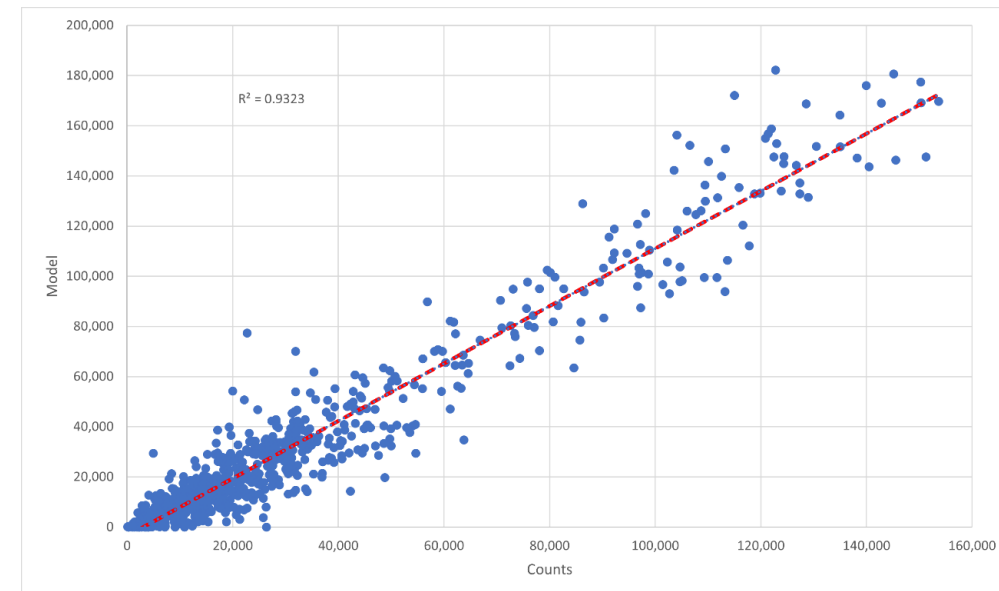
- Caltrans Performance Measurement System (PeMS)
- National Transit Database
- StreetLight
- Replica
- Caltrans Traffic Counts (All Vehicles and Trucks)
- SCAG's 2017 Screenline Vehicle Classification (One Day Field Counts)

Model Validation Attributes

Sample: 35 Screen lines covering 717 network links

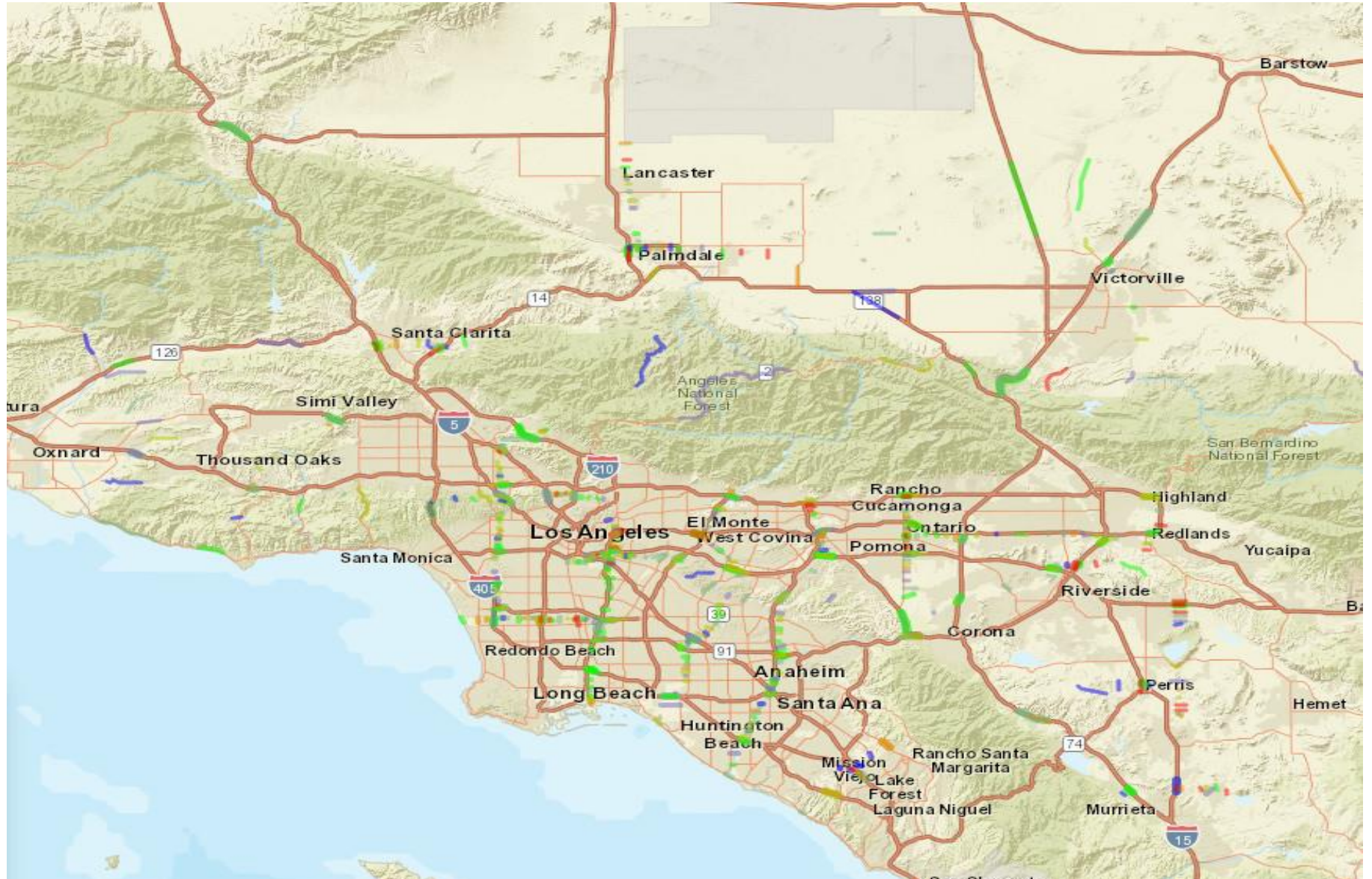
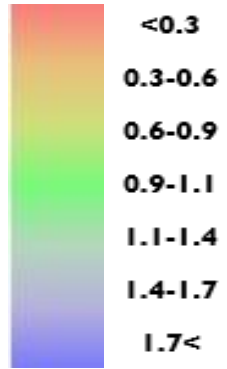
- The multi-class highway assignment simultaneously loads internal-internal, internal-external, and external-external trips
- The OD trip tables loaded to the highway network include:
 - *Drive Alone*
 - *Shared Ride 2 Non-HOV, Shared Ride 3+ Non-HOV*
 - *Shared Ride 2 HOV, Shared Ride 3+ HOV*
 - *Light Trucks, Medium Trucks, Heavy Trucks*

Total %RMSE: 33%



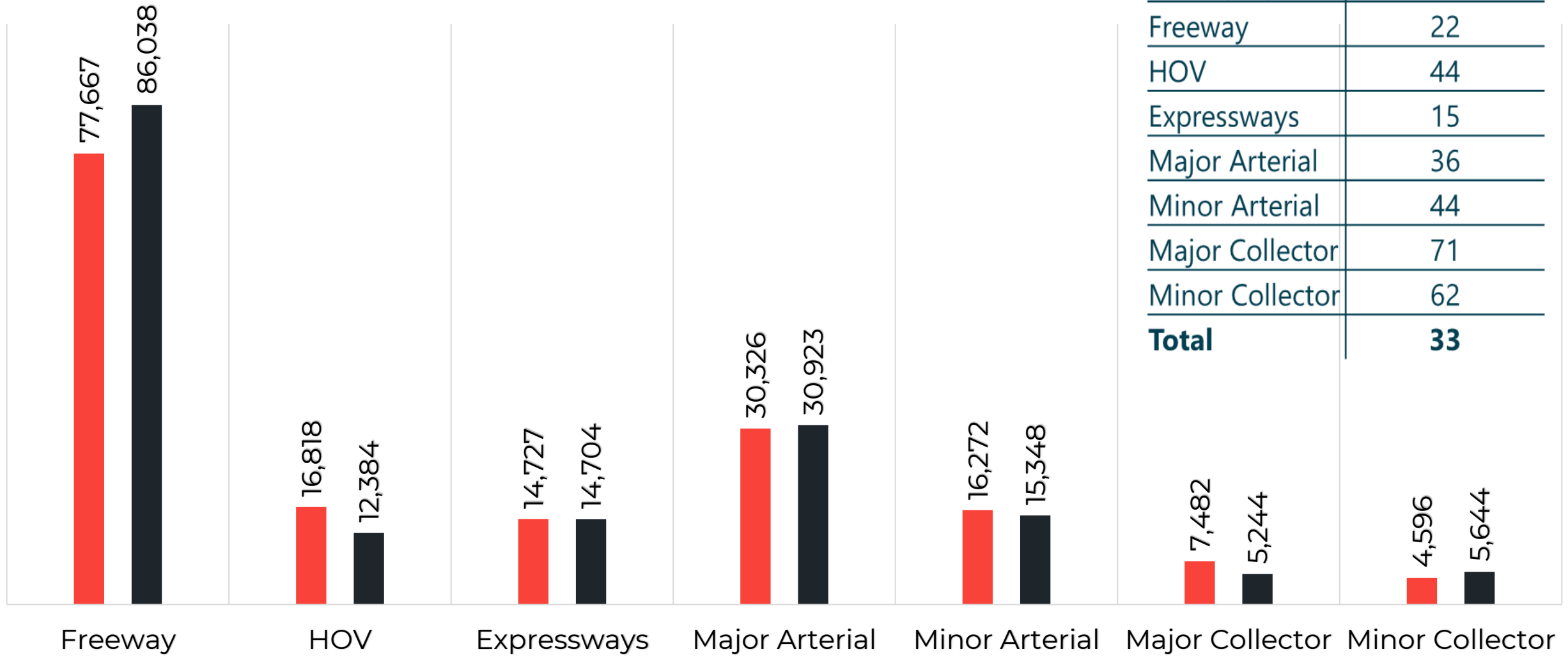
All Vehicles

(Model/Count Ratio)



All Vehicles Validation / Facility Type

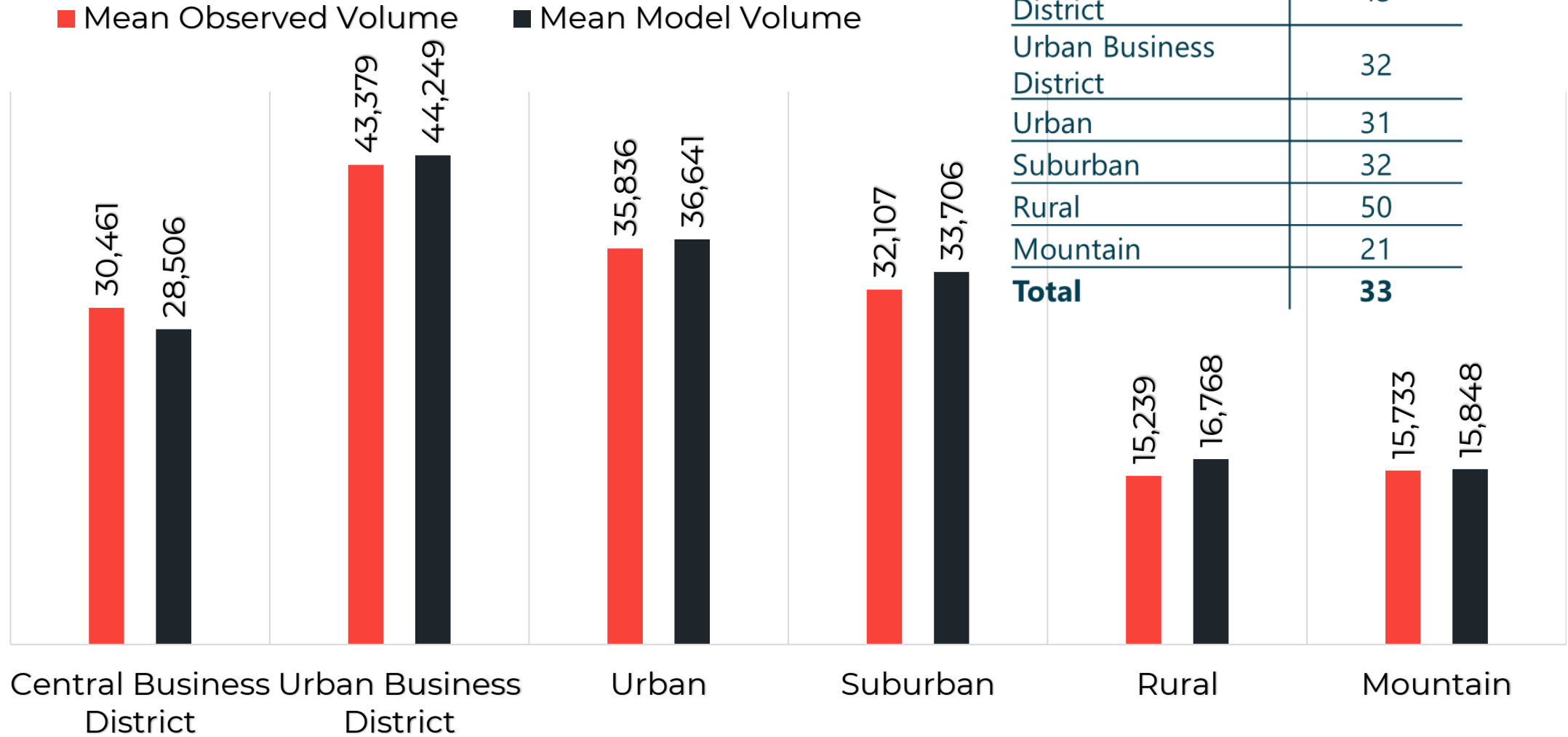
■ Mean Observed Volume ■ Mean Model Volume



Facility Type	% RMSE
Freeway	22
HOV	44
Expressways	15
Major Arterial	36
Minor Arterial	44
Major Collector	71
Minor Collector	62
Total	33



All Vehicles Validation / Area Type



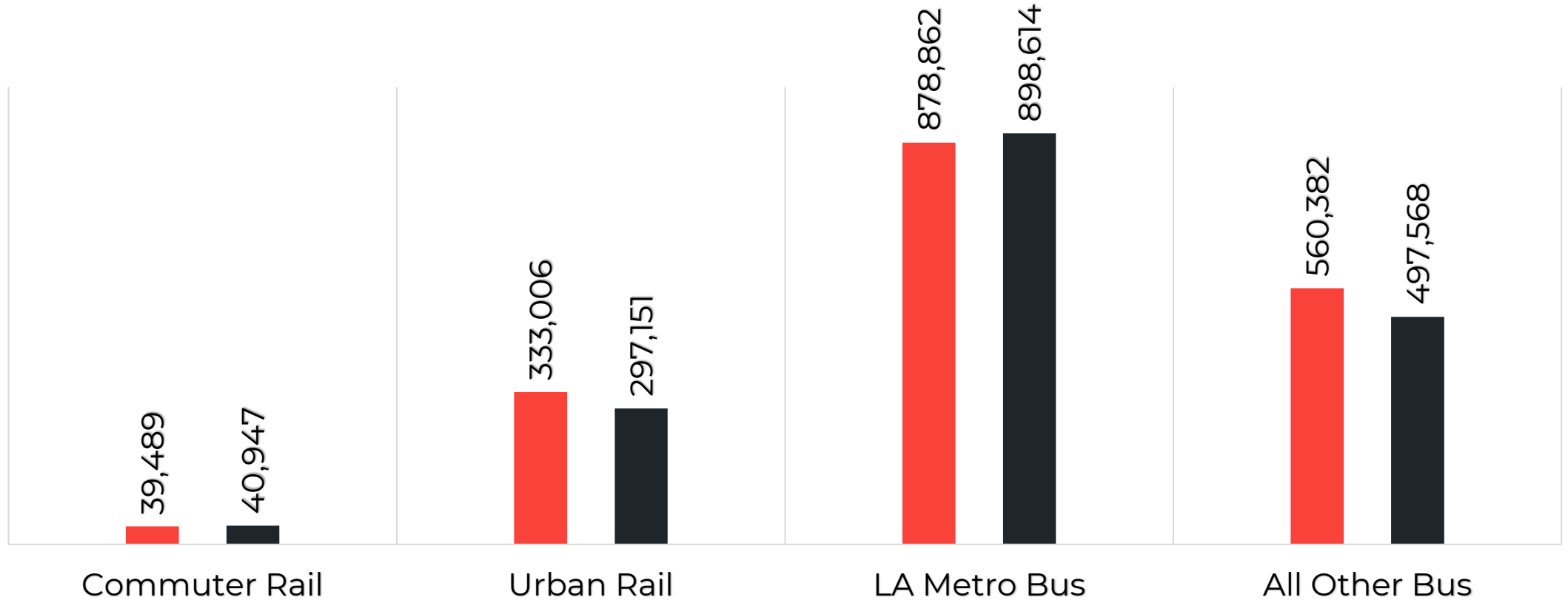
Area Type	Percent RMSE
Central Business District	43
Urban Business District	32
Urban	31
Suburban	32
Rural	50
Mountain	21
Total	33



Transit Validation

Transit Mode	Count/Model Ratio
Commuter Rail	1.04
Urban Rail	0.89
LA Metro Bus	1.02
All Other Bus	0.89
Total	0.96

■ Observed Boarding ■ Model Boardings



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Sensitivity Tests Purpose

- Valuable insights on model robustness and reliability
- Responsiveness to various transportation planning strategies
- Designed based on the previous Model Peer Review recommendations
- Objective to assess the impact on key metrics
 - *VMT, mode share, vehicle trips, transit boardings*
 - *Segment the impact by household income and geographic location*

Sensitivity Test Variables

- Fuel Price and Auto Operating Cost
- Transit Fare
- Work-from-home
- Household Income
- Transit Service Frequency
- Roadway Capacity
- Land-use and Build Environment

Fuel Price/Auto Operating Cost (AOC)

- AOC consists of two components: fuel costs and non-fuel costs
- The base AOC in 2019 was 18.94 cents per mile
 - *Test 1 – decrease fuel price to 75% of the base case.*
 - *Test 2 – increase fuel price to 125% of the base case.*
 - *Test 3 – decrease fuel price to 50% of the base case.*
 - *Test 4 – increase fuel price to 150% of the base case.*

Auto Operating Cost (AOC) (+16.4%)

Variable		Measure	Value
VMT		% change	-2.04%
		Elasticity	-0.124
All Trips	Drive Alone	Percentage Point Difference	-0.22%
	Carpool		0.04%
	Transit		0.05%
	Walk / Bike		0.13%
Work Trips	Drive Alone	Percentage Point Difference	-0.37%
	Carpool		0.20%
	Transit		0.04%
	Walk / Bike		0.12%
Transit Boardings		% change	1.47%
		Elasticity	0.090

*Elasticity w.r.t. AOC

*VMT is LM VM

*Empirical studies, VMT elasticity between - 0.075 (Wenzel and Fujita, 2018) and -0.11 (Langer et al., 2017).



Thank You!

WSP and SCAG