Development of the San Bernardino County Transportation Analysis Model

Existing and Future

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Presentation Outline

- Project Background
- Technical Approach
- 2008 Model Validation
- 2035 Future Year Forecast
- Conclusion

PROJECT BACKGROUND

Project Background

- RIVSAN model is no longer functional and still retained the same essential SCAG model structure from the early 1990s.
- Advanced functionalities have been incorporated into the SCAG regional model in the last decade.
- Consolidating all modeling efforts into one county-wide model is highly desirable.
- Maintain consistency throughout the County and with the remainder of the SCAG region.

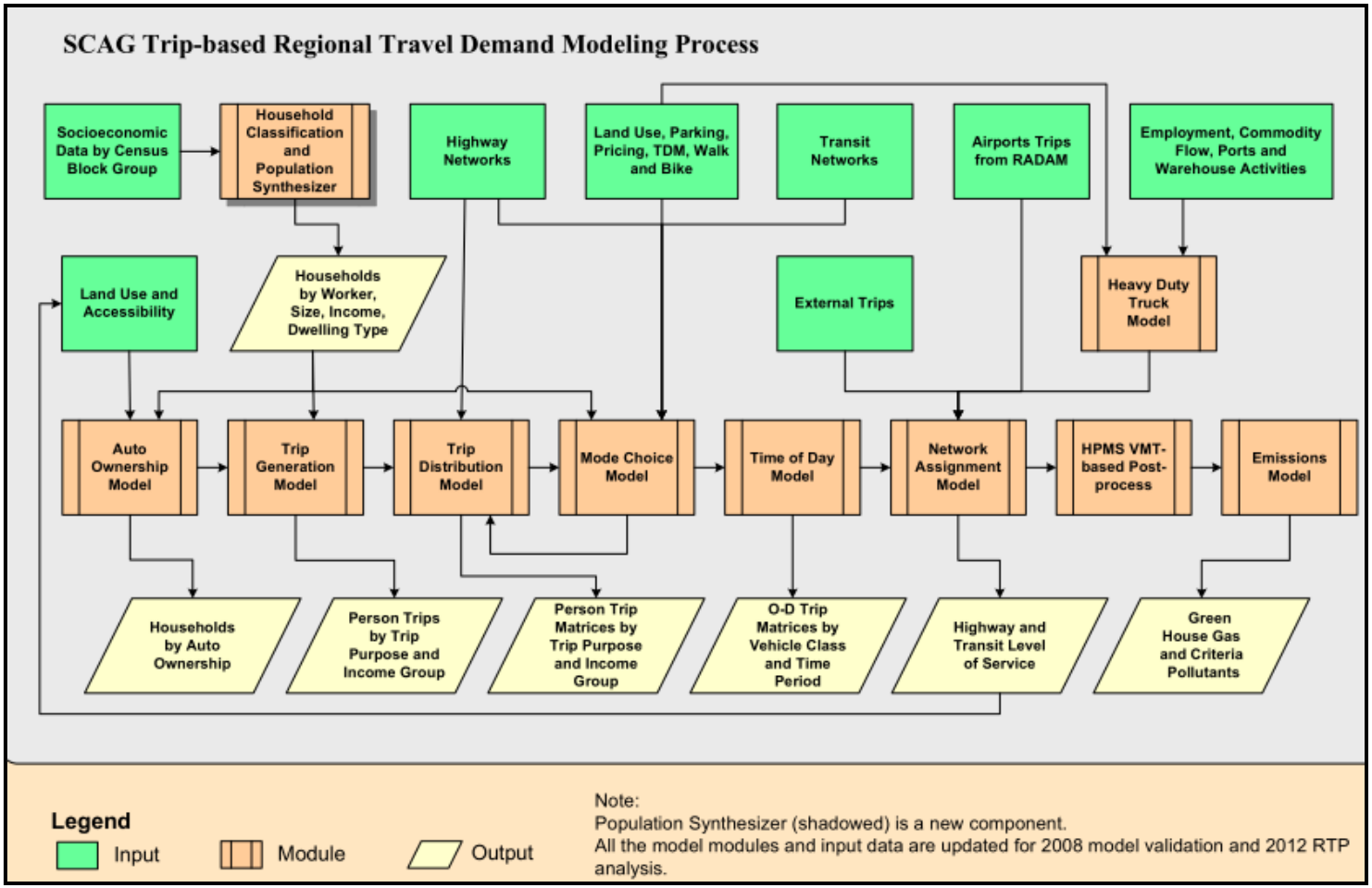
TECHNICAL APPROACH

Technical Approach

- SBTAM is a focused version of the SCAG regional model.
- Build upon the SCAG TransCAD version 5 model with additional features:
  - Trip generation model, including the new HBW trip production and vehicle availability models, etc.
- This model was developed using SCAG's Subregional Model Development Tool (SMDT).

SCAG Modeling Process

Development of the San Bernardino County Transportation Analysis Model



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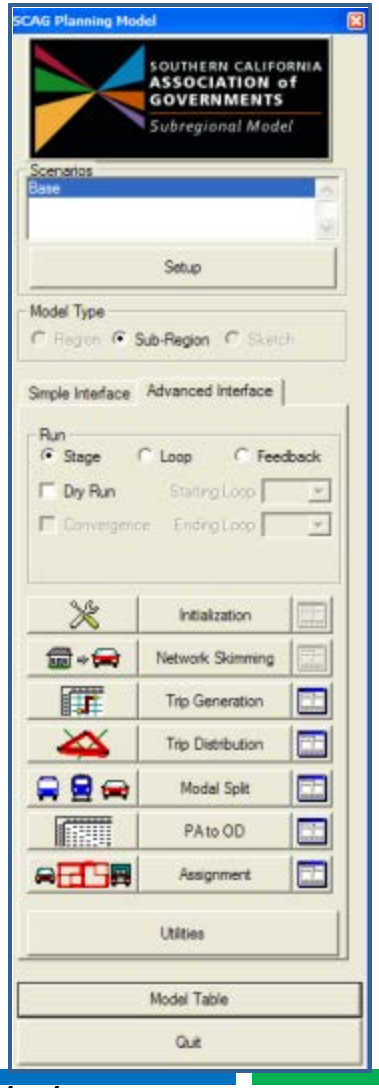
Development of SBTAM



- SMDT can effectively develop a subregional model based on the SCAG version 5 regional model
  - Auto-disaggregates and aggregates TAZ attributes, or based on inputs from sub-region agency
  - Auto-disaggregates and aggregates matrix inputs
  - Auto converts networks and creates new centroid connectors, or based on existing definitions

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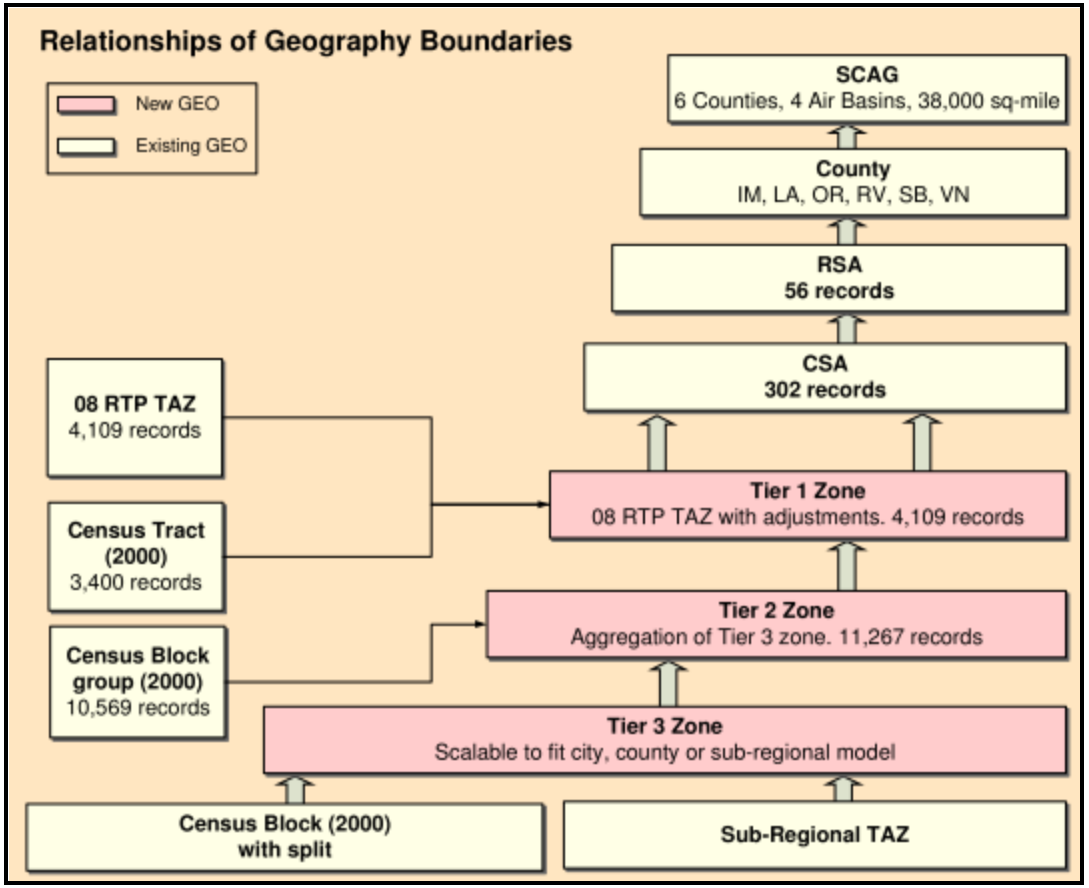
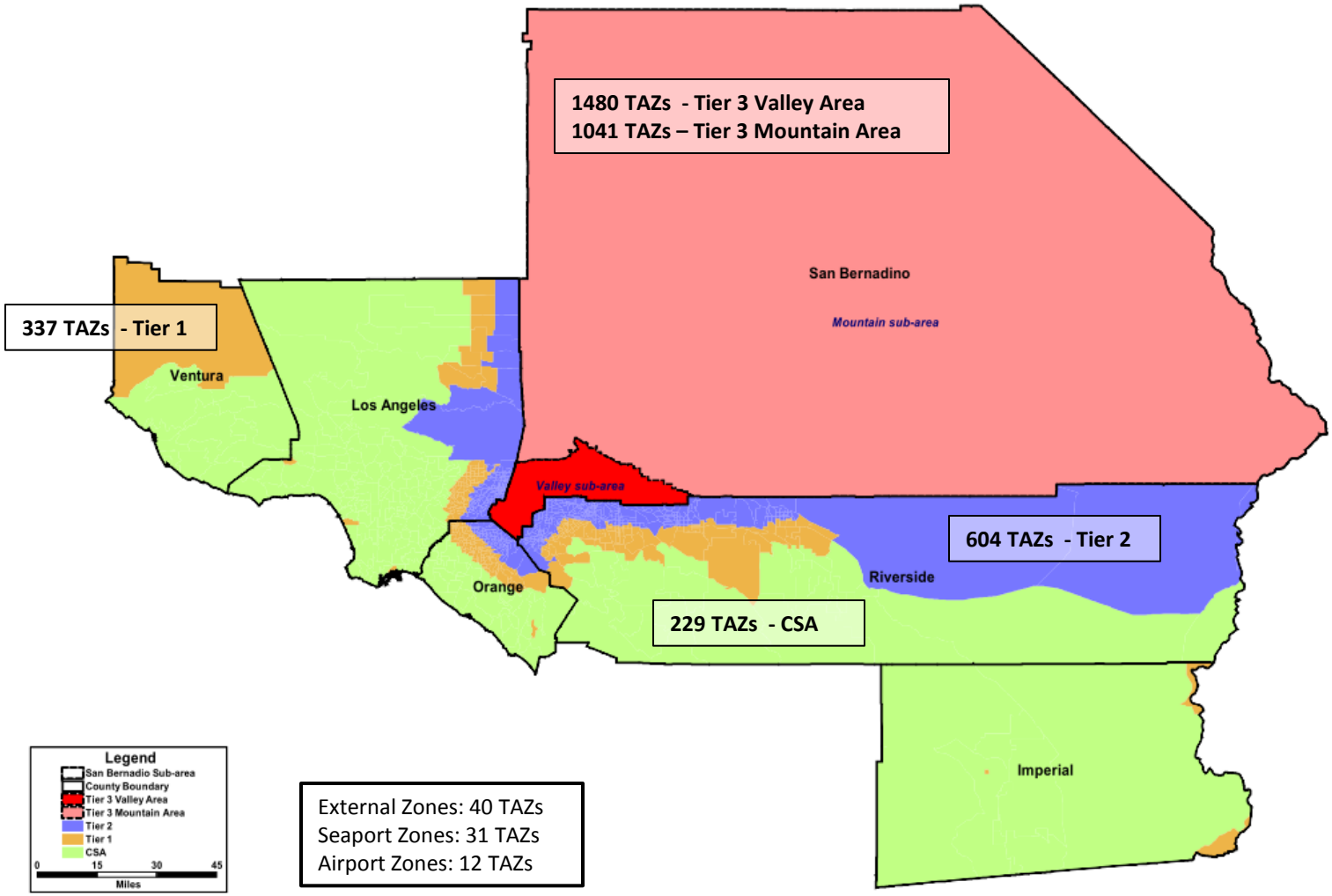
Tiered Zone Structure

- To enhance the precision of the micro-level land use and smart growth analysis



Tiered Zone Structure in SBTAM



2008 MODEL VALIDATION

2008 Model Validation

- Trip Generation
- Trip Distribution
- Mode Split
- Trip Assignment

Trip Generation – Daily Prod. and Attr.

SBTAM Vs. SCAG Model

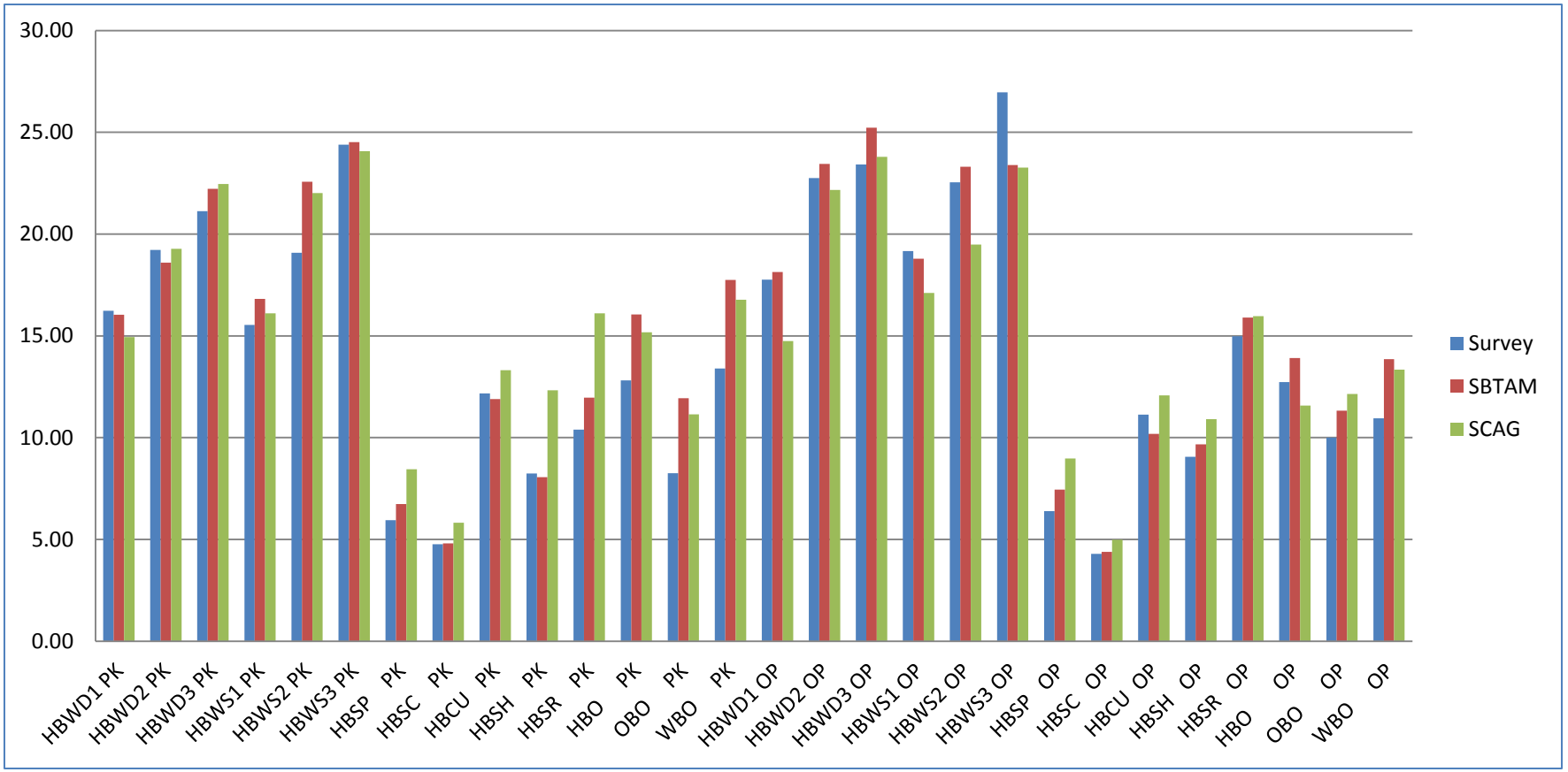
County	HBWD1	HBWD2	HBWD3	HBWS1	HBWS2	HBWS3	HBSC	HBCU	HBSH	HBSR	HBO	HBSP	WBO	OBO	TOTAL
% Difference - Production															
Imperial	-1.7%	-1.5%	-1.2%	-1.6%	1.2%	4.8%	0.0%	1.0%	-0.1%	-0.4%	-0.5%	-0.1%	0.0%	0.5%	-0.1%
Los Angeles	-0.9%	-4.2%	-6.3%	-0.8%	-4.4%	-6.4%	0.0%	-3.3%	0.8%	0.9%	1.2%	0.7%	0.0%	0.5%	-0.1%
Orange	-1.3%	-0.5%	2.3%	-1.2%	-0.4%	2.1%	0.0%	-3.7%	0.0%	0.0%	0.1%	0.0%	0.0%	0.5%	0.1%
Riverside	-1.9%	2.0%	-0.4%	-2.0%	2.1%	-0.2%	0.0%	-3.1%	-0.3%	-0.4%	-0.4%	-0.1%	0.0%	0.5%	-0.1%
San Bernardino	-0.2%	-0.1%	-0.1%	-0.3%	-0.2%	-0.1%	1.7%	-15.0%	-0.3%	-0.5%	-0.5%	0.5%	0.0%	0.5%	0.0%
Ventura	4.6%	-2.1%	-2.5%	5.7%	-2.2%	-3.1%	0.0%	-3.7%	-0.1%	-0.1%	-0.1%	-0.2%	0.0%	0.5%	0.1%
Total	-0.8%	-2.3%	-2.9%	-0.7%	-2.3%	-3.0%	0.2%	-4.5%	0.4%	0.4%	0.6%	0.4%	0.0%	0.5%	0.0%
% Difference - Attraction															
Imperial	-2.3%	-2.5%	-3.2%	-1.6%	-2.2%	-2.8%	0.0%	-2.3%	-0.1%	-0.1%	-0.1%	-0.1%	0.1%	0.5%	-0.4%
Los Angeles	-0.6%	-2.2%	-2.9%	-0.5%	-2.3%	-3.0%	0.0%	0.0%	0.3%	0.3%	0.5%	0.4%	0.0%	0.5%	0.0%
Orange	-0.5%	-2.3%	-3.0%	-0.4%	-2.3%	-3.0%	0.0%	-0.2%	0.5%	0.4%	0.6%	0.4%	0.0%	0.5%	0.0%
Riverside	-2.6%	-2.3%	-3.0%	-2.5%	-2.3%	-3.0%	0.0%	0.1%	0.3%	0.3%	0.5%	0.3%	0.0%	0.5%	-0.1%
San Bernardino	-0.4%	-2.2%	-2.9%	-0.4%	-2.4%	-3.1%	1.7%	-41.9%	0.7%	0.7%	0.9%	1.1%	0.0%	0.5%	-0.1%
Ventura	-0.5%	-2.3%	-3.0%	-0.4%	-2.3%	-3.0%	0.0%	-1.1%	0.2%	0.4%	0.6%	0.4%	0.0%	0.5%	0.0%
Total	-0.8%	-2.3%	-2.9%	-0.7%	-2.3%	-3.0%	0.2%	-4.5%	0.4%	0.4%	0.6%	0.4%	0.0%	0.5%	0.0%

Trip Distribution

- Recalibration
  - Based on the observed trip table
  - Recalibrate the friction factor parameters at the county level

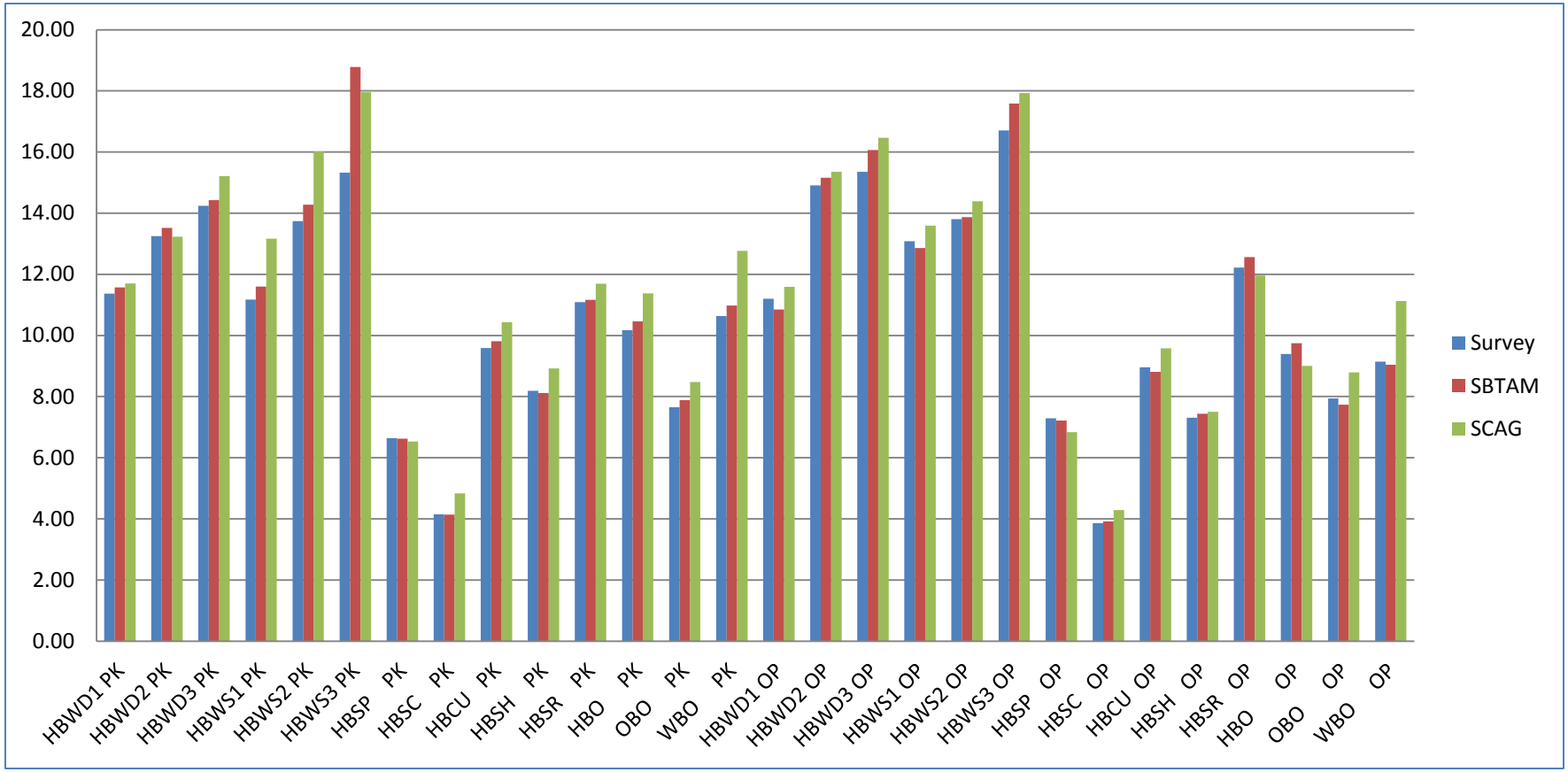
Calibrated Average Trip Distance

San Bernardino County



Calibrated Average Trip Distance

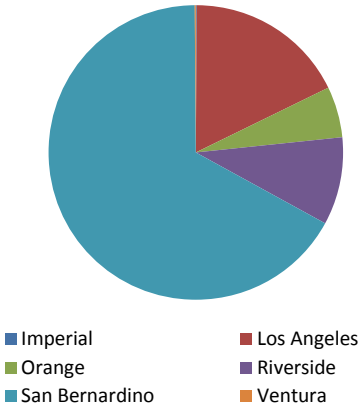
Region-wide



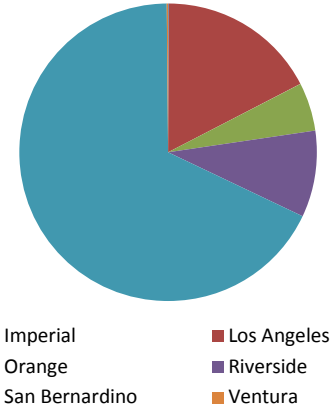
Inter-County Trips – from San Bernardino County
SBTAM Vs. SCAG Model

HBW →

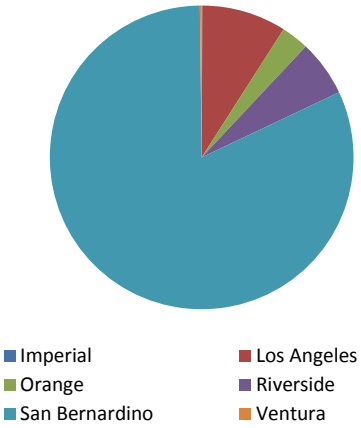
SBTAM HBW Inter-County Trips from San Bernardino County



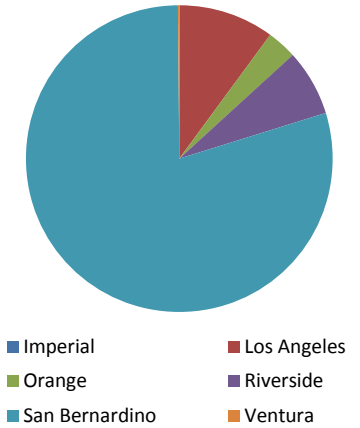
SCAG HBW Inter-County Trips from San Bernardino County



SBTAM Total Inter-County Trips from San Bernardino County



SCAG Total Inter-County Trips from San Bernardino County



← All-Purpose Combined

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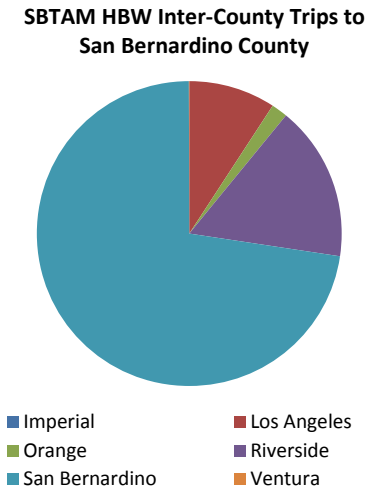
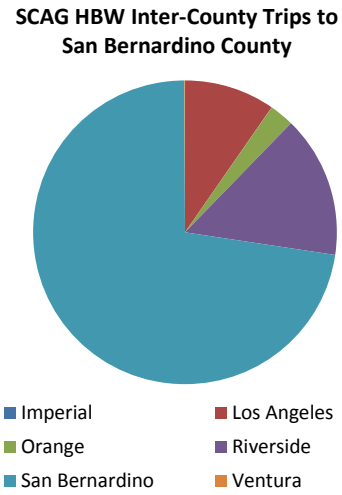
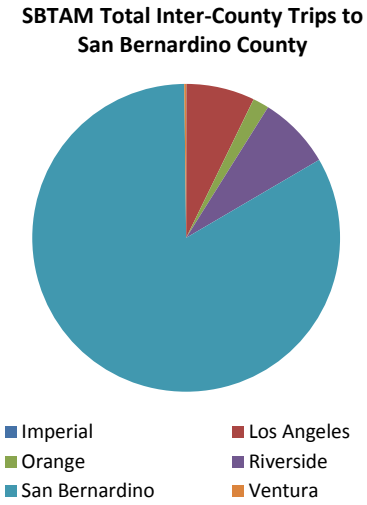
Inter-County Trips – to San Bernardino County
SBTAM Vs. SCAG Model

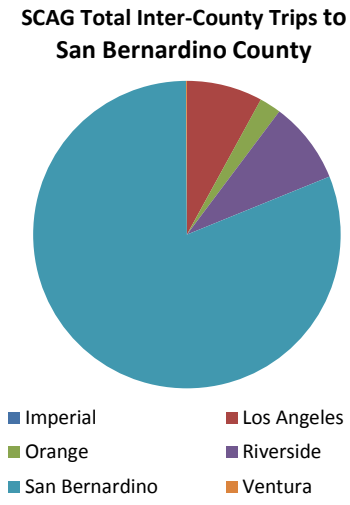
Development of the San Bernardino County Transportation Analysis Model

HBW →









← All-Purpose Combined

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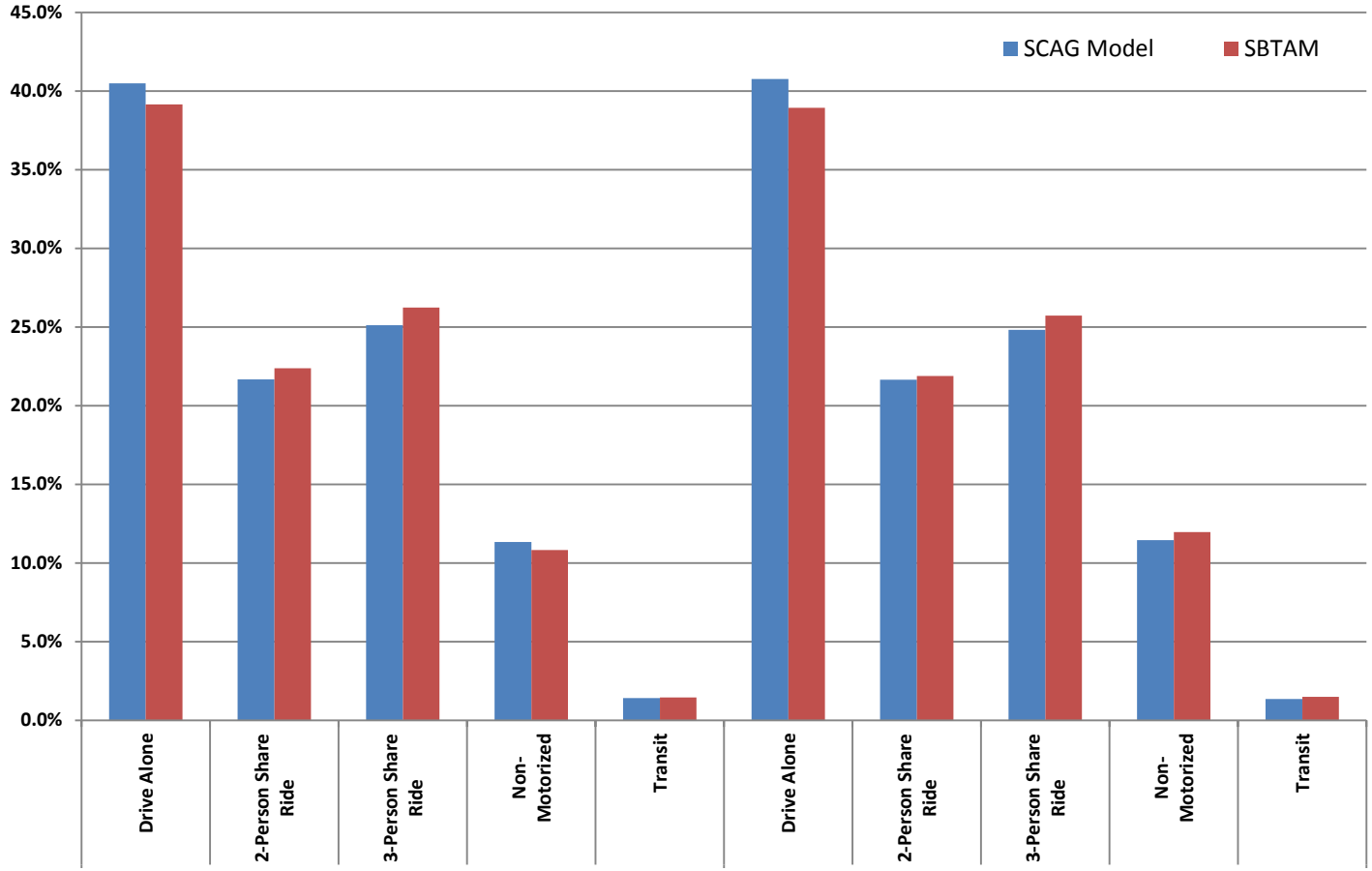
Mode Split

- Mode shares estimated from SBTAM are not consistent with the SCAG model results
  - Non-motorized and transit mode shares estimated from SBTAM are significantly higher than the mode shares from SCAG model, at the expense of auto mode shares.
  - Due to the highly dense zone structure in the San Bernardino County, the accessibility of non-motorized modes and transit modes are significantly increased.
- Shift trips between modes at the county level to match SCAG mode shares.

Daily Mode Share Comparison

SBTAM Vs. SCAG Model



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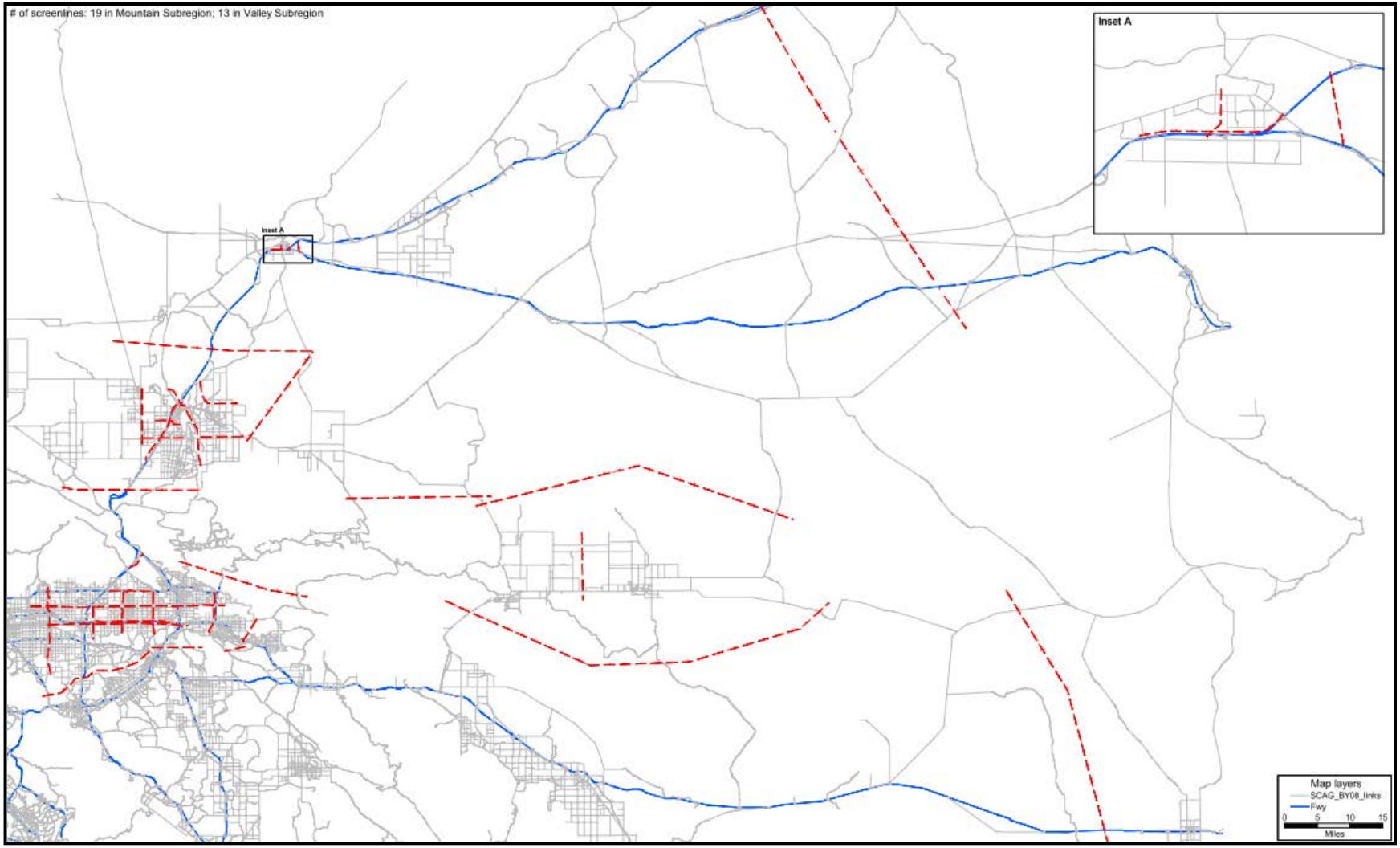
Screenline Traffic Count

- Screenlines are developed to validate the model.
  - 13 screenlines in Valley with 44 freeways, 8 HOVs and 200 arterials
  - 19 screenlines in the Mountain & Desert area with 22 freeways and 84 arterials
- Collect existing traffic counts from different agencies
- Collect traffic counts on-site
  - 49 count locations in Valley
  - 28 count locations in Mountain/Desert

Screenline Locations



Screenline Analysis – Valley

Development of the San Bernardino County Transportation Analysis Model

ID	Street Name	Screenline Count	Max Desirable Deviation	SCAG Model			SBTAM – before Validation			SBTAM – after Validation		
				Model ADT	% Diff (SCAG - Count)	Model Deviation	Model ADT	% Diff (SBTAM - Count)	Model Deviation	Model ADT	% Diff (SBTAM- Count)	Model Deviation
1	North/South east of Riverside Avenue	352,966	16%	365,233	3%		315,439	-11%		402,723	14%	
2	North/South west of Etiwanda Avenue	303,769	17%	253,669	-16%		207,425	-32%	Exceed Max	292,596	-4%	
3	North/South east of Citrus Avenue	443,102	15%	389,295	-12%		342,689	-23%	Exceed Max	439,813	-1%	
4	East/West north of Arrow Highway	974,525	11%	862,253	-12%	Exceed Max	787,440	-19%	Exceed Max	938,763	-4%	
5	East/West north of SR-210 at foothills	32,900	39%	42,106	28%		35,803	9%		40,627	23%	
6	North/South west of Yucaipa Blvd	186,552	20%	178,768	-4%		168,379	-10%		182,774	-2%	
7	East/West north of I-10 between I-15 and I-215	297,177	17%	316,923	7%		264,048	-11%		324,603	9%	
8	East/West South of I-215/I-15 Junction	212,117	19%	235,187	11%		220,257	4%		229,105	8%	
9	East/West south of SR-210 between I-15 and I-215	150,779	21%	127,709	-15%		119,985	-20%		144,962	-4%	
10	(SCAG SCREENLINE 6): North/South east of Euclid Avenue	910,127	11%	940,115	3%		809,037	-11%		934,611	3%	
11	(SCAG SCREENLINE 7): East/West south of I-10	840,408	12%	834,683	-1%		653,800	-22%	Exceed Max	817,733	-3%	
12	(SCAG SCREENLINE 9): North/south west of SR-215	389,540	15%	351,798	-10%		306,634	-21%	Exceed Max	362,177	-7%	
13	(SCAG SCREENLINE 30): East/West north of SR-91	741,496	12%	843,567	14%	Exceed Max	697,822	-6%		761,152	3%	
VALLEY SUBREGION TOTAL		**5,835,457**		**5,741,306**	**-2%**		**4,928,758**	**-16%**		**5,871,640**	**1%**	

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Screenline Analysis – Mountain/Desert

ID	Street Name	Screenline Count	Max Desirable Deviation	SCAG Model			SBTAM – before Validation			SBTAM – after Validation		
				Model ADT	% Diff (SCAG - Count)	Model Deviation	Model ADT	% Diff (SBTAM - Count)	Model Deviation	Model ADT	% Diff (SBTAM - Count)	Model Deviation
1	North/South - South of I-15/Old Highway 58	71,672	28%	62,928	-12%		75,099	5%		74,844	4%	
2	North/South - West of SR-247/Barstow Road	13,400	53%	11,216	-16%		12,106	-10%		11,380	-15%	
3	East/West - North of Bear Valley Road/East of Yates Road	61,200	31%	45,991	-25%		46,415	-24%		50,324	-18%	
4	North/South - West of I-15	161,624	21%	135,139	-16%		132,820	-18%		152,886	-5%	
5	East/West - North of Palmdale Road (SR-18)/North of Green Tree Boulevard	178,183	20%	152,308	-15%		163,215	-8%		167,022	-6%	
6	North/South - East of US-395	52,939	32%	47,768	-10%		51,310	-3%		59,507	12%	
7	East/West - North of I-15/East of SR-58	45,669	34%	34,654	-24%		33,170	-27%		36,165	-21%	
8	East/West - North of Happy Trails Highway (SR-18)	19,015	47%	9,203	-52%	Exceed Max	14,330	-25%		16,136	-15%	
9	(SCAG Screenline 13): East/West - North of Cajon Pass	181,524	20%	207,888	15%		199,438	10%		204,454	13%	
10	(SCAG Screenline 13): East/West - South of SR-247 (Big Bear Area)	6,735	59%	4,405	-35%		6,108	-9%		6,354	-6%	
11	(SCAG Screenline 20): East/West - North of SR-18/North of Dale Evans Parkway	95,866	25%	92,902	-3%		95,234	-1%		95,710	0%	
12	North/South - North of SR-15/West of Bartow Road	101,340	25%	83,350	-18%		90,043	-11%		92,802	-8%	
13	(SCAG Screenline 31): North/South - North of SR-18/North of Dale Evans Parkway	71,217	29%	61,579	-14%		62,136	-13%		61,970	-13%	
14	(SCAG Screenline 32): North/South - South of SR-62/West of US Highway 95	29,300	41%	31,543	8%		35,540	21%		34,205	17%	
15	(SCAG Screenline 34): North/South - East of I-15 / North of State Highway 173	141,441	22%	127,119	-10%		131,336	-7%		138,362	-2%	
16	East/West - East of US Highway 395/North of Bear Valley Road	254,881	18%	187,807	-26%	Exceed Max	200,899	-21%	Exceed Max	230,809	-9%	
17	(Part of SCAG Screenline 13): East/West - South of SR-247/East of SR-18	4,200	63%	5,441	30%		7,371	75%	Exceed Max	5,741	37%	
18	North/South - East of SR-247/North of 29 Palms Highway	16,157	50%	7,257	-55%	Exceed Max	13,017	-19%		15,163	-6%	
19	East/West - North of I-10/ South of 29 Palms Highway	29,699	40%	28,368	-4%		31,641	7%		29,464	-1%	
MOUNTAIN/DESERT SUBREGION TOTAL		**1,536,062**		**1,336,867**	**-13%**		**1,401,228**	**-9%**		**1,483,300**	**-3%**	

Screenline Volume by Facility Type

Facility Code	Facility Type	Total Counts	SCAG Model		SBTAM – before Validation		SBTAM – after Validation	
			Model ADT	% Diff (SCAG - Count)	Model ADT	% Diff (SBTAM - Count)	Model ADT	% Diff (SBTAM - Count)
1	Freeway	3,259,039	3,348,748	3%	2,899,380	-11%	3,464,277	6%
2	HOV	80,322	113,646	41%	93,644	17%	75,934	-5%
3	Expressway/Parkway	95,200	87,466	-8%	75,606	-21%	80,931	-15%
4	Principal Arterial	1,063,113	1,044,965	-2%	877,959	-17%	1,085,641	2%
5	Minor Arterial	1,074,326	999,402	-7%	828,387	-23%	988,046	-8%
6	Major Collector	251,438	144,660	-42%	147,229	-41%	168,955	-33%
7	Minor Collector	12,019	2,419	-80%	6,553	-45%	7,856	-35%
VALLEY SUBREGION TOTAL		**5,835,457**	**5,741,306**	**-2%**	**4,928,758**	**-16%**	**5,871,640**	**1%**
1	Freeway	732,728	755,575	3%	792,028	8%	799,473	9%
4	Principal Arterial	289,585	216,612	-25%	248,523	-14%	268,449	-7%
5	Minor Arterial	391,881	293,578	-25%	283,821	-28%	333,874	-15%
6	Major Collector	112,468	65,578	-42%	64,766	-42%	67,844	-40%
7	Minor Collector	9,400	5,524	-41%	12,090	29%	13,659	45%
MOUNTAIN/DESERT SUBREGION TOTAL		**1,536,062**	**1,336,867**	**-13%**	**1,401,228**	**-9%**	**1,483,300**	**-3%**

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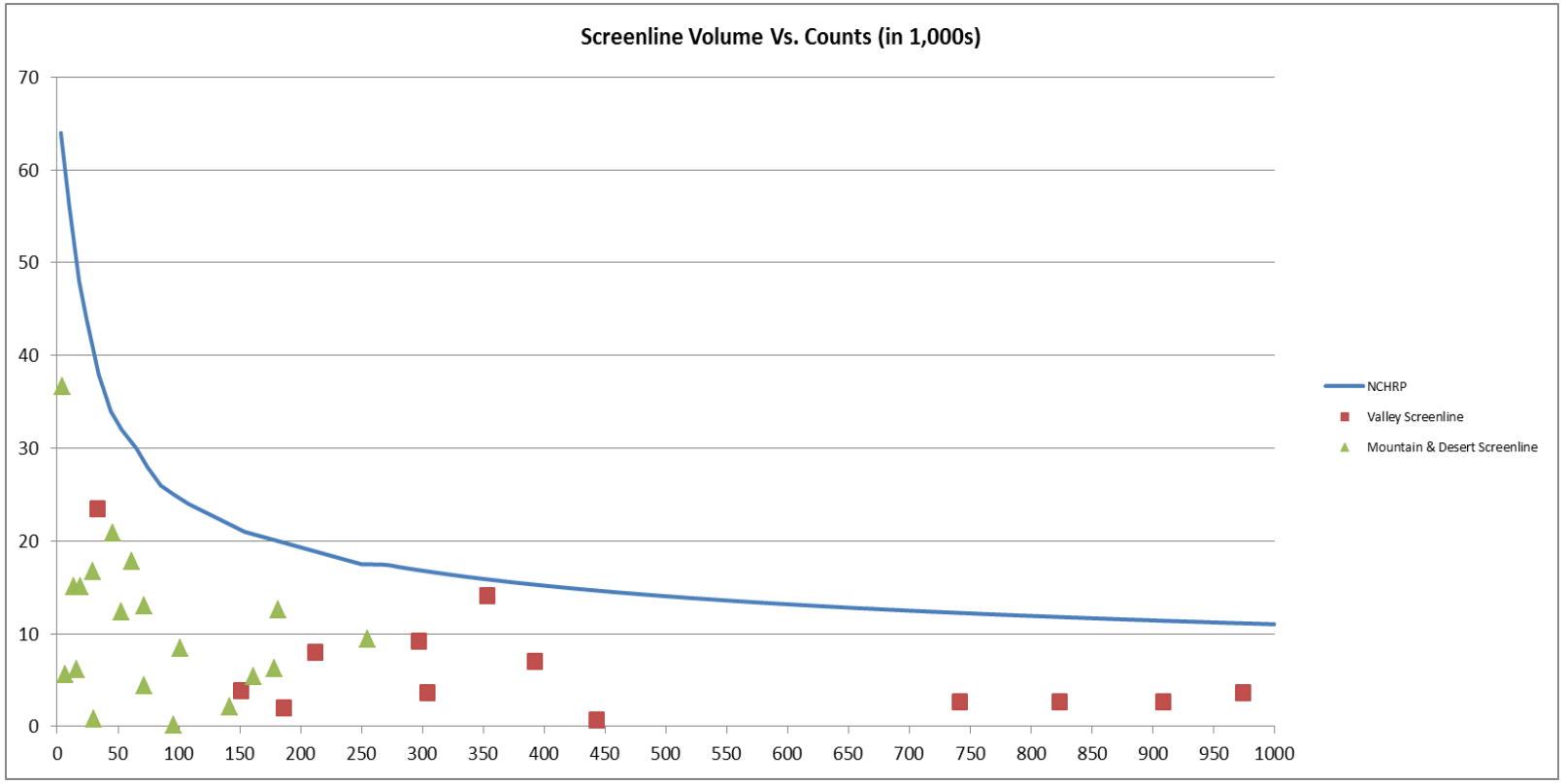
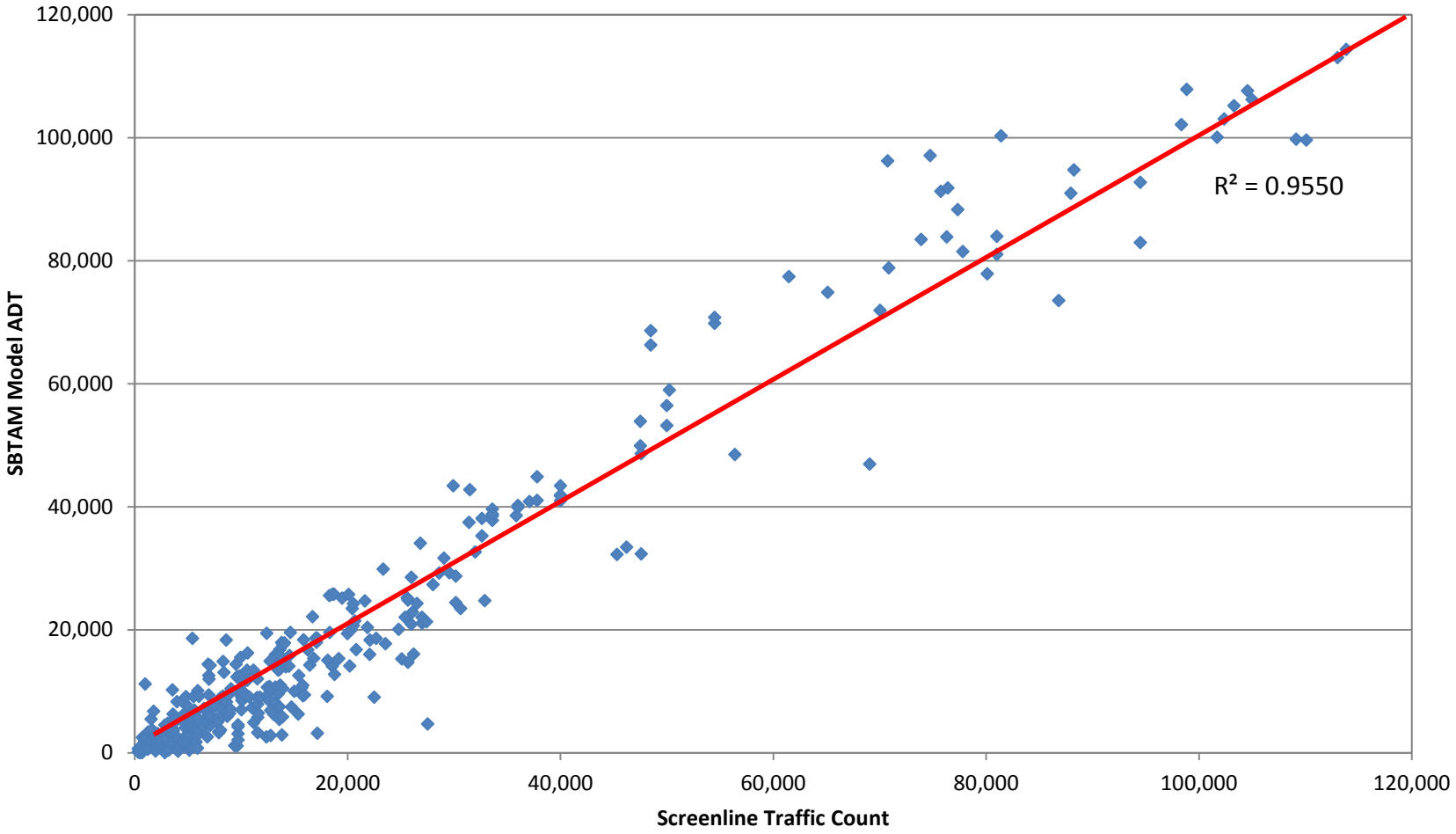
Reasonableness of Model Validation

Development of the San Bernardino County Transportation Analysis Model

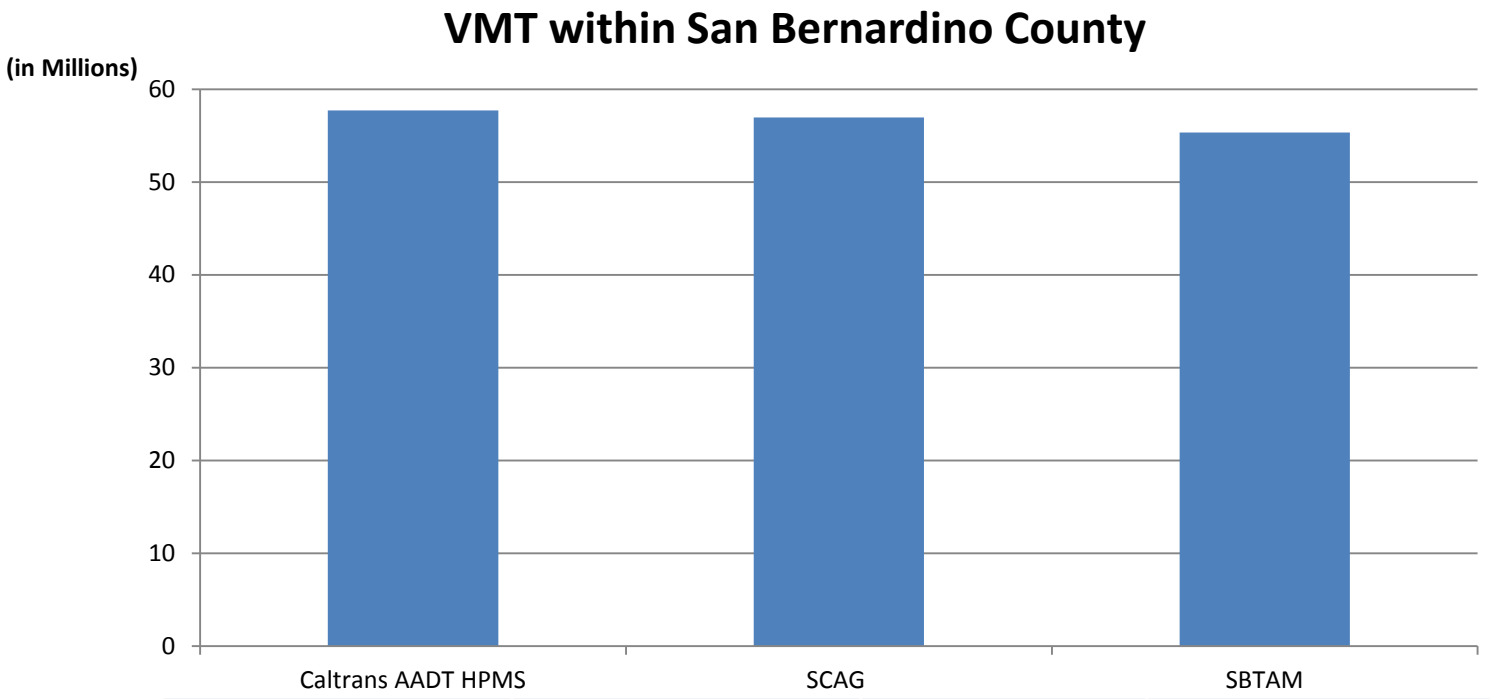
Subregion	PRMSE		
	SCAG Model	SBTAM – before Validation	SBTAM – after Validation
Valley	28%	34%	27%
Mountain/Desert	39%	35%	31%



Model and Traffic Count Validation



VMT – SBTAM Vs. SCAG Model



County	Caltrans AADT HPMS	SCAG Model	SBTAM
San Bernardino	57,701,180	56,967,227	55,336,315
compared to HPMS		-1.3%	-4.1%
compared to SCAG			-2.9%

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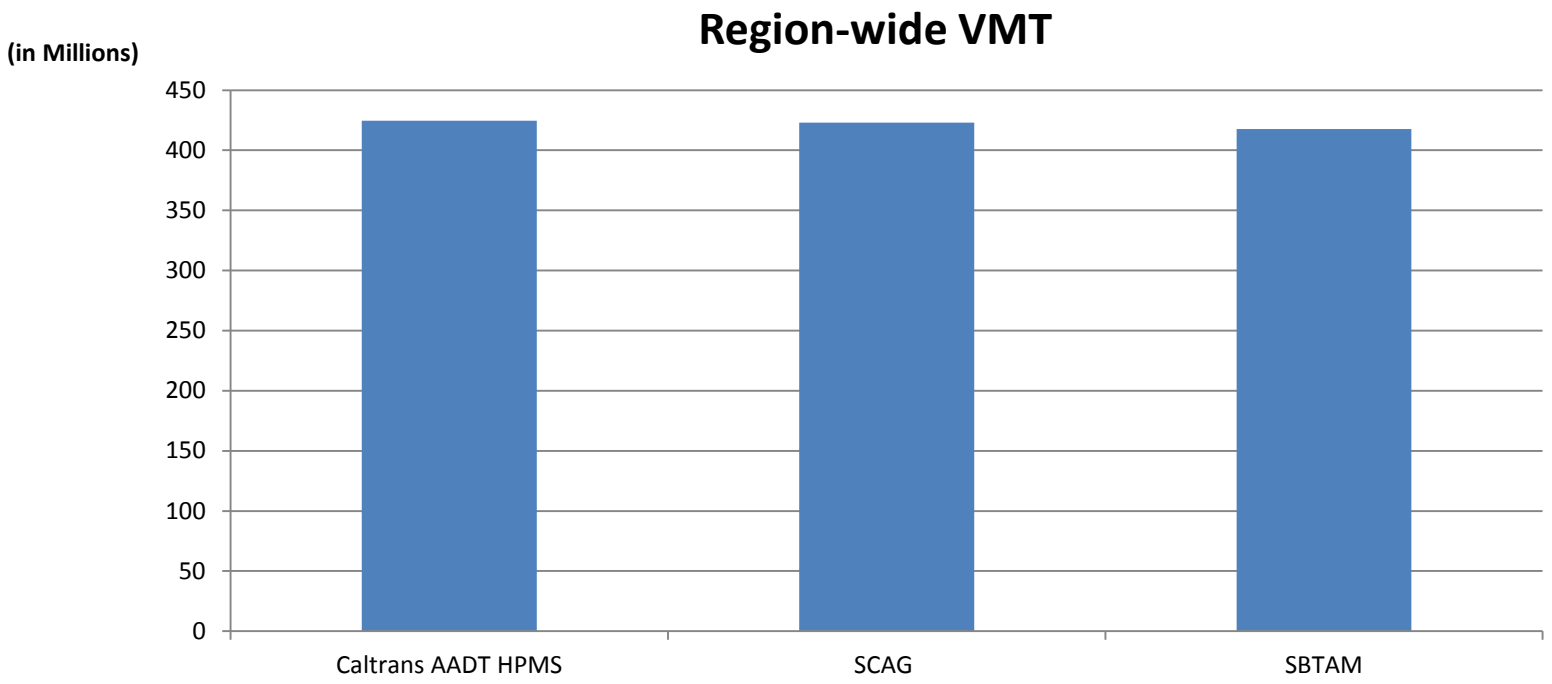
VMT – SBTAM Vs. SCAG Model



County	Caltrans AADT HPMS	SCAG Model	SBTAM
Region-wide	424,598,100	422,942,866	417,630,336
compared to HPMS		-0.4%	-1.6%
compared to SCAG			-1.3%

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2035 FUTURE YEAR FORECAST

2035 SCAG Model Update

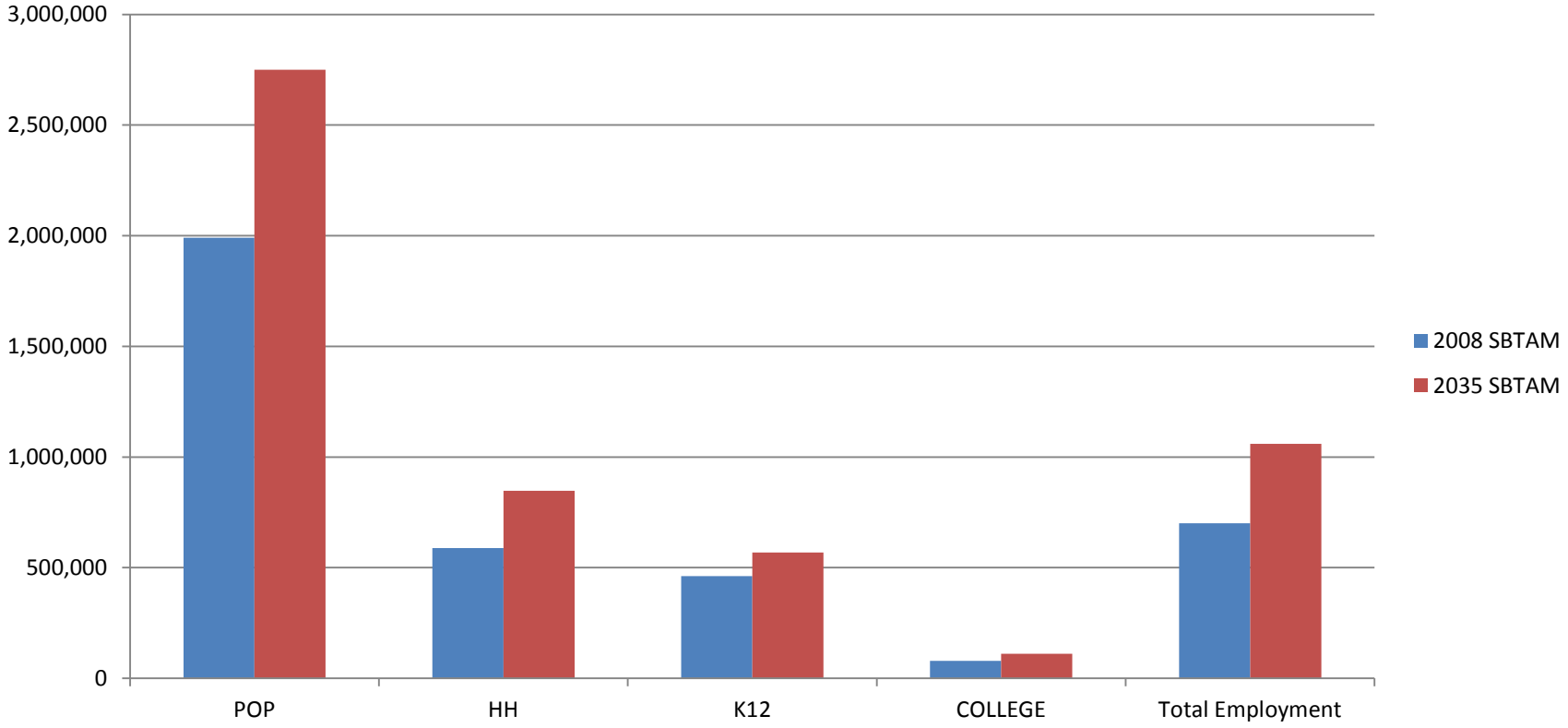
- SCAG version 6 model has been significantly updated compared to version 5 model, the base model to develop SBTAM.
  - Different zone structures
    - SCAG V5 model uses Tier 1 zone structure
    - SCAG V6 model uses mixed zone structures
      - Tier 1 zone structure: Time of day and assignment models
      - Tier 2 zone structure: Skimming, trip generation, distribution and mode choice
  - Different toll procedure
  - Significant enhancement in each model step

    Trip Generation, distribution, mode split and assignment

Development of SBTAM Future Scenario

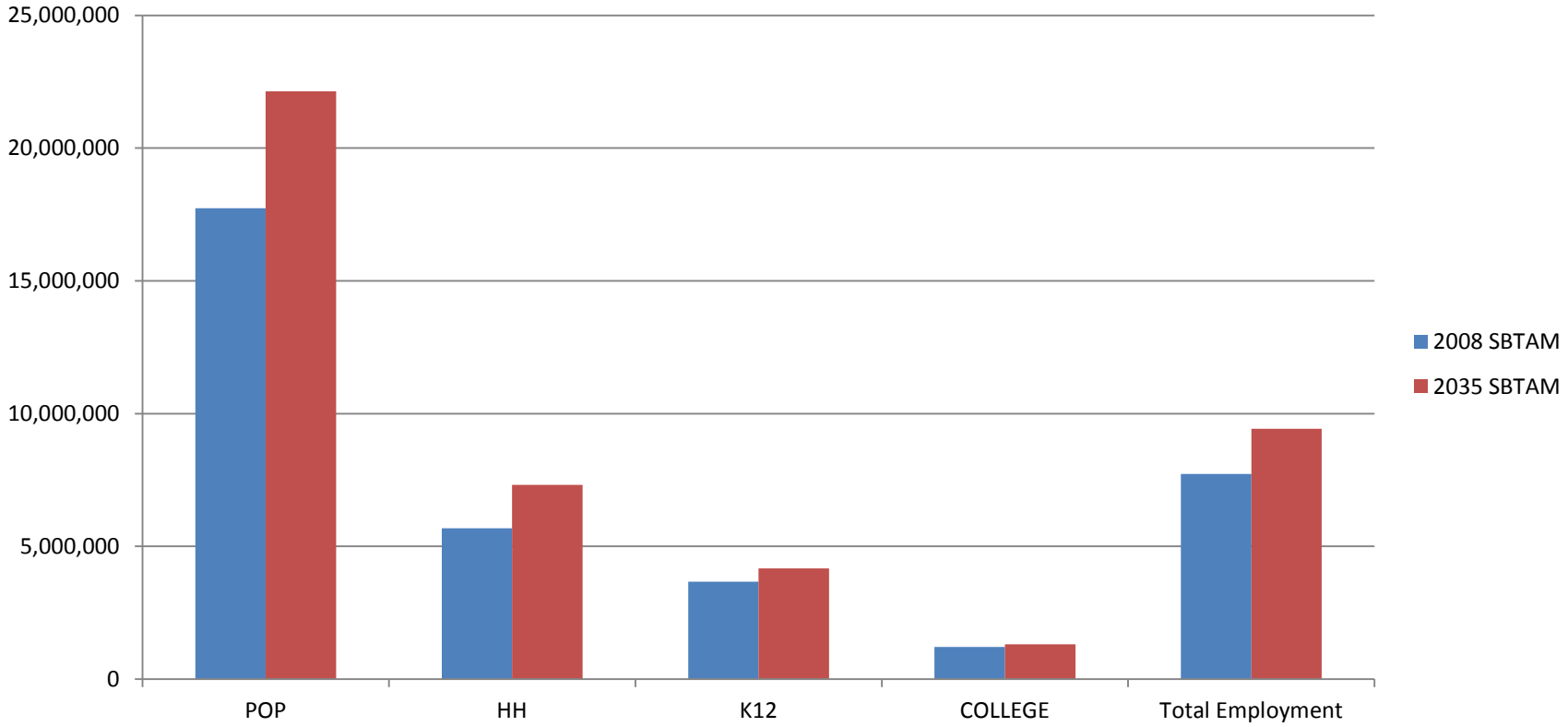
- Use the highway/transit networks in SCAG V6 model, including projects adopted in the 2012 RTP.
- Network Update:
  - Highway Network: centroid connector, toll facility, and other project-related updates
  - Transit Network: transit route update, transit mode revision to be consistent with the definition in SCAG v5 model
- Tables and matrices conversion between zone structures

San Bernardino SED Growth



SED	Population	Household	K12	College	Total Employment
SB County Growth%	38.2%	43.9%	23.0%	41.0%	51.2%

Region-wide SED Growth



SED	Population	Household	K12	College	Total Employment
Region-wide Growth%	24.8%	28.7%	13.9%	8.9%	21.9%

County-to-County Trip Growth

From	To	Growth	Growth%
San Bernardino	Imperial	73	2%
	Los Angeles	204,849	36%
	Orange	103,761	55%
	Riverside	316,832	83%
	San Bernardino	1,861,974	35%
	Ventura	5,769	49%
	TOTAL	**2,493,258**	**39%**

From	To	Growth	Growth %
Imperial	San Bernardino	1,548	88%
Los Angeles		131,007	29%
Orange		33,728	31%
Riverside		253,924	53%
San Bernardino		1,861,974	35%
Ventura		3,808	30%
TOTAL		**2,285,989**	**36%**

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Person Trip Growth by Mode

MODE	2035 vs. 2008			
	Production Growth%		Attraction Growth%	
	Valley	Mountain	Valley	Mountain
DA Peak	40%	56%	40%	54%
SR2 Peak	30%	45%	29%	43%
SR3 Peak	34%	50%	30%	43%
Non-Motorized Peak	34%	59%	47%	62%
Transit Peak	19%	25%	19%	30%
TOTAL PEAK	**34%**	**51%**	**33%**	**47%**
DA Off-Peak	39%	52%	38%	50%
SR2 Off-Peak	34%	46%	30%	43%
SR3 Off-Peak	37%	50%	30%	41%
Non-Motorized Off-Peak	36%	64%	51%	67%
Transit Off-Peak	23%	24%	24%	30%
TOTAL OFF-PEAK	**36%**	**50%**	**33%**	**46%**
DA Daily	39%	54%	39%	52%
SR2 Daily	32%	46%	30%	43%
SR3 Daily	36%	50%	30%	42%
Non-Motorized Daily	35%	61%	49%	64%
Transit Daily	20%	25%	20%	30%
TOTAL DAILY	**35%**	**50%**	**33%**	**47%**

Screenline Volume Growth – Valley

ID	Street Name	2008 SBTAM	2035 SBTAM	
			Model ADT	Growth%
1	North/South east of Riverside Avenue	402,723	569,276	41%
2	North/South west of Etiwanda Avenue	292,596	393,118	34%
3	North/South east of Citrus Avenue	439,813	608,742	38%
4	East/West north of Arrow Highway	938,763	1,309,273	39%
5	East/West north of SR-210 at foothills	40,627	83,951	107%
6	North/South west of Yucaipa Blvd	182,774	268,842	47%
7	East/West north of I-10 between I-15 and I-215	324,603	429,268	32%
8	East/West South of I-215/I-15 Junction	229,105	360,541	57%
9	East/West south of SR-210 between I-15 and I-215	144,962	181,800	25%
10	(SCAG SCREENLINE 6): North/South east of Euclid Avenue	934,611	1,298,147	39%
11	(SCAG SCREENLINE 7): East/West south of I-10	817,733	1,168,966	43%
12	(SCAG SCREENLINE 9): North/south west of SR-215	362,177	527,991	46%
13	(SCAG SCREENLINE 30): East/West north of SR-91	761,152	1,182,027	55%
VALLEY SUBREGION TOTAL		**5,871,640**	**8,381,942**	**43%**

Screenline Volume Growth – Mountain/Desert

ID	Street Name	2008 SBTAM	2035 SBTAM	
			Model ADT	Growth%
1	North/South - South of I-15/Old Highway 58	74,844	111,634	49%
2	North/South - West of SR-247/Barstow Road	11,380	17,885	57%
3	East/West - North of Bear Valley Road/East of Yates Road	50,324	56,625	13%
4	North/South - West of I-15	152,886	217,383	42%
5	East/West - North of Palmdale Road (SR-18)/North of Green Tree Boulevard	167,022	263,784	58%
6	North/South - East of US-395	59,507	109,373	84%
7	East/West - North of I-15/East of SR-58	36,165	43,809	21%
8	East/West - North of Happy Trails Highway (SR-18)	16,136	28,497	77%
9	(SCAG Screenline 13): East/West - North of Cajon Pass	204,454	338,181	65%
10	(SCAG SCREENLINE 13): East/West - South of SR-247 (Big Bear Area)	6,354	6,853	8%
11	(SCAG SCREENLINE 20): East/West - North of SR-18/North of Dale Evans Parkway	95,710	161,142	68%
12	North/South - North of SR-15/West of Bartow Road	92,802	135,896	46%
13	(SCAG SCREENLINE 31): North/South - North of SR-18/North of Dale Evans Parkway	61,970	95,270	54%
14	(SCAG SCREENLINE 32): North/South - South of SR-62/West of US Highway 95	34,205	59,709	75%
15	(SCAG SCREENLINE 34): North/South - East of I-15 / North of State Highway 173	138,362	216,571	57%
16	East/West - East of US Highway 395/North of Bear Valley Road	230,809	312,897	36%
17	(Part of SCAG SCREENLINE 13): East/West - South of SR-247/East of SR-18	5,741	7,706	34%
18	North/South - East of SR-247/North of 29 Palms Highway	15,163	17,005	12%
19	East/West - North of I-10/ South of 29 Palms Highway	29,464	39,261	33%
MOUNTAIN/DESERT SUBREGION TOTAL		**1,483,300**	**2,239,479**	**51%**

Screenline Volume Growth by Facility Type

Facility Code	Facility Type	2008 SBTAM	2035 SBTAM	
			Model ADT	Growth%
1	Freeway	3,464,277	4,725,745	36%
2	HOV	75,934	149,000	96%
3	Expressway/Parkway	80,931	166,171	105%
4	Principal Arterial	1,085,641	1,531,263	41%
5	Minor Arterial	988,046	1,509,002	53%
6	Major Collector	168,955	290,047	72%
7	Minor Collector	7,856	10,713	36%
VALLEY SUBREGION TOTAL		**5,871,640**	**8,381,942**	**43%**
1	Freeway	799,473	1,250,091	56%
2	HOV	0	25,571	NA
4	Principal Arterial	268,449	349,637	30%
5	Minor Arterial	333,874	504,153	51%
6	Major Collector	67,844	90,395	33%
7	Minor Collector	13,659	19,633	43%
MOUNTAIN/DESERT SUBREGION TOTAL		**1,483,300**	**2,239,479**	**51%**

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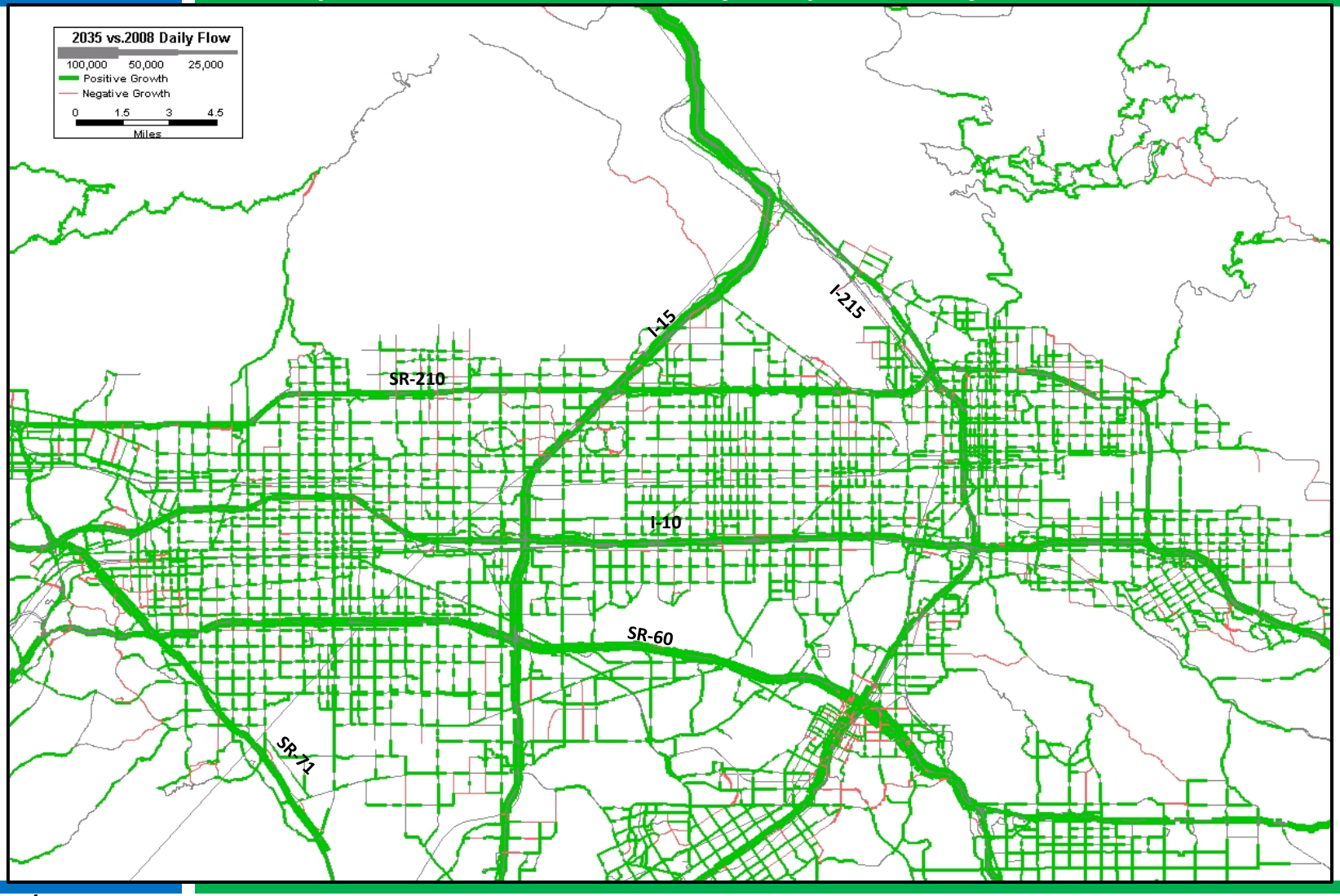
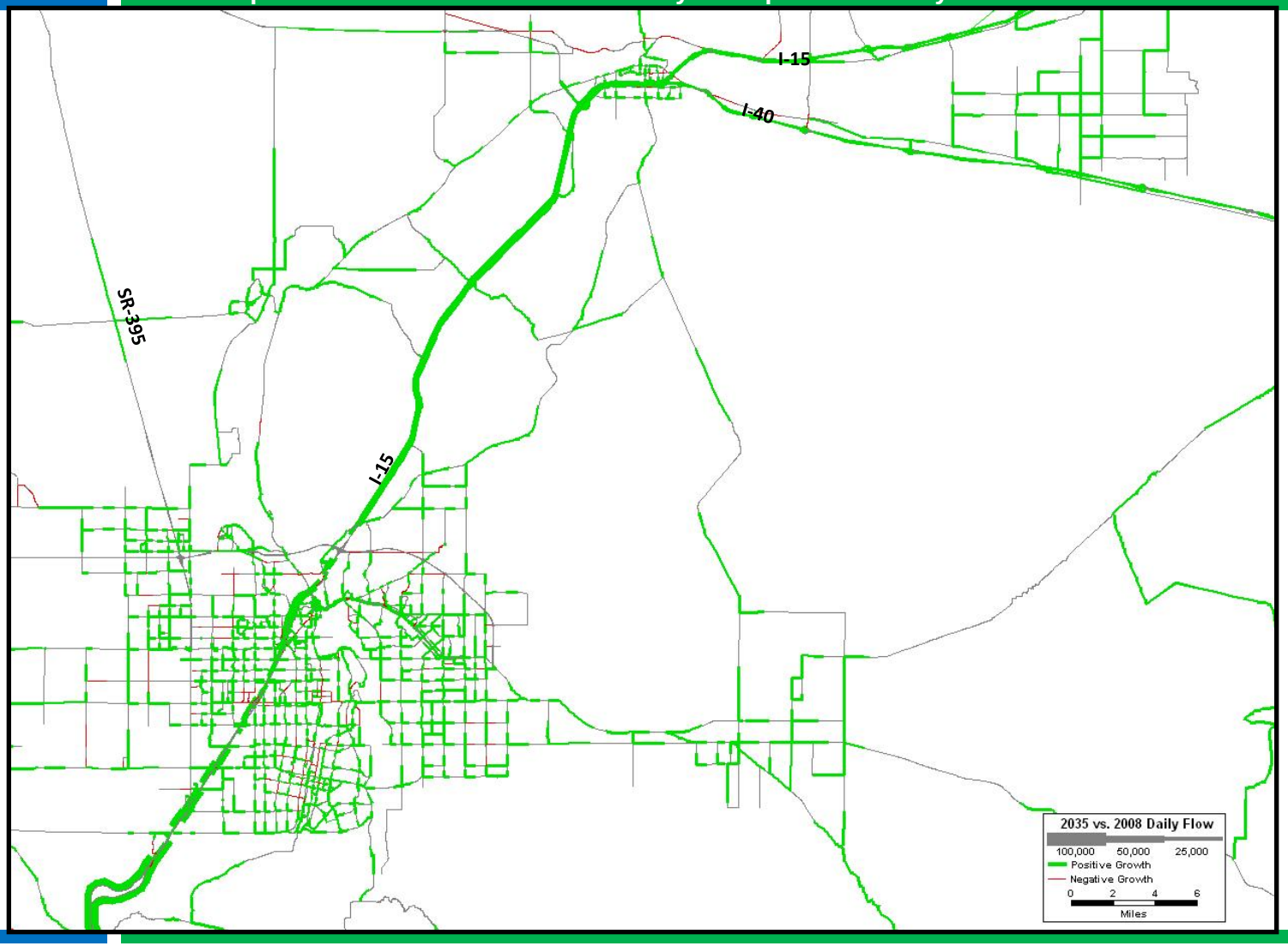
Daily Volume Growth – Valley

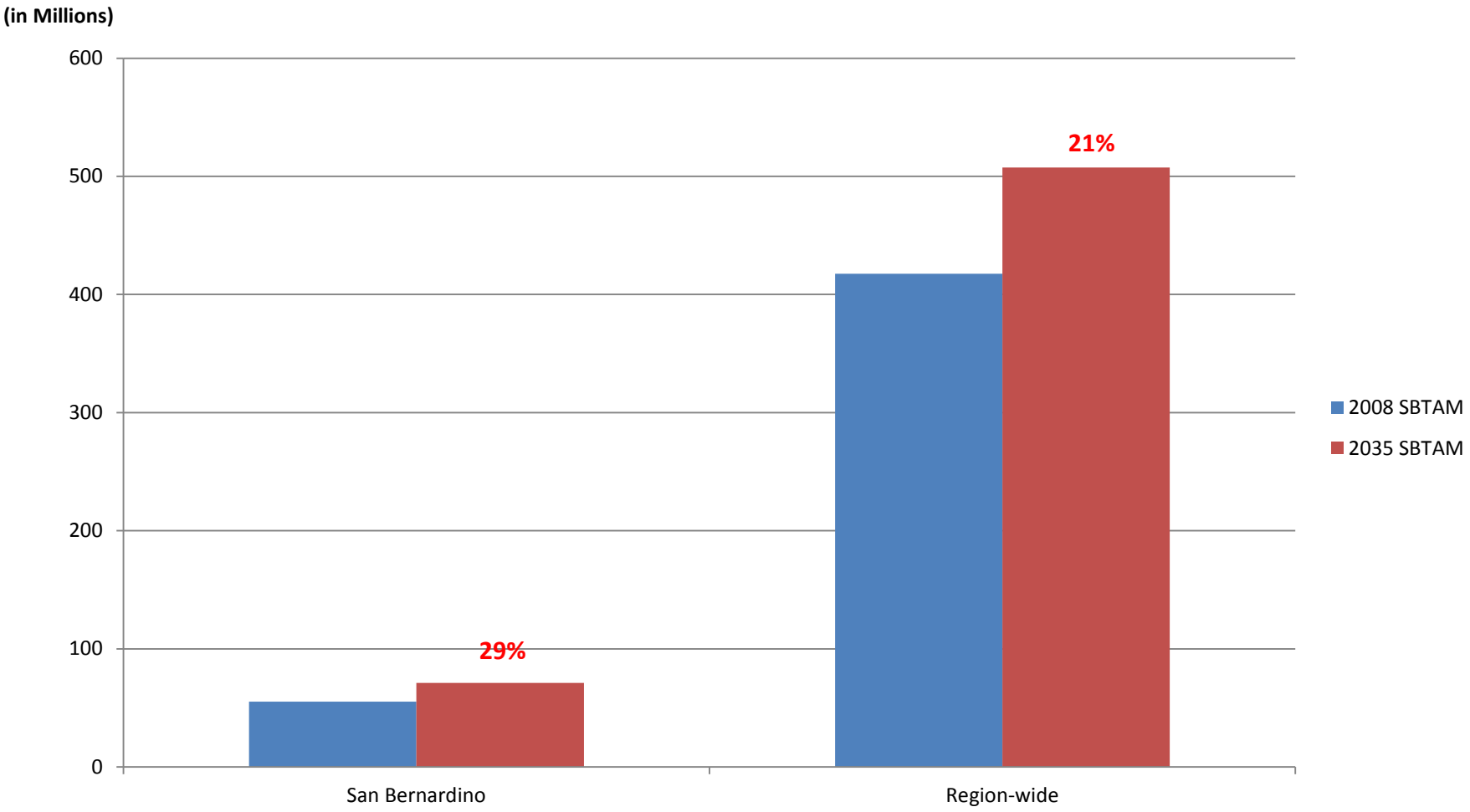


Daily Volume Growth – Mountain/Desert



VMT Growth

Development of the San Bernardino County Transportation Analysis Model



CONCLUSION

Conclusion

- SBTAM incorporates most of the enhancements of the SCAG regional model in the last decade.
- SBTAM can be used in a wide range of analyses
  - Policy analysis,
  - Freeway/Arterial segment and corridor study
  - Interchange development, etc.
  - Impact analysis of new development and general plans

Conclusion

- Next Step
  - A detailed mode choice calibration can be done if there are enough observed data to support it.
  - Validation at the transit side.
  - Move to SCAG V6.

THANK YOU!