

# Activity-Based Microsimulation Model System in Southern California: Design, Implementation, Preliminary Findings, and Future Plans

## Development of SimAGENT

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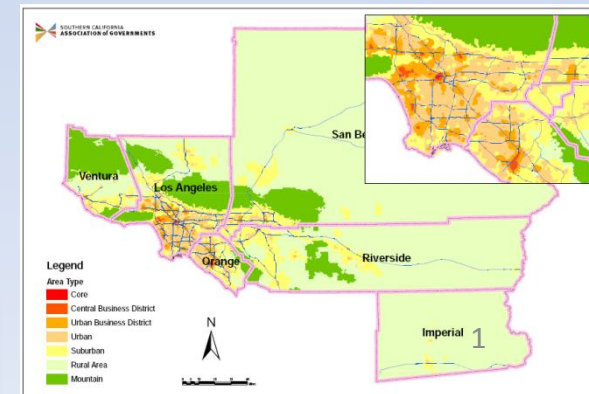
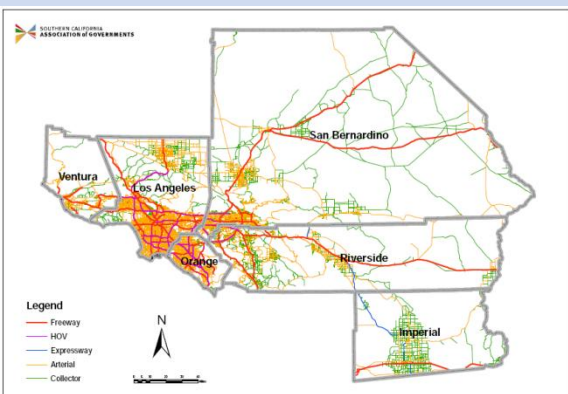


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# The Region & Context

- “SCAG is the nation's largest metropolitan planning organization, representing six counties, 189 cities and more than 19 million residents” *from SCAG web site.*
- Senate Bill 375 is the legislative framework that guides this model ->
  - coordinated land use and transportation policy to decrease GHG
  - use of activity-based models for policy assessment

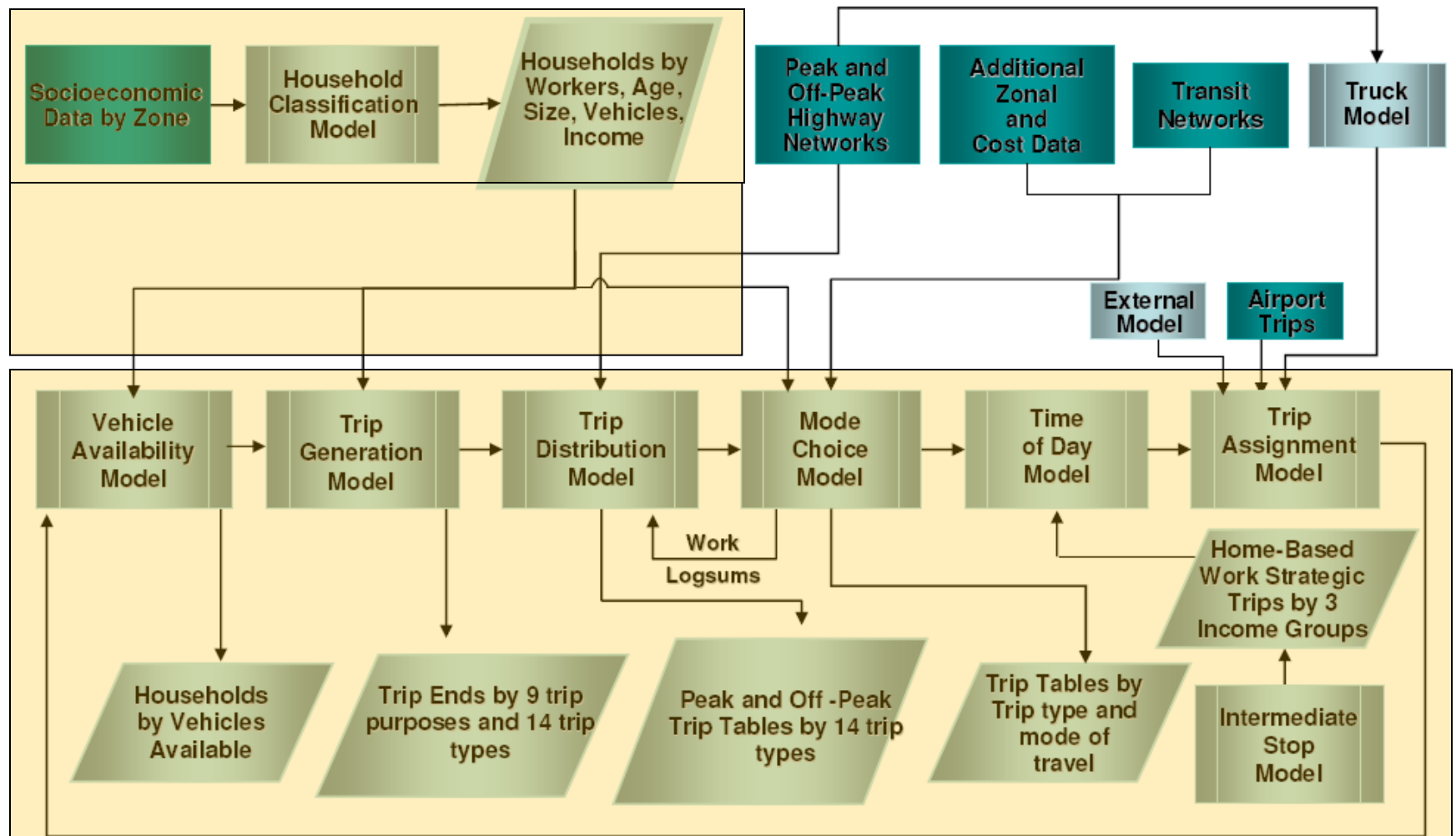
# A few basic definitions

- PopGen = method and software to recreate the population (household and person characteristics) of an area – **developed at ASU and used in a few places.**
- CEMDAP = method and software to give each person a daily schedule of activities and travel – **developed at UT Austin and used in DFW.**
- CEMSELTS = method and software to give each household primary locations (home, work, school) and other important variables for CEMDAP – **developed at UT Austin and used in DFW.**
- SimAGENT =  
PopGen+GISMaps+CEMSELTS+CEMDAP+Networks+EMFAC
- Input = demographics, spatial structure, networks, policies
- Output = a day in the life of people in SCAG + 4-step+em.

# Two Phase project

- Phase 1 = insert CEMDAP in the SCAG four-step model system and test feasibility (Tasks 1 & 2)
- Phase 2 = convert the entire passenger demand model into an activity-based model system (Tasks 3 & 4)

**FIGURE 1-1.  
SCAG REGIONAL TRAVEL MODELING PROCESS**



Legend

Input Files

Updated Models

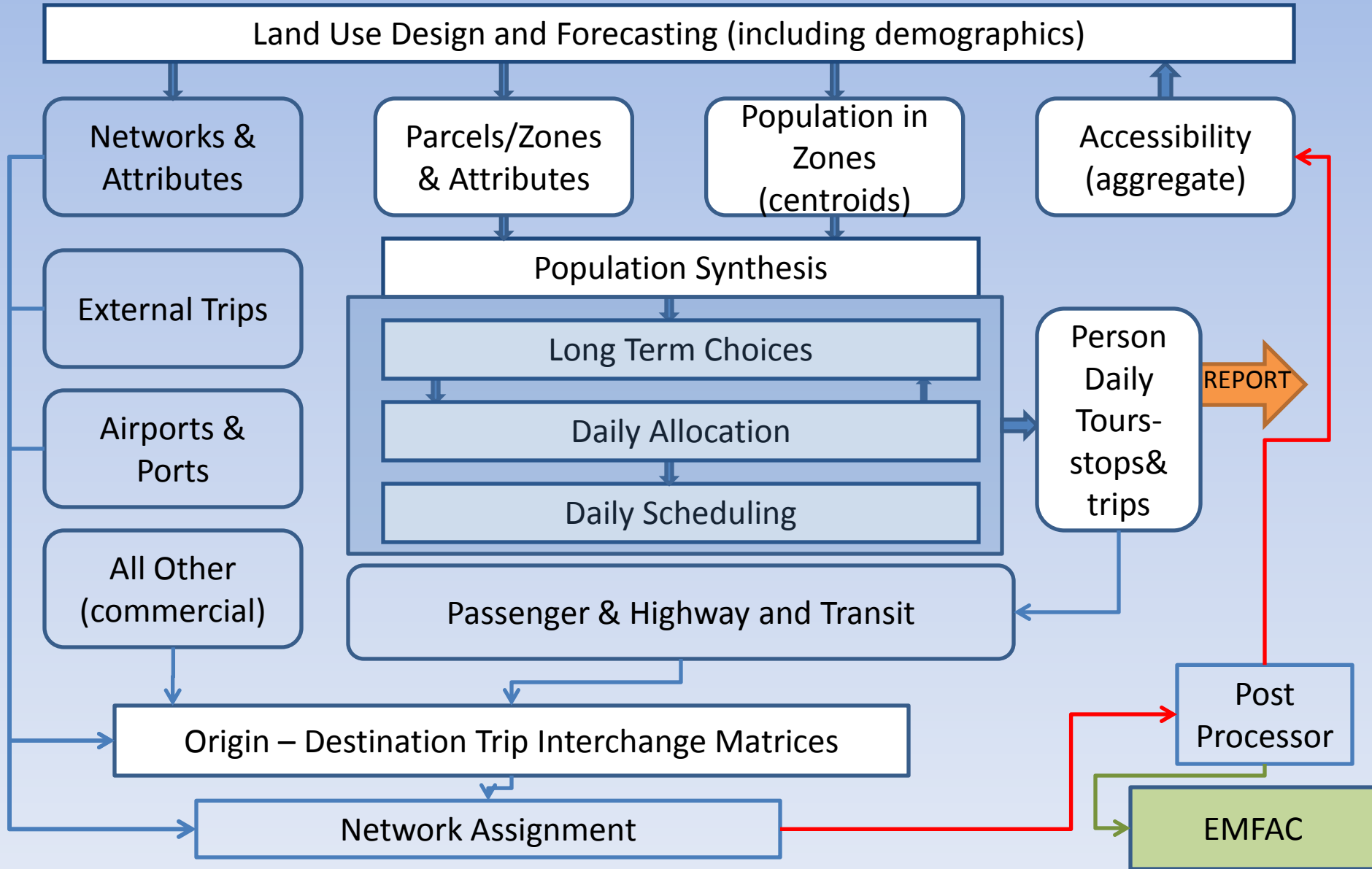
Data Output Files

Replaced with new components

# Phase 1 & Status

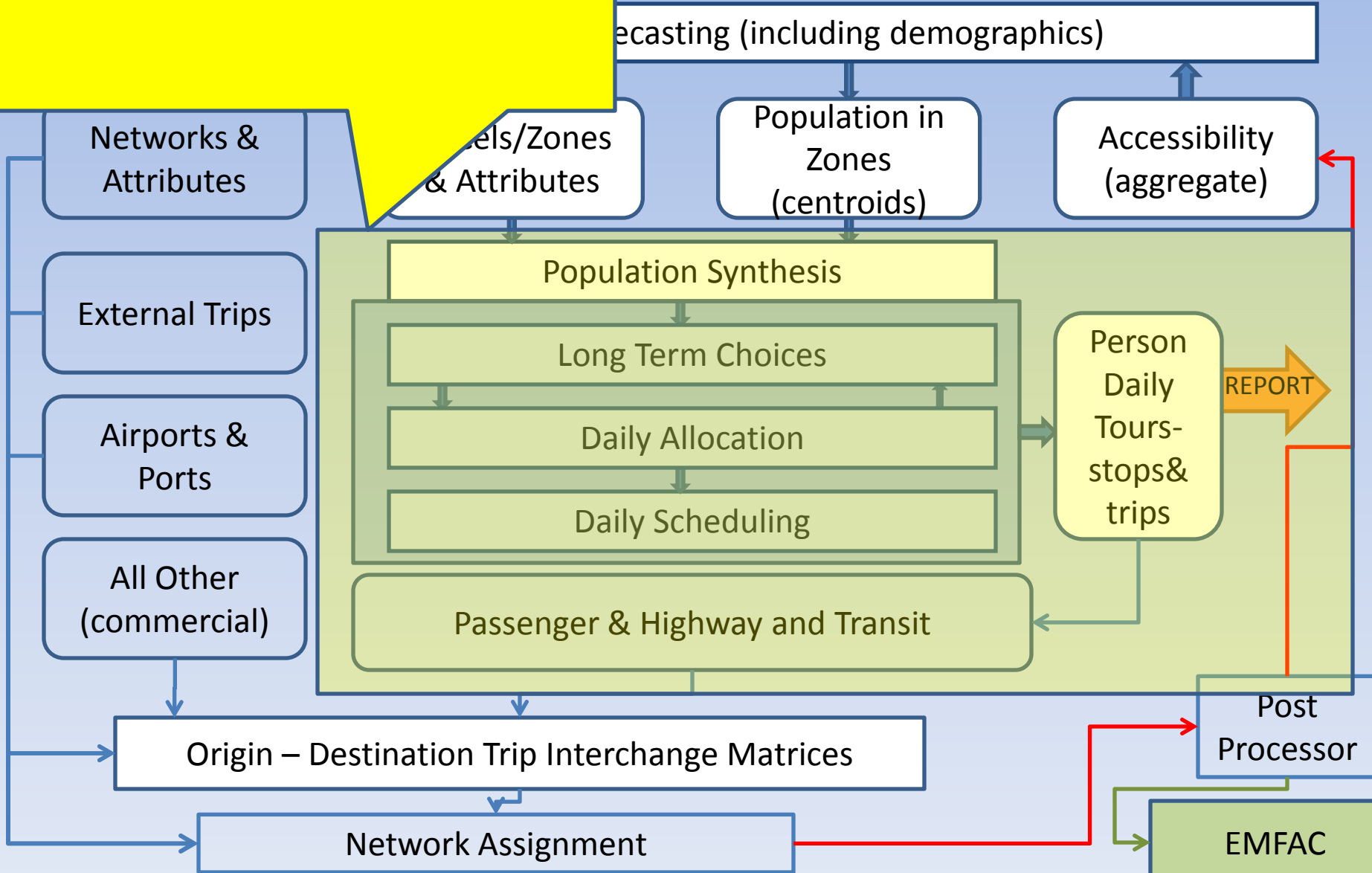
- Started in April 2009
- We have synthetically generated 17+ million people in the region and allocated them in each traffic analysis zone (years 2003).
- Repeated the same process for year 2035 generating 24 million people
- We then gave them (using models) locations of homes, schools, jobs, and cars.
- Then, with demographic and land use input we synthetically generated their daily schedule (activities, durations of activities, tours, stops, and modes).
- The output looks very much like an activity diary for 17+ (24 million) million people.
- This means we could assign travel on a network at any temporal and spatial scale.
- We also finished a battery of sensitivity tests to policies and have a plan for model modifications in 2010 (Phase 2).
- We also ran EMFAC2007 for the four-step and the CEMDAP-enhanced four-step and made comparisons

# Phase 1 – Adapt CEMDAP-DFW to SCAG



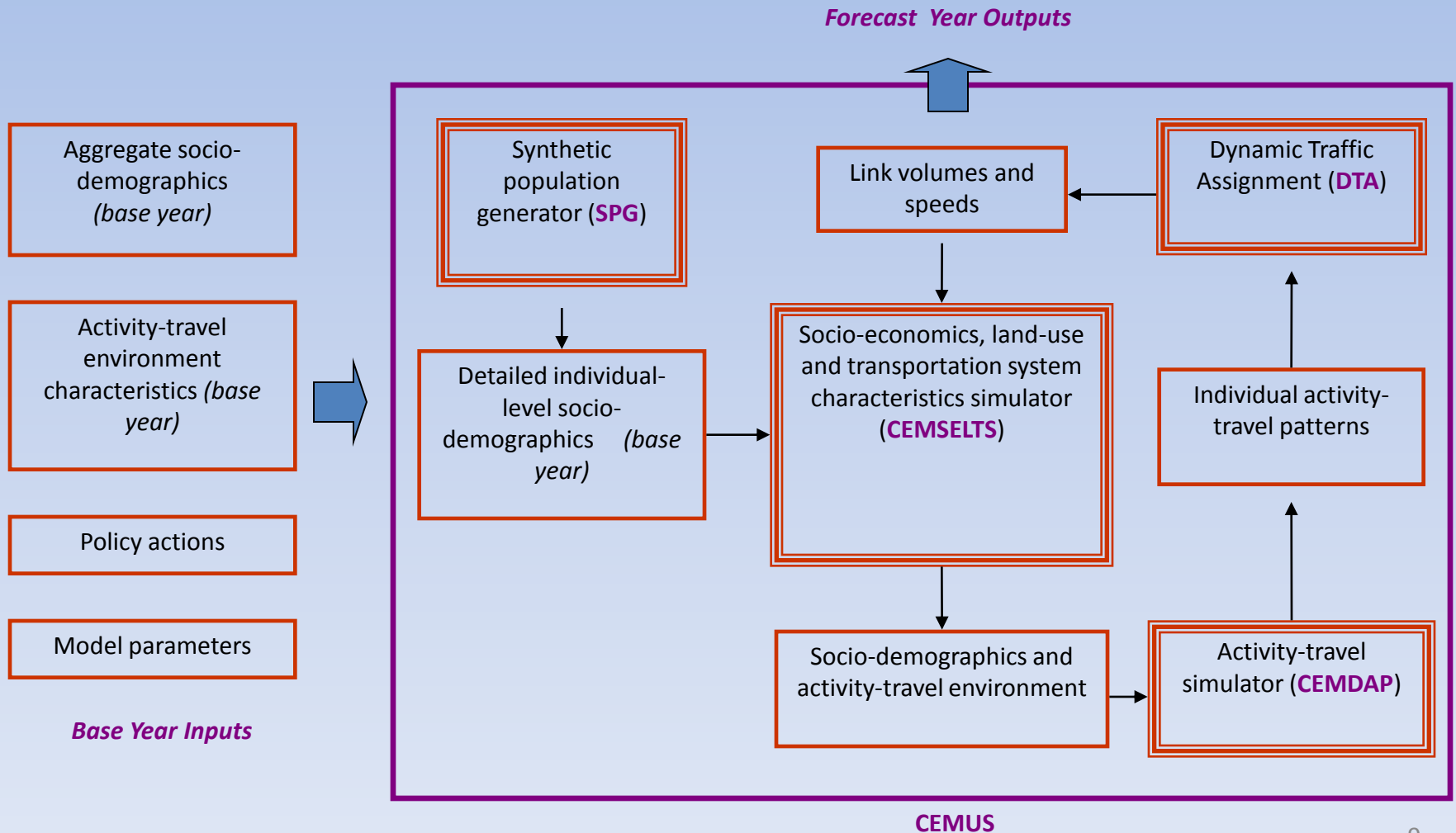
# CEMDAP-DFW to SCAG

ADAPTED CEMDAP MODEL

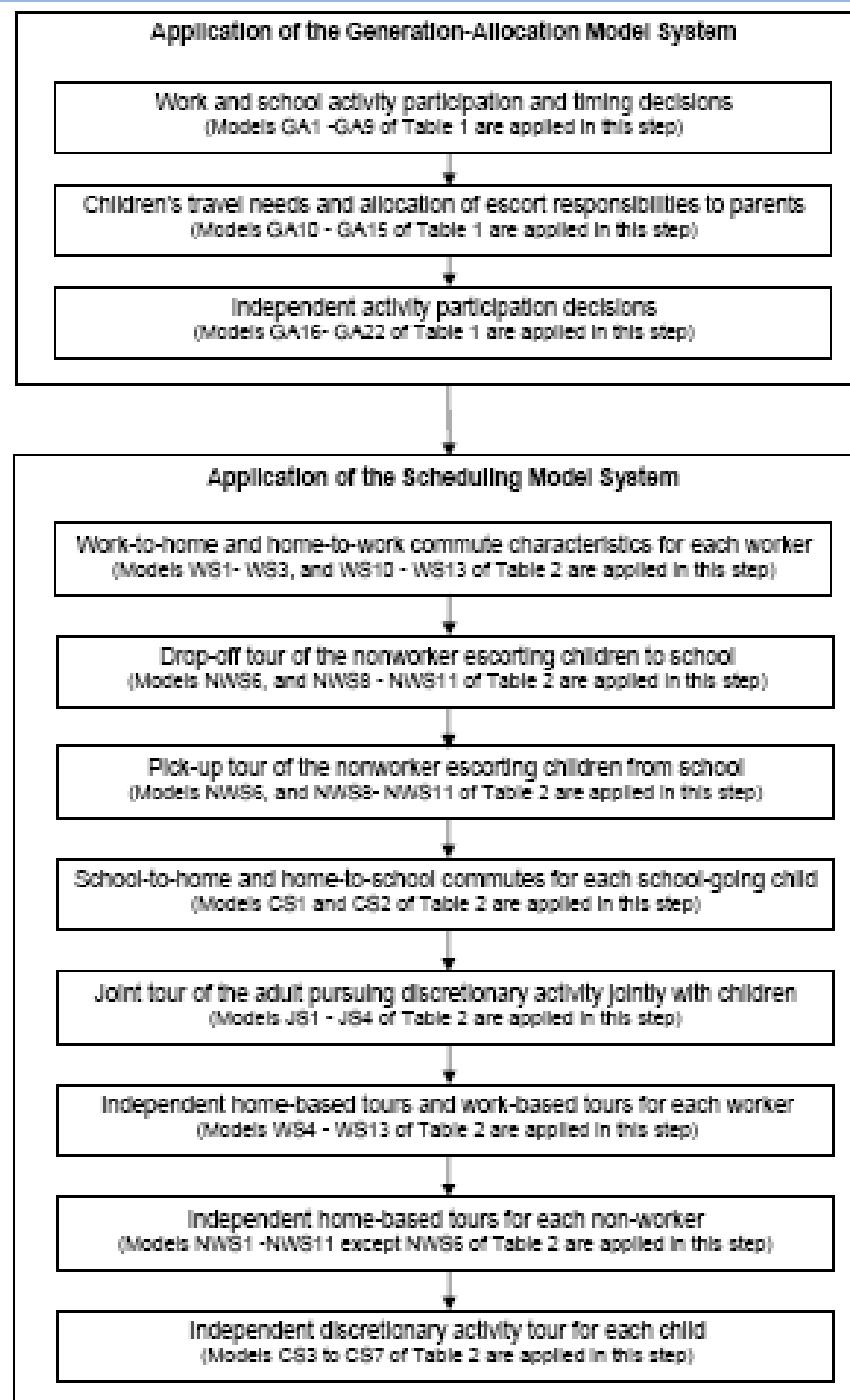




# Conceptually Same Process as CEMUS with Modifications and Adaptation to SCAG Region



# The overall activity model system



Source: papers on Chandra's web site at UT Austin

# Steps Completed

- Population Synthesis
- CEMSELTS
  - Generated 100% attributes including
    - Individual: education attainment, employment choices (employment status, work industry, work location, work flexibility, work duration in hours per week)
    - Household: income, vehicle ownership, residential tenure (own or rent), housing type
- CEMDAP
  - Generated travel patterns for SCAG region population

# PopGen (training in this conference)

- Household & Person Level Variables
- Expandable
- Scalable
- Tested in Multiple Environments
- Uses Multiple Data Sources (STF, ACS, PUMS, Surveys)
- Provides Summary Performance Measures (fit)
- Seed = relationship among variables of the population to recreate
- Control totals = Zonal distribution known from agency

TAZ  
270200000

### Synthetic Household

### Household Marginal

Size	
1	2067
2	926
3	239
4	112
5	25
6	7
7+	3

Presence of own household children

Yes	2075
No	1304

Householder Age

15-64	3023
>=65	356

Household type

Type 1	Family: married couple	625
Type 2	Family: male householder	71
Type 3	Family: female householder	140
Type 4	Non-family: householder alone	2149
Type 5	Non-family: householder not alone	394

hhldchildren	Householder age	hhldtype	Household Size (number of persons)						Total	
			1	2	3	4	5	67+		
Presence of own household children	15-64	Type 1	0	0	952	445	100	27	12	1536
		Type 2	0	171	0	0	0	0	0	171
		Type 3	0	347	0	0	0	0	0	347
		Type 4	0	0	0	0	0	0	0	0
		Type 5	0	0	0	0	0	0	0	0
No presence of own household children	>=65	Type 1	0	0	9	5	0	1	0	15
		Type 2	0	5	0	0	0	0	0	1
		Type 3	0	0	0	0	0	0	0	0
		Type 4	0	0	0	0	0	0	0	0
		Type 5	0	0	0	0	0	0	0	0
No presence of own household children	15-65	Type 1	0	0	0	0	0	0	0	0
		Type 2	0	0	0	0	0	0	0	0
		Type 3	0	0	0	0	0	0	0	0
		Type 4	698	277	0	0	0	0	0	975
		Type 5	118	32	0	0	0	0	0	150
No presence of own household children	>=66	Type 1	0	0	0	0	0	0	0	0
		Type 2	0	0	0	0	0	0	0	0
		Type 3	0	0	0	0	0	0	0	0
		Type 4	110	17	0	0	0	0	0	127
		Type 5	49	2	0	0	0	0	0	1
<b>Grand Total</b>			<b>975</b>	<b>851</b>	<b>961</b>	<b>450</b>	<b>100</b>	<b>28</b>	<b>14</b>	<b>3379</b>

# Person Characteristics

## Population Marginal

Gender	
Male	2937
Female	2588

Age	
<5	347
5-14	238
15-24	370
25-34	1352
35-44	1240
45-54	1009
55-64	472
65-74	227
75-84	158
>=85	112

Race	
White	4253
African-American	413
AMIndian&Alaska	33
Asian	211
Pacific Islander	3
other race	363
2+ races	249

TAZ  
270110000

## Synthetic Population

Gender	Age	Race						
		White	African	AMIndian&Alaska	Asian	Pacific Islander	other race	2+ races
Male	<5	198	32	1	10	38	48	327
	5-14	165	40	3	4	30	23	265
	15-24	220	29	1	35	36	16	337
	25-34	701	50	3	38	72	46	910
	35-44	671	71	3	20	63	31	859
	45-54	515	39	4	17	32	17	624
	55-64	204	16	2	2	10	8	242
	65-74	75	8	1	3	3	2	92
	75-84	60	3	1	2	1	3	70
	>=85	29	2	0	0	0	1	32
	<b>Subtotal</b>	<b>2838</b>	<b>290</b>	<b>19</b>	<b>131</b>	<b>285</b>	<b>195</b>	<b>3758</b>
Female	1	224	24	1	10	52	57	368
	2	163	20	0	10	18	10	221
	3	218	31	11	15	52	26	353
	4	565	68	3	37	66	60	799
	5	542	58	3	43	41	22	709
	6	466	42	3	27	28	27	593
	7	183	25	3	3	17	8	239
	8	102	8	0	2	1	5	118
	9	79	2	0	5	2	2	90
	10	56	3	0	0	0	0	59
	<b>Subtotal</b>	<b>2598</b>	<b>281</b>	<b>24</b>	<b>152</b>	<b>277</b>	<b>217</b>	<b>3549</b>

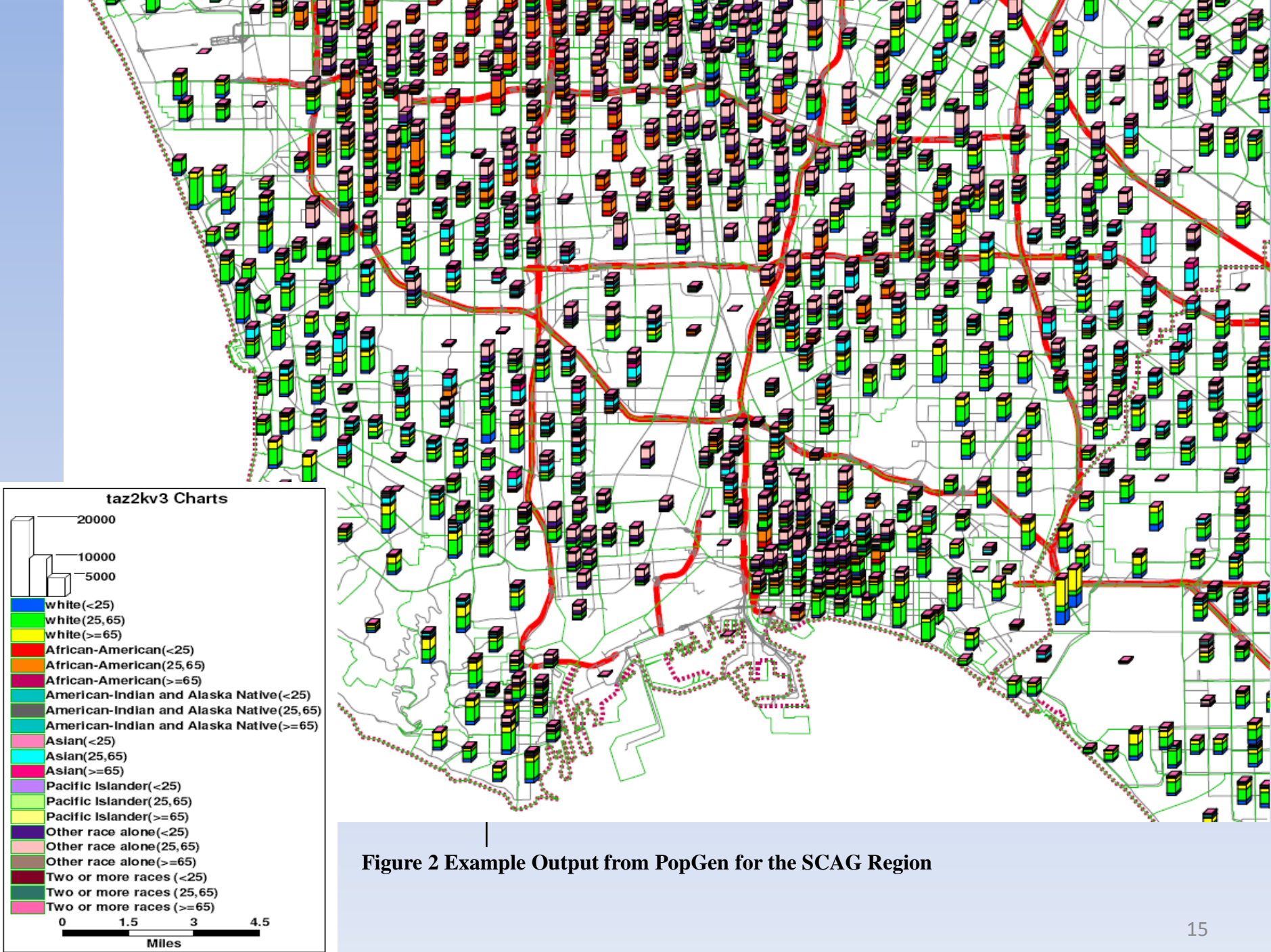
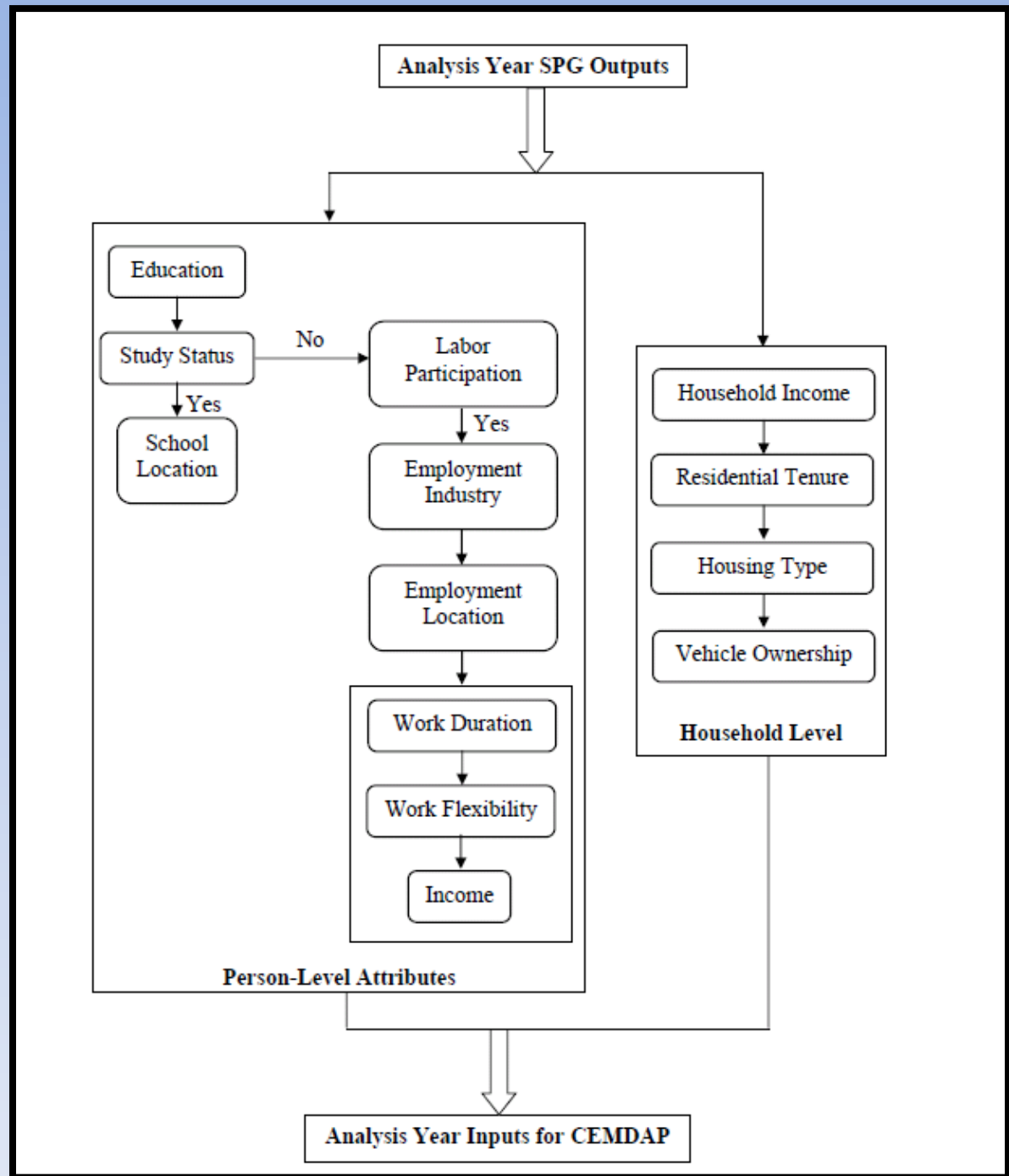


Figure 2 Example Output from PopGen for the SCAG Region

# CEMSELTS Flowchart





# Person Models

Model name	Econometric Structure / Rule Based and Independent Variables	Choice Alternatives/Comments
<i>Schooling</i>		
For children aged < 5 years	Rule based model – all children under the age of 5 are considered as not going to school	Schooling or no schooling
For children between 5 to 12 years	Rule based model – all children between 5-12 years are assumed to attend school, and their grade is based on age	Grades K through 7
If age between 13 and 18 years	Rate-based probability model depending on age, race, and gender	Continue school, drop-out, or complete schooling. If drops out, grade is set to the grade at which drop-out occurs
If age > 18 years	Rate-based probability model for education level based on race.	Associate degree, bachelors, Masters, Ph.D.
School location of children	Rule based assignment to closest zone (from residence) with a school	Traffic analysis zones

# Person Models

Model name	Econometric Structure / Rule Based and Independent Variables	Choice Alternatives/Comments
<b>Employment</b>		
Labor participation model	Binary Logit model; independent variables include age, gender, years of education, marital status and presence of children	Employed, Not employed (Applied for individuals over 16 years of age and not studying)
Employment industry model	Multinomial logit model; ; independent variables include age, race, gender and education level	Construction and Manufacturing, Trade and Transportation, Professional businesses, Government, Retail and Repair, Other (relevant for employed individuals)
Employment location model	Spatial location choice model; independent variables include employment density, transportation level of service, accessibility to population and employment, and zones in central business district	TAZs of SCAG area
Weekly work duration model	Grouped response model; independent variables include gender, education level and industry	< 35 hours, 35-45 hours, and > 45 hours (the results are post processed to estimate a continuous “work hours” variable for each employed individual)
Work flexibility model	Ordered probit model; independent variables include age, gender, race, parent, education level, employment industry, and hours worked.	Low flexibility, Medium flexibility, High flexibility (flexibility level definition is based on individual response in the survey)
Personal income model	Grouped response model; independent variables include age, gender, race, education level, employment status, and employment industry	\$0 - \$9,999, \$10,000 - \$19,999, \$20,000 - \$29,999, \$30,000 - \$39,999, \$40,000 - \$49,999, and \$50,000 or above (the results are post processed to estimate a continuous “income” variable for each employed individual)

# Household Models

Model Name	Econometric Structure and Independent Variables	Choice Alternatives
Household Income model	Sum of incomes of individuals in the household	Continuous household income value
Residential location model	Multinomial logit model; independent variables include level of service variables, accessibility variables interacted with presence of children, household income, residential tenure, and residential type	TAZs of SCAG area
Residential tenure model	Binary logit model; independent variables include household income, household size, number of employed people, number of children, race, presence of elderly people, single-adult household and presence of unrelated people	Own or rent house
Housing type model	Multinomial logit model; independent variables include household income, race, presence of elderly people, single-adult household, presence of unrelated people and highest education level in the household	Single-family detached, Single-family attached, Apartment, and Mobile home or trailer
Vehicle ownership model	Multinomial logit model; independent variables are household income, number of employed and unemployed adults, presence of children, own house, single-adult household	0, 1, 2, 3, and 4 or more

# CEMSELTS Validation – Person Level

	CEMSELTS	ACS 2003
<b>Educational Attainment (18 years and above)</b>		
High school or less	70.4	69.6
Associate	5.3	6.1
Bachelors	19.0	16.1
Graduate	5.4	8.1
Total error	1.8	-
<b>Labor Participation</b>		
Unemployed	49.9	42.9
Employed	50.1	57.1
Total error	7.0	-
<b>Employment Industry</b>		
Construction and Manufacturing	18.7	20.7
Wholesale Trade and Transportation	14.1	9.7
Professional, Personal, and Financial	33.7	48.2
Public and Military	5.8	3.8
Retail and Repair	24.3	11.2
Other Industry	3.4	6.4
Total error	6.5	-

# CEMSELTS – Work Flows

**County-County Flows (2000 Census Data)**

		% within County of Work						
		Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total
County of Residence	Imperial	97.2	0.0	0.0	0.1	0.0	0.0	0.6
	Los Angeles	1.0	89.9	12.0	1.9	7.2	10.8	56.9
	Orange	0.4	4.7	81.9	2.4	1.7	0.2	19.3
	Riverside	1.0	0.9	3.8	85.0	10.6	0.1	8.4
	San Bernardino	0.4	2.8	2.2	10.6	80.4	0.2	9.7
	Ventura	0.0	1.7	0.1	0.0	0.1	88.7	5.0
	Total	0.6	59.3	19.9	7.3	8.5	4.4	100.0

**County-County Flows (CEMSELTS Work location module)**

		% within County of Work						
		Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total
County of Residence	Imperial	99.3	0.0	0.0	0.1	0.0	0.0	0.2
	Los Angeles	0.0	97.8	14.1	9.2	20.4	29.0	58.5
	Orange	0.0	1.4	85.8	9.8	2.7	0.0	16.9
	Riverside	0.7	0.0	0.0	69.4	4.8		9.4
	San Bernardino	0.0	0.4	0.1	11.5	72.2	0.0	10.1
	Ventura	0.0	0.4	0.0	0.0	0.0	71.0	4.8
	Total	0.2	51.8	17.0	12.8	11.7	6.5	100.0

**County-County Flows Error Matrix**

		% within County of Work						
		Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total
County of Residence	Imperial	2.1	0.0	0.0	0.1	0.0	0.0	0.4
	Los Angeles	1.0	7.9	2.1	7.3	13.1	18.3	1.6
	Orange	0.4	3.2	3.9	7.5	1.0	0.2	2.4
	Riverside	0.3	0.9	3.8	15.6	5.9	0.1	1.0
	San Bernardino	0.4	2.4	2.1	0.9	8.2	0.2	0.4
	Ventura	0.0	1.4	0.1	0.0	0.1	17.8	0.2
	Total	0.4	7.5	2.8	5.4	3.2	2.1	

# CEMSELTS Validation –Household Level

	CEMSELTS	ACS 2003
<b>Number of workers</b>		
Households with no worker	16.8	12.2
Households with 1 worker	38.2	34.2
Households with 2 workers	30.0	40.0
Households with 3 or more workers	15.0	13.6
Total error	5.0	-
<b>Number of vehicles</b>		
Households with no vehicles	8.6	8.3
Households with 1 vehicle	37.4	33.3
Households with 2 vehicles	32.3	37.5
Households with 3 vehicles	15.0	14.1
Households with 4 or more vehicles	6.6	6.8
Total error	2.1	-

	CEMSELTS	ACS 2003
<b>Residential Tenure</b>		
Rent	33.3	44.3
Own	66.7	55.7
Total error	11.0	-
<b>Housing Type for Owners</b>		
Single Family Detached	93.8	88.1
Single Family Attached	3.2	
Mobile Home/Trailer	3.0	5.2
Multi-Family/Apartment/Condo	0.0	6.7
Total error	5.9	-
<b>Housing Type for Renters</b>		
Single Family Detached	30.5	27.9
Single Family Attached	8.4	
Mobile Home/Trailer	0	1.4
Multi-Family/Apartment/Condo	61.1	70.7
Total error	7.3	-

# CEMDAP 2003 Outputs

- Trip-based comparison measures
  - Trip Generation Comparison
  - Person Trip Distribution
  - Mode Share Comparison
  - Traffic Assignment Comparison

# Trip Generation

C  
E  
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County \ Trip Purpose	County						
	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total
Home Based Work	84421	4251118	1840505	1117733	1087162	554893	8935832
Home Based Non-work	237162	15006163	5186908	3157026	3186762	1426082	28200103
Non-home based	103084	7165100	2544863	1629896	1499246	779227	13721416
Total	424884	30807841	9602245	5954942	5888380	2773915	55452207

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County \ Trip Purpose	County						
	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total
Home Based Work	85537	6373271	2136243	1012238	1082147	559912	11249349
Home Based Non-work	254430	16854127	5012646	3022069	3225586	1365002	29733860
Non-home based	110998	9834957	3374279	1497380	1538297	750077	17105987
Total	450966	33062356	10523168	5531687	5846030	2674991	58089196



# Trip Generation Household Averages by Trip Purpose

**C E M D A P**

<b>County</b>	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total
<b>Trip Purpose</b>							
Home Based Work	2.01	1.30	1.86	1.96	1.91	2.12	1.57
Home Based Non-work	5.63	4.60	5.25	5.52	5.60	5.46	4.95
Non-home based	2.45	2.19	2.58	2.85	2.63	2.98	2.41
Total	10.09	9.44	9.72	10.42	10.35	10.62	9.73

**S C A G M O D E L**

<b>County</b>	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total
<b>Trip Purpose</b>							
Home Based Work	2.06	2.01	2.22	1.81	1.95	2.20	2.03
Home Based Non-work	6.12	5.31	5.20	5.39	5.83	5.36	5.36
Non-home based	2.67	3.10	3.50	2.67	2.78	2.95	3.08
Total	10.84	10.41	10.92	9.87	10.56	10.51	10.47

# Reason?

- Difference in number of workers
  - No. of employed individuals is very similar to the ACS counts. However, we have a Go to Work model that seems to be under predicting no. of workers going to work

# Decision to Work Model

<b>Explanatory variables</b>	<b>Param.</b>	<b>t-stat</b>
Constant	1.910	9.68
Age	-0.008	-2.07
Ratio of personal income to household income	0.461	3.11
Female	0.316	3.27
Number of non-school going children * Mother	-0.495	-2.85
<i>Weekly work duration</i>		
Between 0 and 20 hours	-1.776	-12.41
Between 20 and 40 hours	-0.450	-4.37
High work flexibility	-1.146	-12.49

# Trip Distribution

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	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total
Imperial	410071	1831	477	9920	2309	276	42488
Los Angeles	2176	29363649	639404	134919	379363	288330	30807841
Orange	486	634720	8793012	116677	54957	2393	9602245
Riverside	9608	138170	108418	5330618	364179	3949	5954942
San Bernardino	2375	376014	59325	361655	5084934	4077	5888380
Ventura	164	2886	1877	3661	3512	2476096	2773915
Total	424880	30802989	9602513	5957450	5889254	2775121	55452207

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	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total
Imperial	444061	217	122	6056	504	5	450965
Los Angeles	998	30875478	1317551	140232	426536	301559	33062354
Orange	810	1225351	9057299	119533	111676	8498	10523166
Riverside	13792	256533	242381	4552028	463754	3198	5531686
San Bernardino	2321	614208	199507	425591	4597644	6758	5846030
Ventura	52	374800	10856	2240	4898	2282145	2674991
Total	462034	33346587	1.1E+07	5245680	5605014	2602162	58089193

# Mode Shares

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	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total	-
Drive Alone	39.0%	37.9%	39.5%	41.3%	40.1%	40.8%	39.1%	+
Shared Ride (as driver)	22.6%	22.4%	22.6%	22.1%	22.4%	22.0%	22.4%	+
Shared ride (as passenger)	28.5%	28.4%	27.9%	27.6%	28.2%	27.8%	28.2%	-
Transit	.0%	1.4%	1.1%	.3%	.4%	.7%	1.0%	-
School Bus	1.5%	1.1%	1.0%	1.3%	1.4%	1.1%	1.1%	-
Non-motorized	8.4%	8.7%	7.9%	7.3%	7.6%	7.7%	8.2%	-

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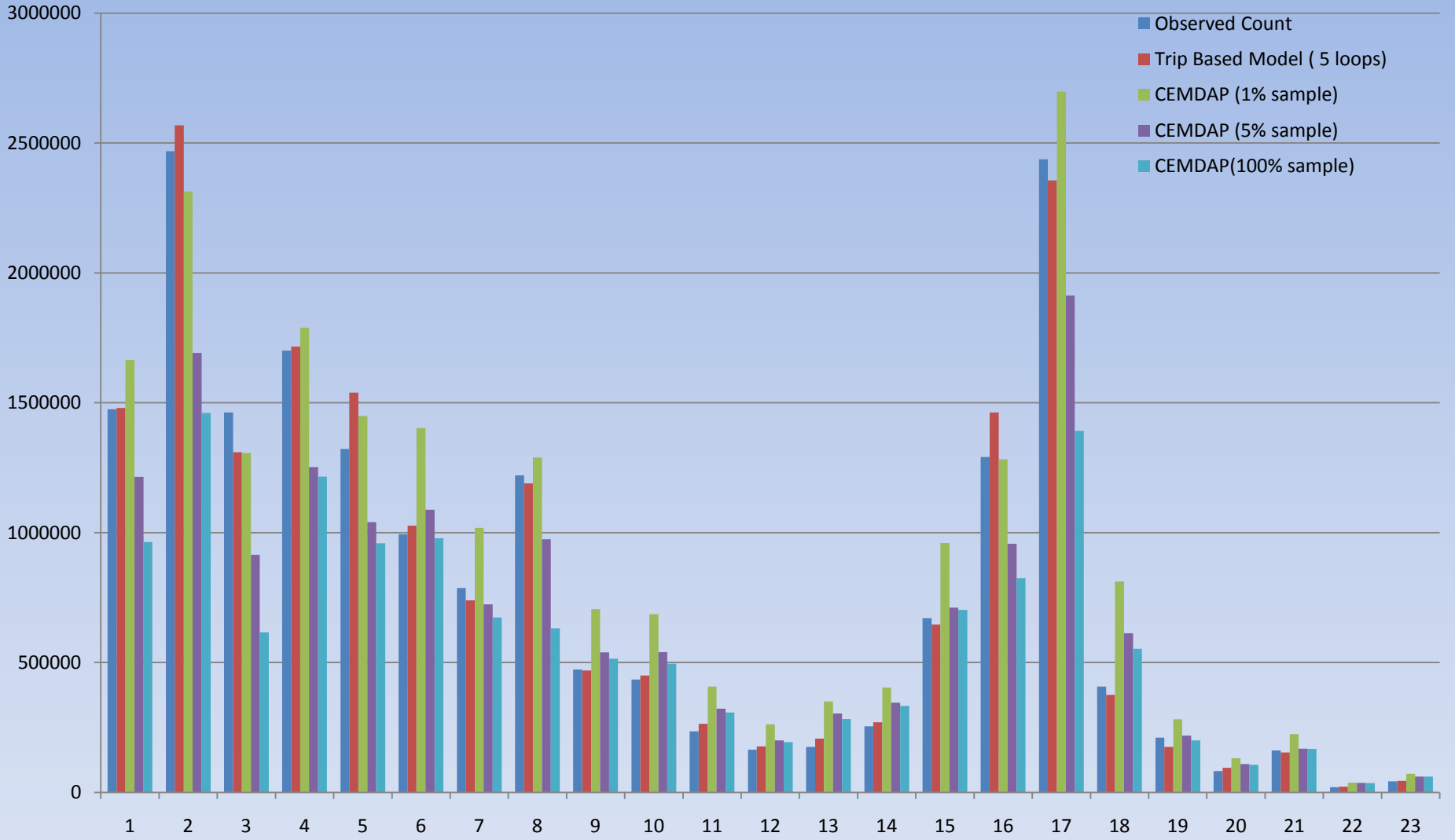
	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	Total
Drive Alone	39.76%	40.72%	45.78%	40.91%	39.91%	45.98%	41.81%
Shared Ride (as driver)	21.16%	20.02%	18.44%	20.73%	21.34%	18.41%	19.86%
Shared ride (as passenger)	24.04%	24.06%	22.56%	25.41%	25.97%	22.32%	24.0%3
Transit	0.19%	2.27%	0.98%	0.38%	0.65%	0.47%	1.59%
School Bus	1.29%	0.97%	0.87%	1.13%	1.20%	0.97%	0.99%
Non-motorized	13.55%	11.96%	11.36%	11.43%	10.92%	11.87%	11.71%

# Traffic Assignment

- Tested different options with and without calibration and feedback loops (from assignment to trip distribution)
- Used typical screen lines to get an idea of difference

# Observed vs Four-step vs CEMDAP

Screenline	Observed Count	Trip Based Model ( 5 loops)	CEMDAP (1% sample)	CEMDAP (5% sample)	CEMDAP (100% sample)
1	1475361	1480053	1664718	1214498	963466
2	2468539	2567739	2313785	1692200	1460103
3	1462303	1309860	1306876	914459	615885
4	1701072	1716449	1788749	1252331	1216116
5	1321967	1539022	1448948	1040491	958937
6	994195	1026883	1402926	1088276	978481
7	786550	739451	1018070	724256	673338
8	1220265	1189547	1289527	974597	631905
9	472748	468780	705596	538574	514812
10	434119	449327	686420	539888	495693
11	235150	263771	407600	322021	307843
12	164486	176438	261980	199746	192809
13	174994	206598	349683	304059	282719
14	253920	270106	403545	345272	332739
15	670570	646373	959600	711481	702239
16	1290971	1462299	1282873	956770	824367
17	2437178	2355957	2698014	1913168	1391522
18	407512	375081	811979	612047	551969
19	211090	175239	281627	218424	199662
20	82342	94578	130856	109260	105742
21	161106	153313	223761	168145	166697
22	19698	21460	37585	36299	35455
23	41930	44463	70768	60244	60151
<b>Total</b>	18488066	18732786	21545489	15936507	13662650





# Scenario Analysis





Scenario	Description	Changes to Base Year
Base Scenario	2003 is the analysis year	---
15% Increase in Population and Employment Densities	Population and employment in the study area are increased by 15%	The population and employment density measures were increased by 25%
100% Increase in Cost—Drive Alone Mode	A 100% increase in cost for drive-alone for all time periods	LOS tables were altered by multiplying the drive alone auto cost by 2 in the a.m., p.m., and off-peak files
\$2 Increase in CBD Cost—Auto Mode and Peak Periods	A \$2 charge is imposed on the auto trips that enter/exit the CBD during a.m. and p.m. peak periods	LOS tables were altered by adding an additional \$2 to the existing cost for auto trips that originate or end in the CBD in the a.m. and p.m. peak files
25% Increase in IVTT—Auto Mode and Peak Periods	A 25% increase in IVTT for the drive-alone and shared ride for the a.m. and p.m. peak time periods	LOS tables were altered by multiplying the auto IVTT by 1.25 in the a.m. and p.m. peak files



# Scenario Analysis

- Aggregate level
- Disaggregate level

# Aggregate level

- Mode Comparison

Overall Mode Shares	Drive Alone	Shared Ride	Walk/ Bike	Transit	School Bus
Base Case	49.62%	36.16%	10.28%	1.96%	1.99%
15% Increase in Population and Employment Densities	49.62%	36.18%	 10.28%	1.94%	 1.99%
100% Increase in Cost-DA Mode	48.76%	35.44%	11.09%	 2.71%	 2.00%
2 Dollar Increase in Auto Cost—Peak Periods and CBD	48.50%	35.65%	11.59%	2.28%	1.99%
25% Increase in IVTT—Auto Mode and Peak Periods	49.49%	36.14%	10.35%	2.04%	1.99%

Commute Shares	Drive Alone	Shared Ride	Walk/ Bike	Transit	
Base Case	67.75%	23.35%	5.38%	3.52%	
15% Increase in Population and Employment Densities	67.75%	 23.38%	5.38%	3.48%	 3.48%
100% Increase in Cost-DA Mode	66.39%	23.65%	6.80%	4.91%	
2 Dollar Increase in Auto Cost—Peak Periods and CBD	65.72%	22.43%	7.75%	4.10%	
25% Increase in IVTT—Auto Mode and Peak Periods	67.45%	23.37%	5.52%	3.66%	

# Disaggregate Analysis

- At an aggregate level there are minor changes in travel patterns
- Reasons
  - Lower sensitivity to accessibility in DFW region
  - Transit availability measures from DFW region
- To highlight the CEMDAP model richness we undertake disaggregate level analysis of travel patterns
- We look at same individual's travel patterns for different scenarios

# Drive Alone Cost Increase by 100%

## Base Scenario

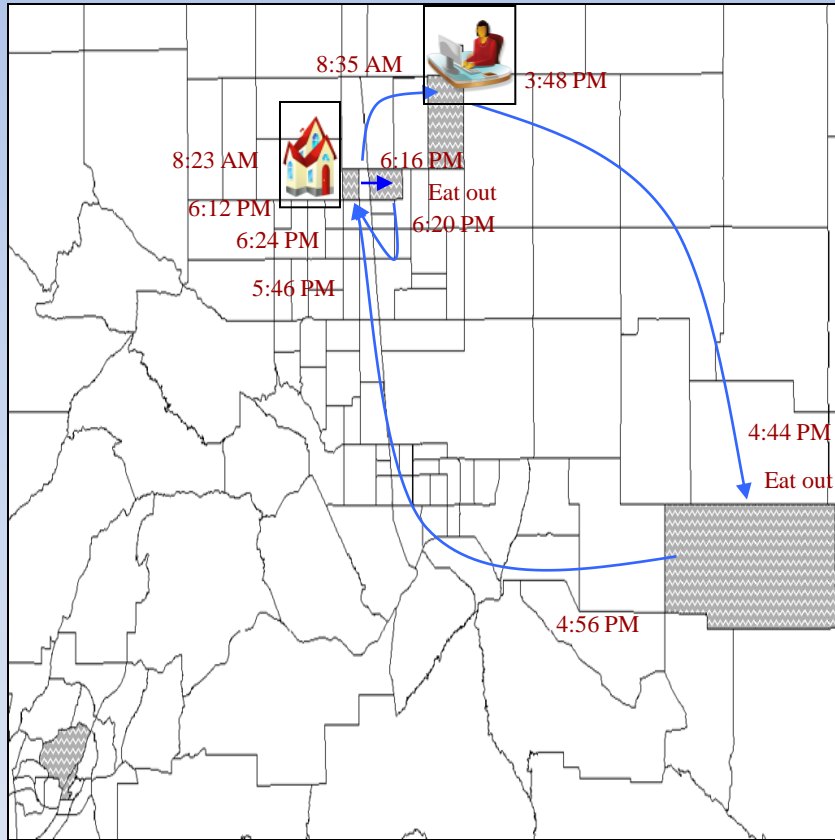
## Policy Scenario

Overall Pattern	Commute and additional tour
Total Mileage (miles)	82.7
<b>HW commute</b>	
Number of non-work stops	0
Mode	Drive alone
Activity at non-work stops	-
<b>WH commute</b>	
Number of non-work stops	1
Mode	Drive alone
Activity at non-work stops	Eat out
<b>Tour 1</b>	
Number of stops	1
Mode	Shared ride
Activity at stops	Eat out

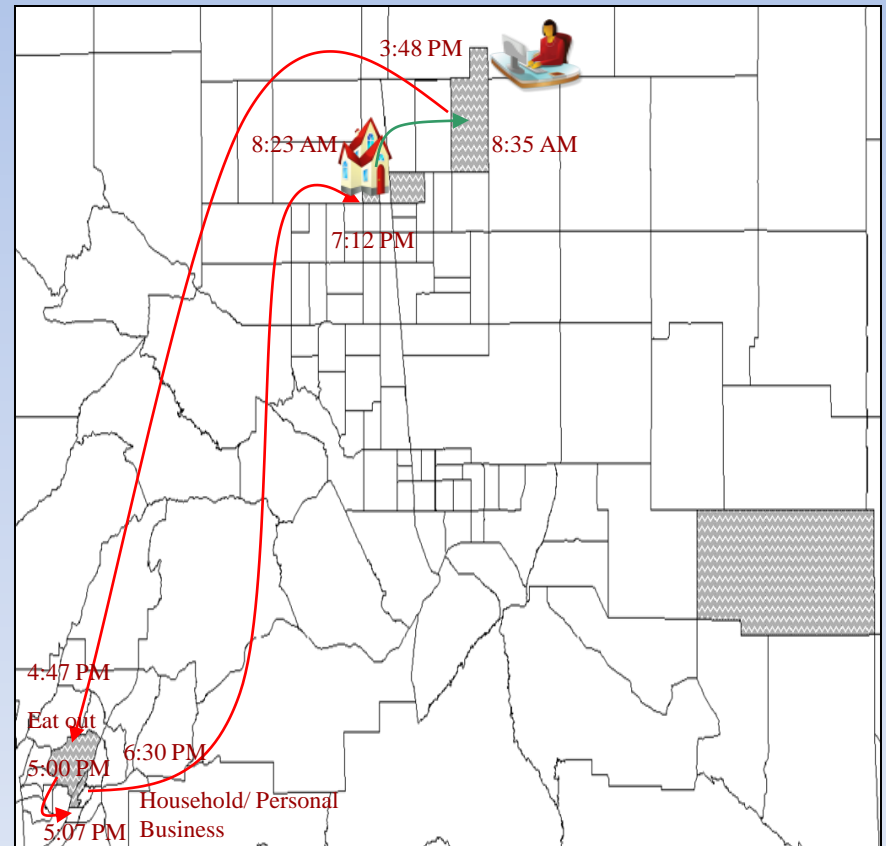
Overall Pattern	Commute tour
Total Mileage (miles)	93.7
<b>HW commute</b>	
Number of non-work stops	0
Mode	Shared ride
Activity at non-work stops	-
<b>WH commute</b>	
Number of non-work stops	2
Mode	Shared ride
Activity at non-work stops	Eat out, Household/Personal Business

# Drive Alone Cost Increase by 100%: Person 1

## Base Case



## Policy Scenario



# Drive Alone Cost Increase by 100%

## Base Scenario

## Policy Case Scenario

Overall Pattern	Commute and additional tour
Total mileage (miles)	47.17
<b>HW Commute</b>	
Number of non-work stops	0
Mode	Drive alone
Activity at non-work stops	-
<b>WH Commute</b>	
Number of non-work stops	0
Mode	Drive alone
Activity at non-work stops	-
<b>Tour 1</b>	
Number of stops	1
Mode	Drive alone
Activity at stops	Eat out

Overall Pattern	Commute tour
Total mileage (miles)	35.21
<b>HW Commute</b>	
Number of non-work stops	0
Mode	Drive alone
Activity at non-work stops	-
<b>WH Commute</b>	
Number of non-work stops	1
Mode	Drive alone
Activity at non-work stops	Eat out



# Dedicated Hardware



1. Sun Fire X4450 x64 Rack-Mount Server: Four Intel(R) Xeon(R) processor X7460 (6-Core, 16MB L3, 2.66 GHz, 1066 MHz FSB, 130W), 24GB of memory (12x2GB PC2-5300 - 667 MHz ECC fully buffered DDR2 DIMMs)

2. Similar but less cores: Sun Fire X4270 x64 Server – with four Xeon 5570 quad cores.

3. TRANSCAD and GIS dedicated server - 8-core Xeon Dell workstation





# Phase 2

(January 2010 to June 2011)

# What Next?

- Rectify selectively CEMDAP framework limitations
- Example 1: Difference in number of workers
  - No. of employed individuals is very similar to the ACS counts. However, we have a Go to Work model that seems to be under predicting no. of workers going to work
- Example 2: Re-estimation of all DFW modules with SCAG survey data (SCAG post-Census 2001 travel survey) to enhance CEMDAP framework to suit SCAG region better

# Important Aspects Identified for Phase 2

- In addition to re-estimation, we have identified some specific modules of CEMDAP that require enhancements
  - Mode choice
  - Joint activity participation
  - Accessibility measures
  - Transit mode
  - Spatial resolution

# Mode Choice

- Tour mode
  - Currently there is explicit allowance for drop-off and pickup of children, serve passenger, and SR modes
- Enhance flexibility by supplementing the tour mode with a trip mode model
  - Currently we have limitations of same mode for a tour when mode is not auto related
  - For example in a tour, a person could use SR for one trip and might walk for another trip
  - Examine SCAG HH survey data and decide the structure for this model
  - Potentially include more mode choice alternatives in addition to what we have

# Joint Activity Participation

- CEMDAP for DFW model
  - Current CEMDAP incorporates interactions of children with adults (pickup/drop-off, joint activity with children)
  - Incorporate joint activity participation among adults
    - by creating alternatives corresponding to pursue activity alone or jointly
    - structure to be determined based on data

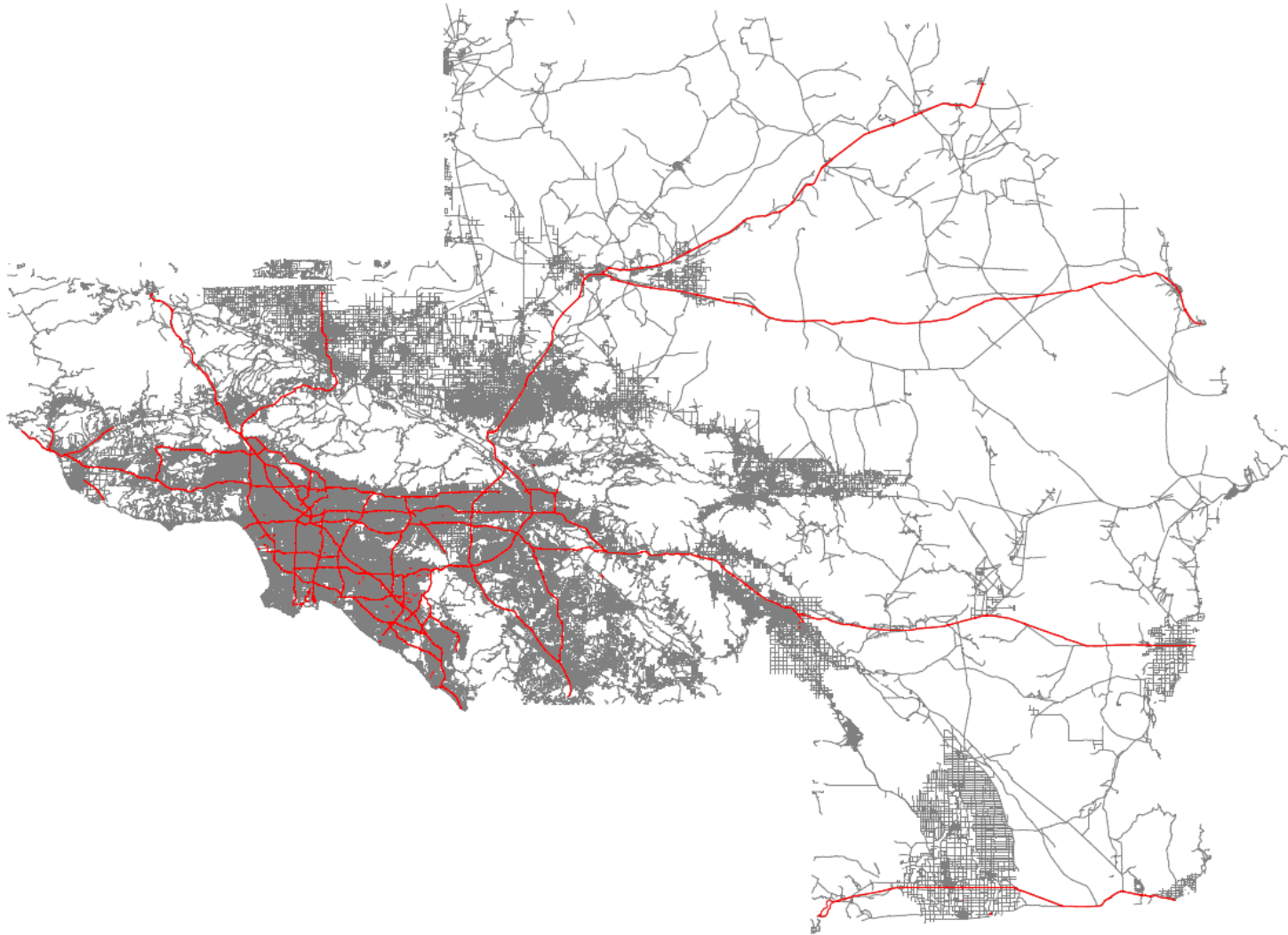
# Accessibility measures

- Land-use strategies impact the opportunities available and the accessibility of zones for activity purposes.
- In CEMDAP, the opportunities available are represented as a measure of attraction
- DFW region accessibility measures were significant only in few CEMDAP modules
- Enhance modeling framework by computing different accessibility measures and accommodating these in the re-estimation

# Current SCAG network

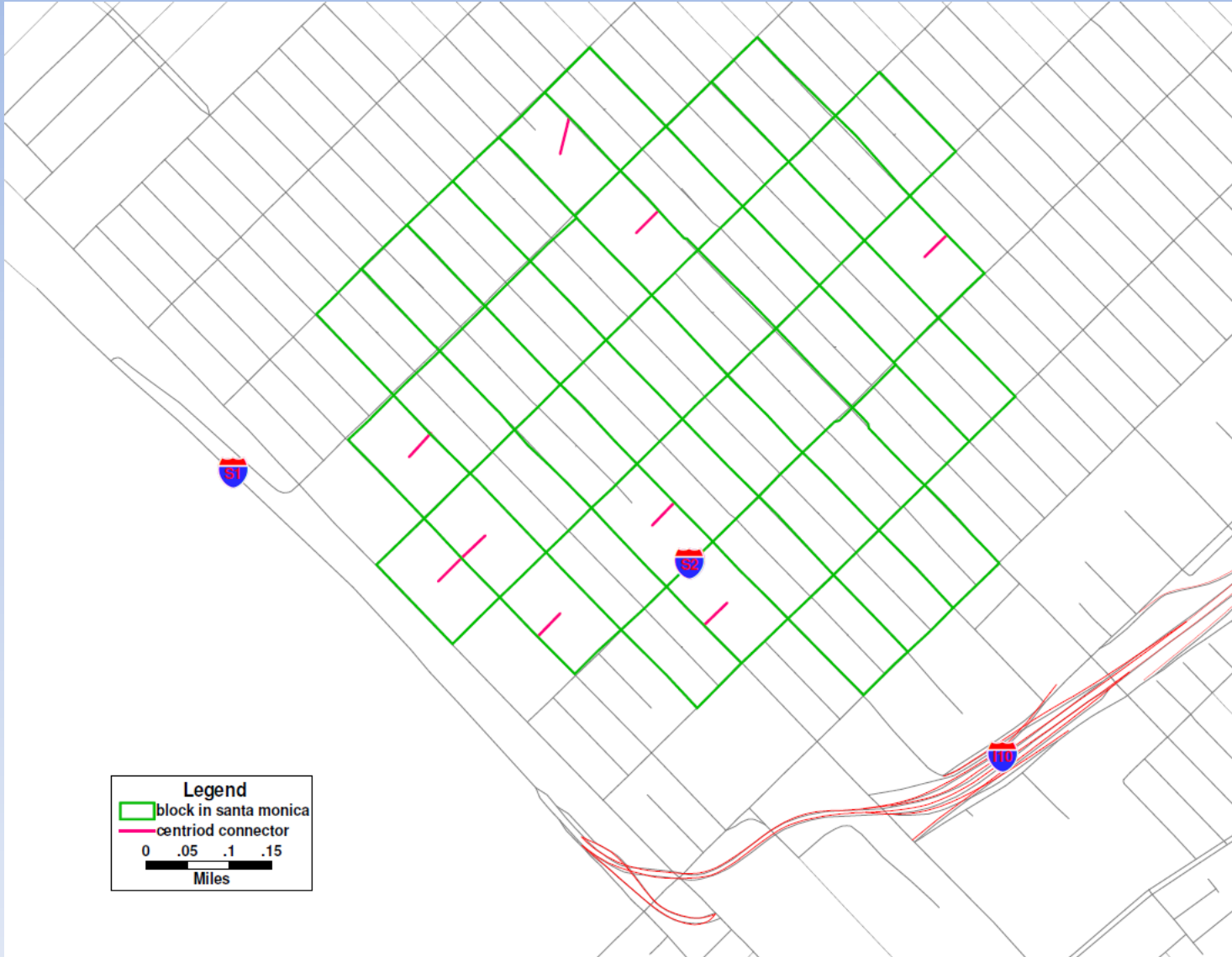


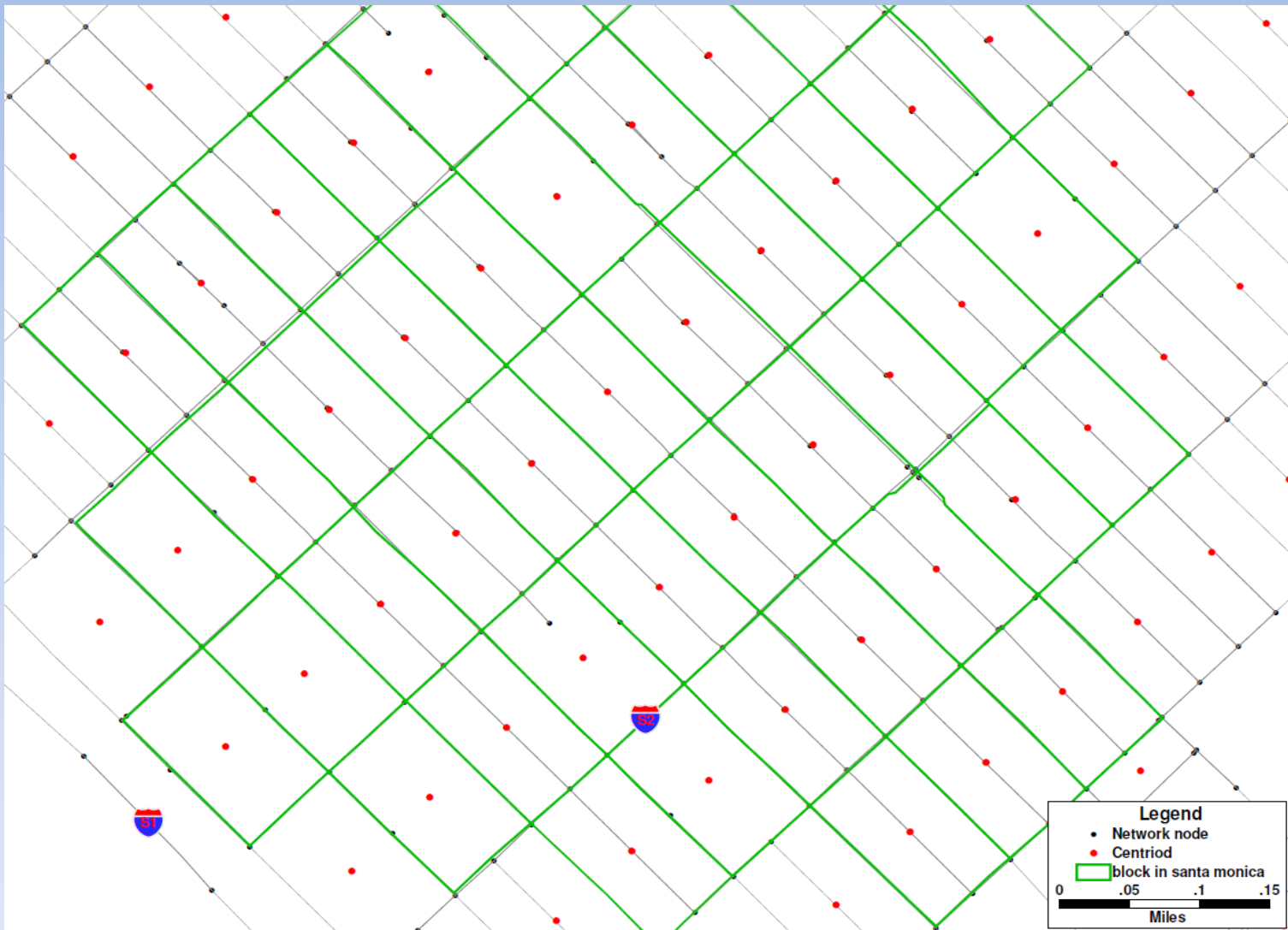
# Detailed network





# Block Level Centroid Connector

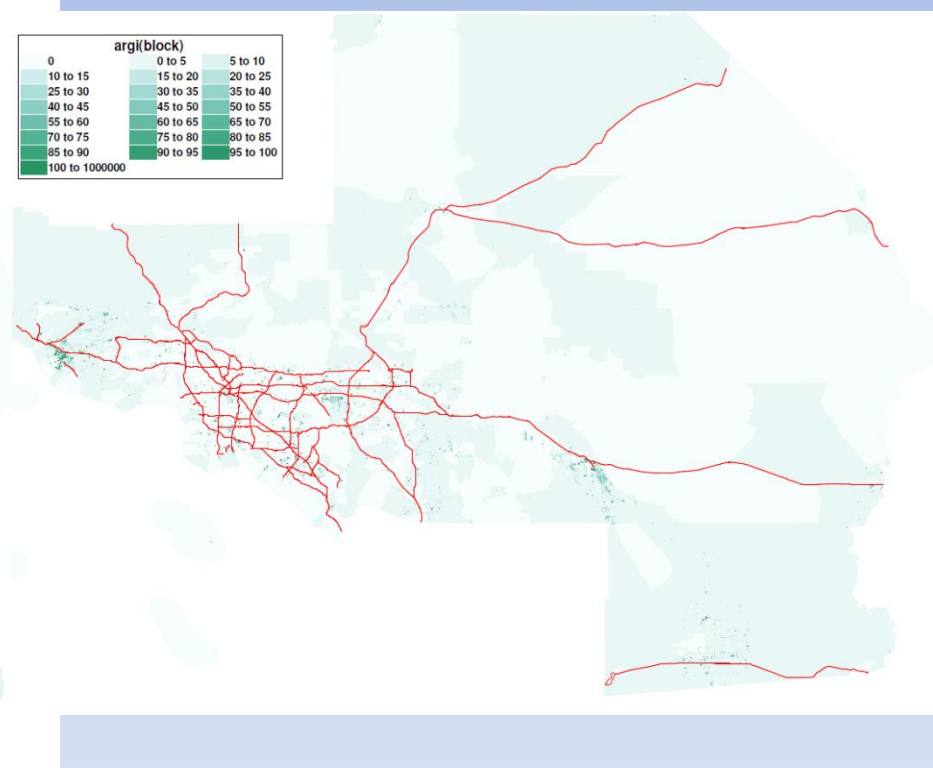
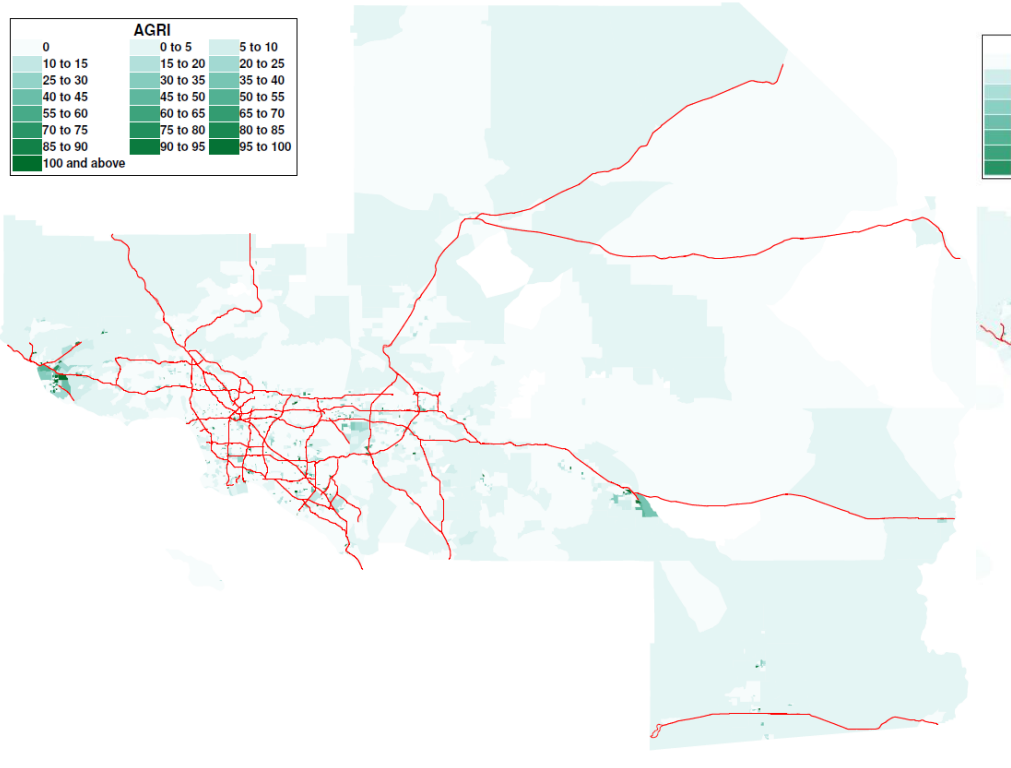




# Agriculture Density

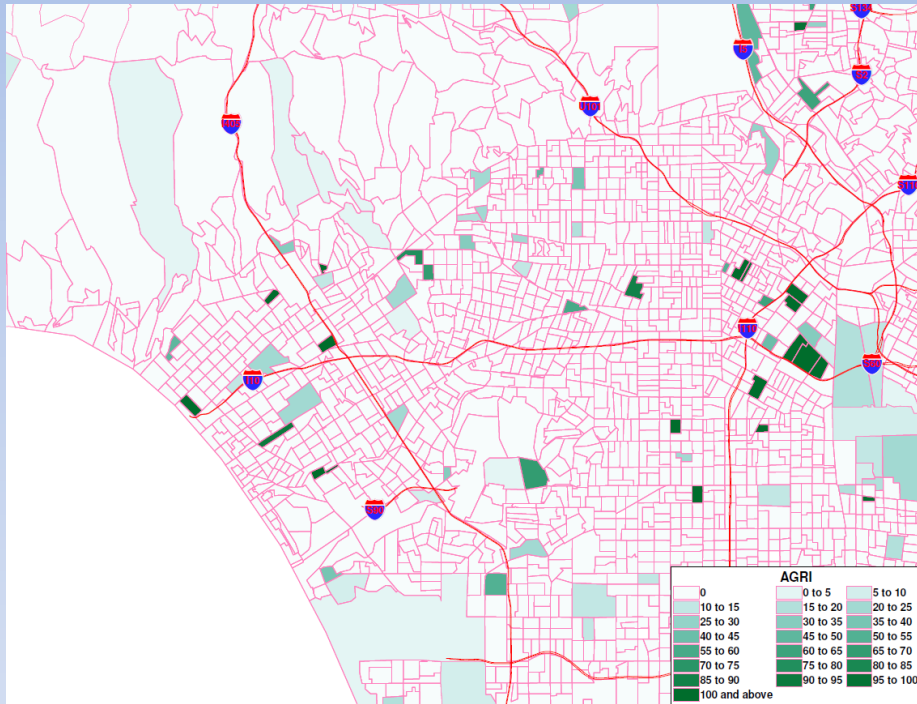
Block group level(observed)

Block level(predicted from model)

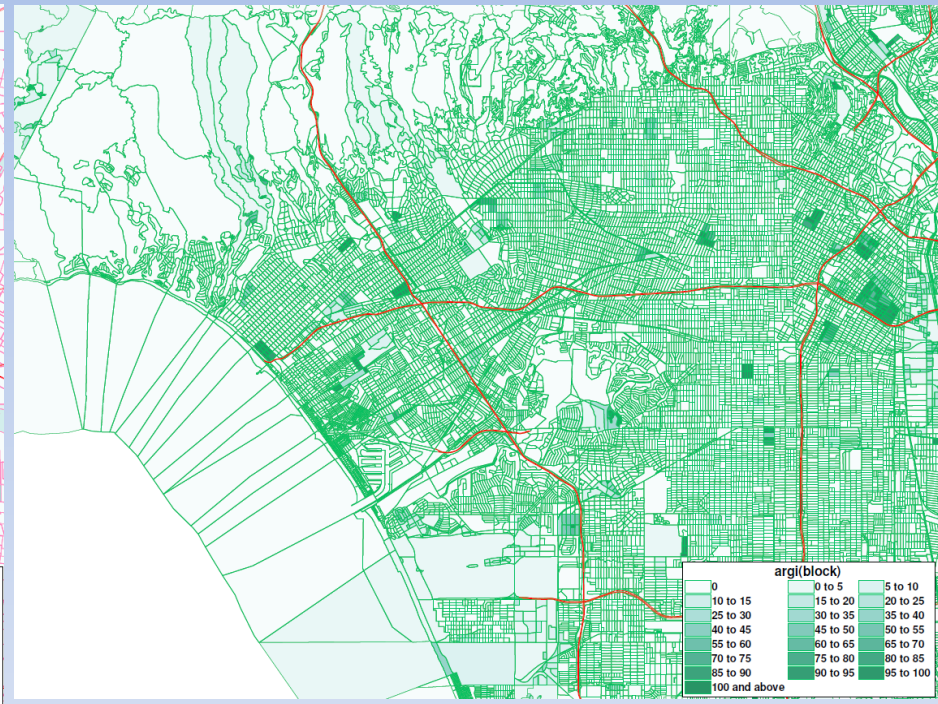


# Agriculture Density

Block group level(observed)

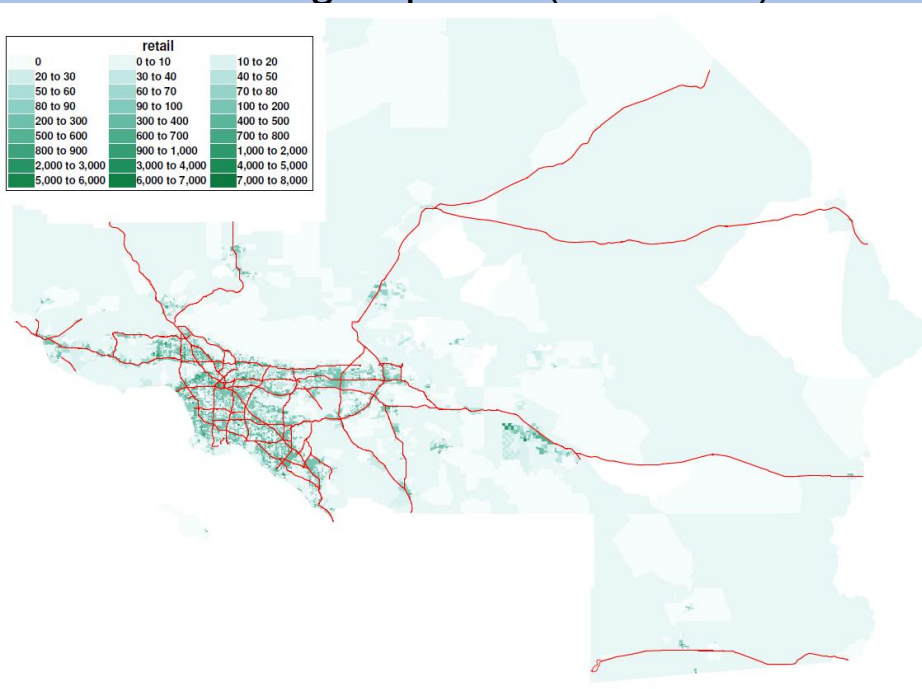


Block level(predicted from model)

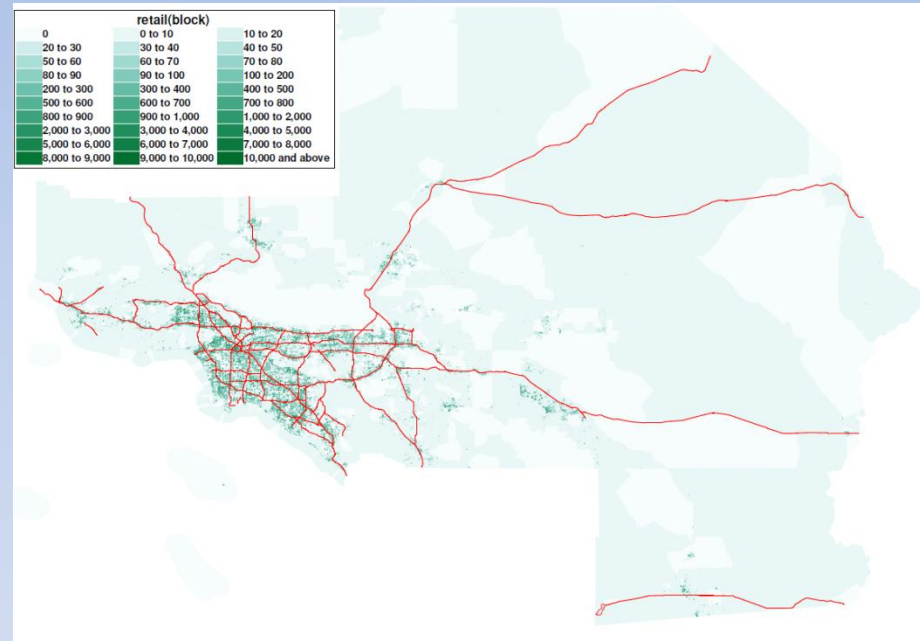


# Retail Density

Block group level(observed)



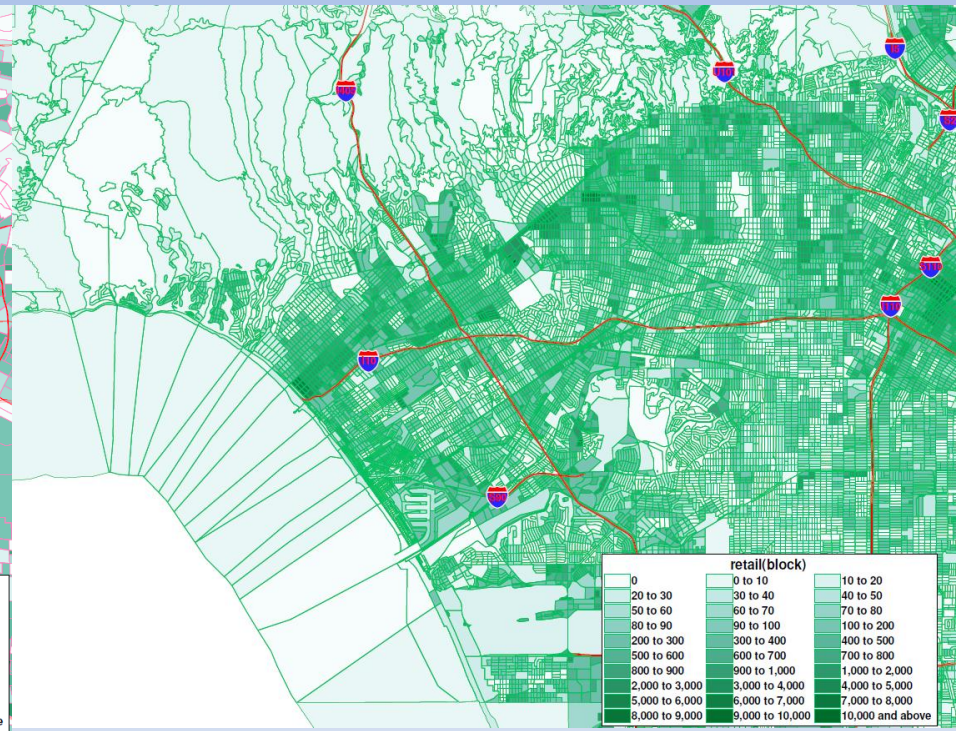
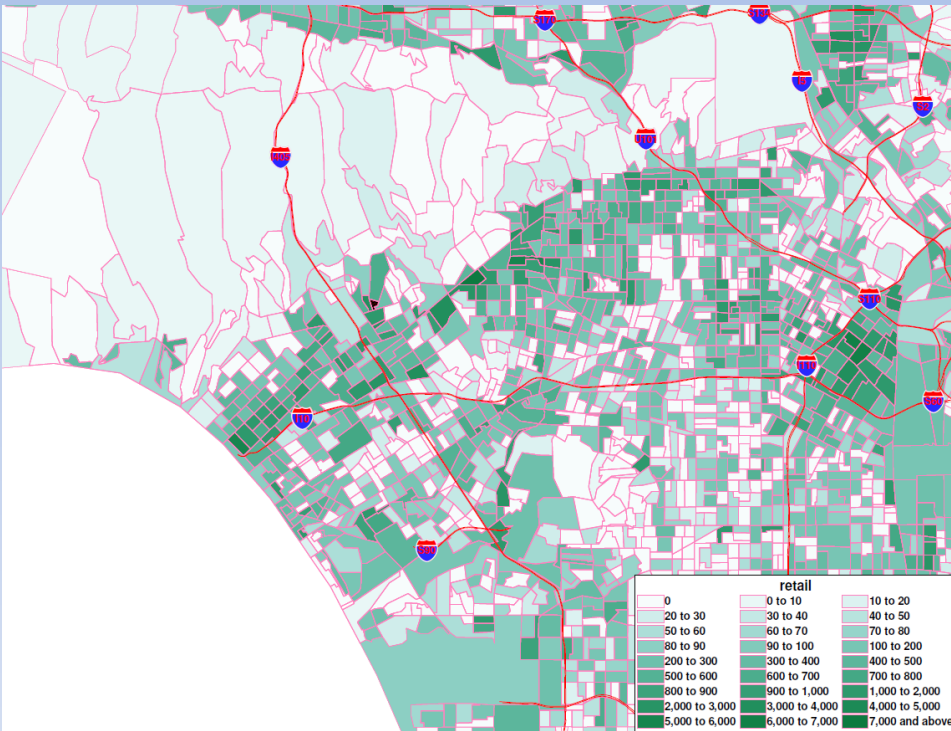
Block level(predicted from model)



# Retail Density

Block group level(observed)

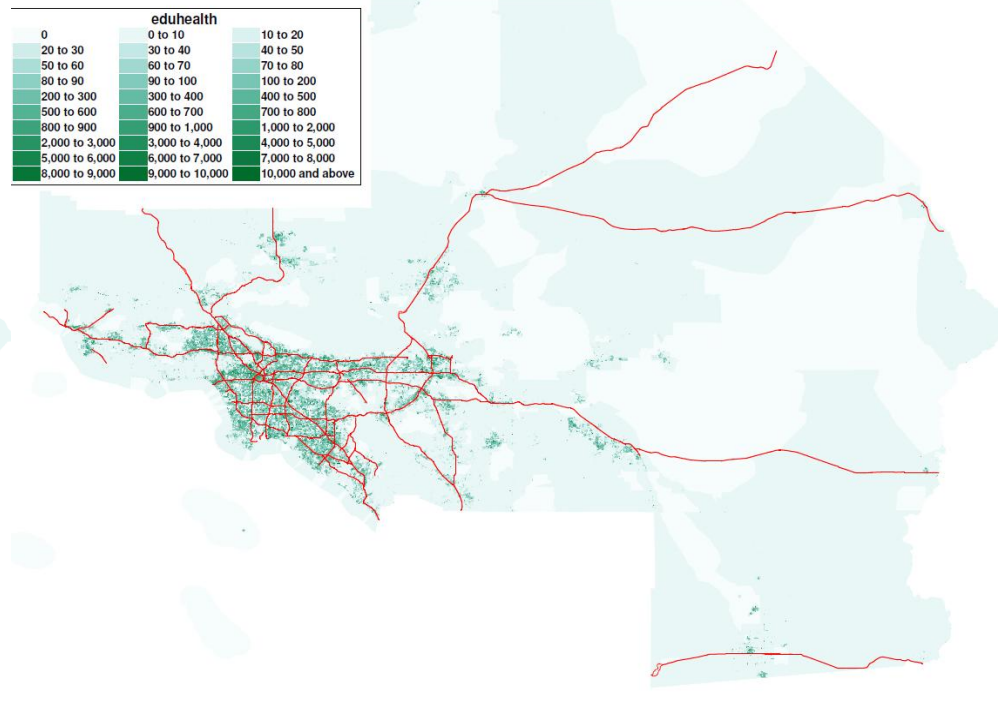
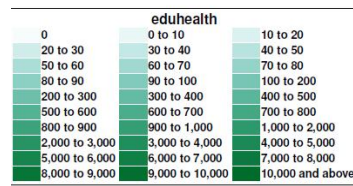
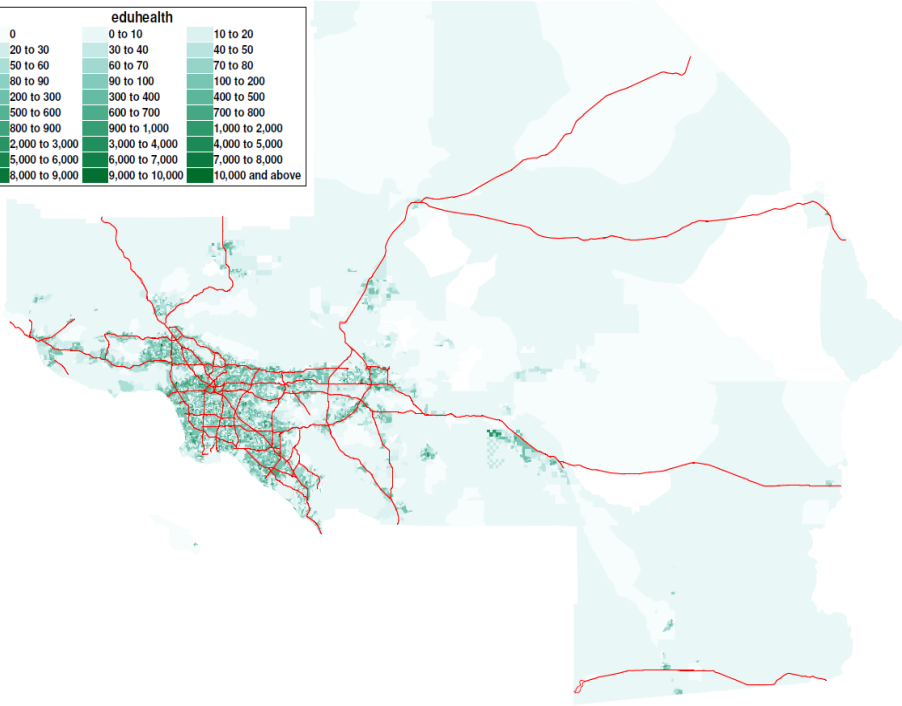
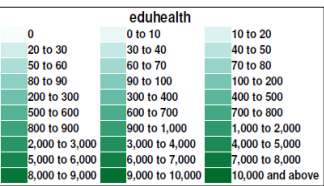
Block level(predicted from model)



# Education & Health Density

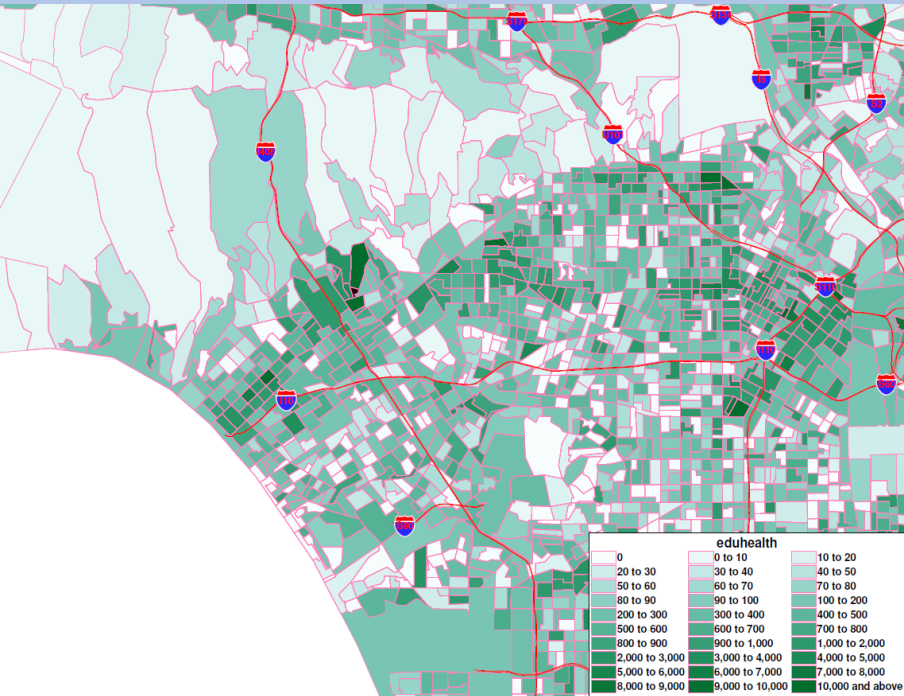
Block group level(observed)

Block level(predicted from model)

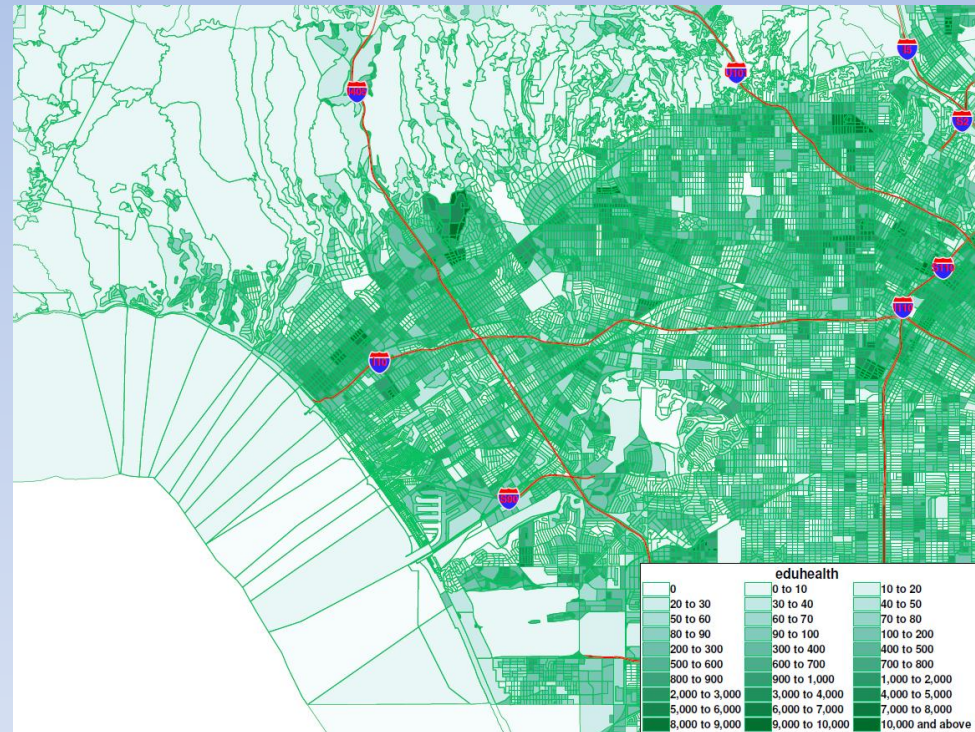


# Education & Health Density

Block group level(observed)



Block level(predicted from model)





# Transit mode

- Transit mode was scarcely available in the DFW survey
  - As a result only commute mode model includes transit mode in Phase 1 but augmented with tour mode in Phase 2 and possibly added detail
- Include transit mode at a fine level (bus, rail etc.) in the SCAG model
  - Also we will include the egress modes for transit (walk-transit-transit, Drive-transit-walk, etc.)
  - Enhanced measures of accommodating transit accessibility in TAZs

# Next Steps – part 1

- Currently we are modeling assignment at TAZ level (4000+ TAZs)
- Moving to finer resolutions (12,000 block groups and 200,000 blocks)
- There are some interesting issues that we will discuss in another forum when ready
- Give parcels/housing unit to synthetic households
- Start the path toward a demographic microsimulator for at least 25 years
- Interface with PECAS & a new land use model by UC Riverside

# Next Steps - part 2

- Buffer of land around SCAG (+external zones) synthetic population and added to the passenger model = eliminate many external trips
- Spatial allocation with probabilistic techniques = exchange data among parcels, grid cells, and zones
- Increase details of accessibility in space and time
- Dynamic Traffic Assignment (& ways to convert all other travel into a DTA compatible OD)
- We are also experimenting with TRANSIMS but slow progress!
- Build a small case study of extreme detail -> expand to entire region

# THANK YOU!

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Tempe



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