SCAG Activity-Based Model Development Workshop

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Modeling Task Force

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SOUTHERN CALIFORNIA ASSOCIATION of GOVERNMENTS

Model Development Team

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Software / Model Operation: *Hao Cheng*

Model Validation: *Mana Sangkapichai and Sung Su Yoon*

Travel survey and data: *Yongping Zhang*

Model Concept

- The Activity-Based Travel Demand Modeling (ABM) is a agent-based model in which individuals and their interaction with each other and their environment are explicitly represented.

- The activity-based approach views travel as a derived demand to pursue activities.
  - It considers the all-important link between activity participation behavior and travel behavior,
  - It accommodates the interaction among different activities pursued by an individual, and
  - It accommodates the interaction between the temporal and spatial dimensions of activity participation.

Model Application

- SCAG ABM will be fully implemented for the **2016 RTP/SCS.**
- The model will generate performance indicators, conformity analysis, and environmental justice analysis.
- To analyze the impact of infrastructure investment, land use development, pricing policy, active transportation, high speed rail, and travel demand management.

Motivation

RTP Guideline by California Transportation Commission - the largest four MPOs in California are encouraged to transition

to activity-based travel demand models.

Progress

Oct. 2008

SCAG decided to develop an activity-based model for the region

April 2009

SCAG launched ABM development project

Jan. 2013

End of Stage 1 development

Stage 1 Model Development

A

- **Task 1: Modeling Framework Setup**
  - Based on CEMDAP (UT Austin)

B

- **Task 2: Initial Estimation**
  - Three Core Modules
  - Based on 2001 Travel Survey

C

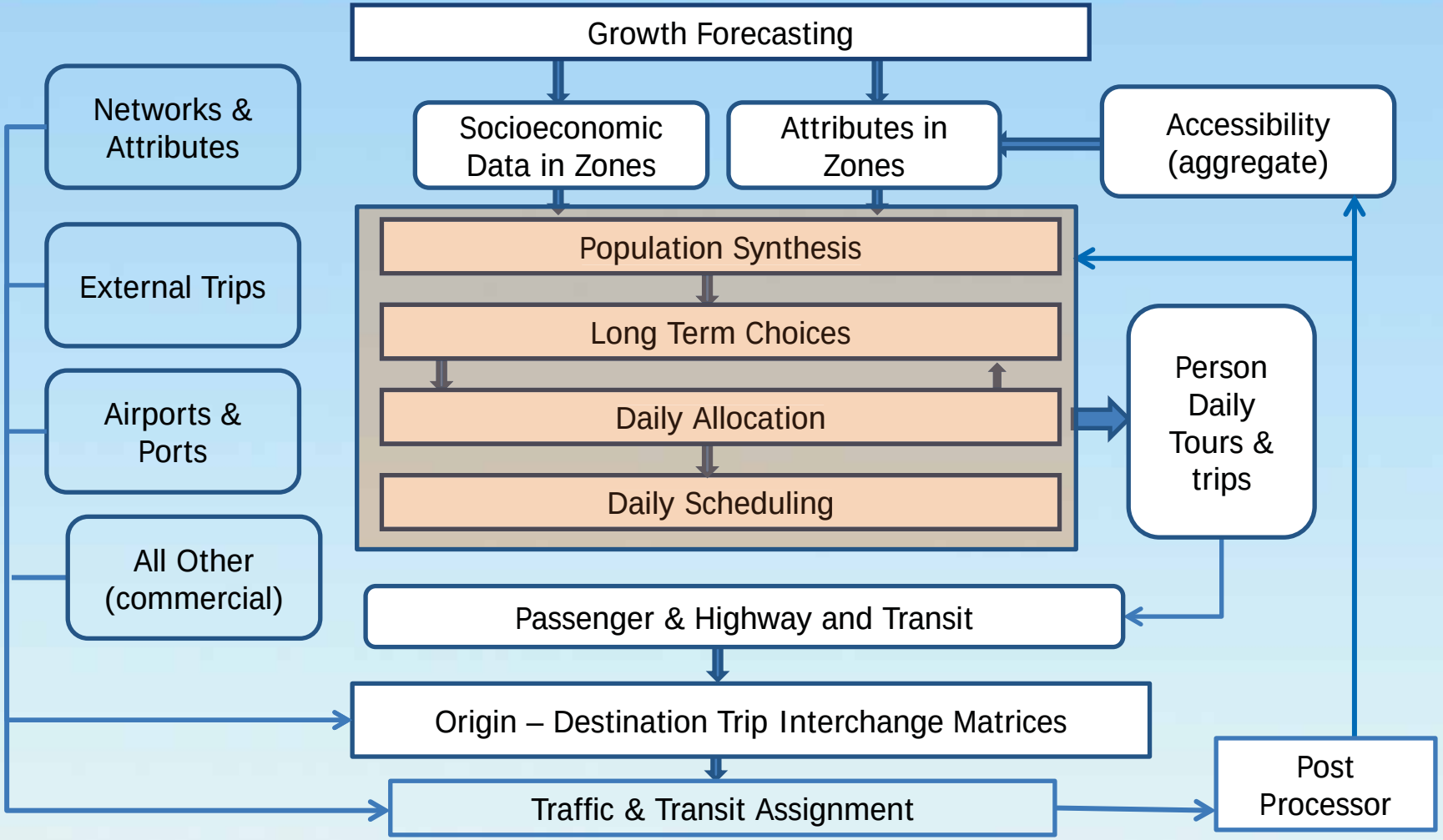
- **Task 3: Initial Calibration**
  - Base Year 2003

OVERVIEW OF SCAG ABM

About SCAG ABM

- Simulates daily activities and travel patterns for each person (18 million +) of SCAG region
- Creates rich socioeconomic characteristics for each person
- Outcome of ABM = every person with a day timer attached to them – just like travel survey
- Model outputs are converted to OD matrix, and input to assignment

SCAG ABM Flowchart



Salient Features of SCAG ABM

- Comprehensively characterizes the activity-travel patterns of all household members
- Incorporates **spatial-temporal dependencies and constraints** between and within individuals of a household
- Incorporates advanced **vehicle type choice model,** which determines the mix of vehicles in a fleet

Salient Features of SCAG ABM

- Enables a holistic assessment of the effects of **land-use, built environment, and transportation policies** on entire activity-travel patterns.

- Facilitates **environmental justice (EJ)** analyses by having the ability to examine the effects of policies on any defined segment.

- **Accessibility** indicator is used as model input. It is sensitive to time of day, availability of opportunities, and variation of transportation LOS, offering increased **behavioral realism and behavioral sensitivity**.

Salient Features of SCAG ABM

Temporal Resolution

- Continuous time scale

- **Spatial Resolution**
  - Allows for any number of zones

Salient Features of SCAG ABM

Software

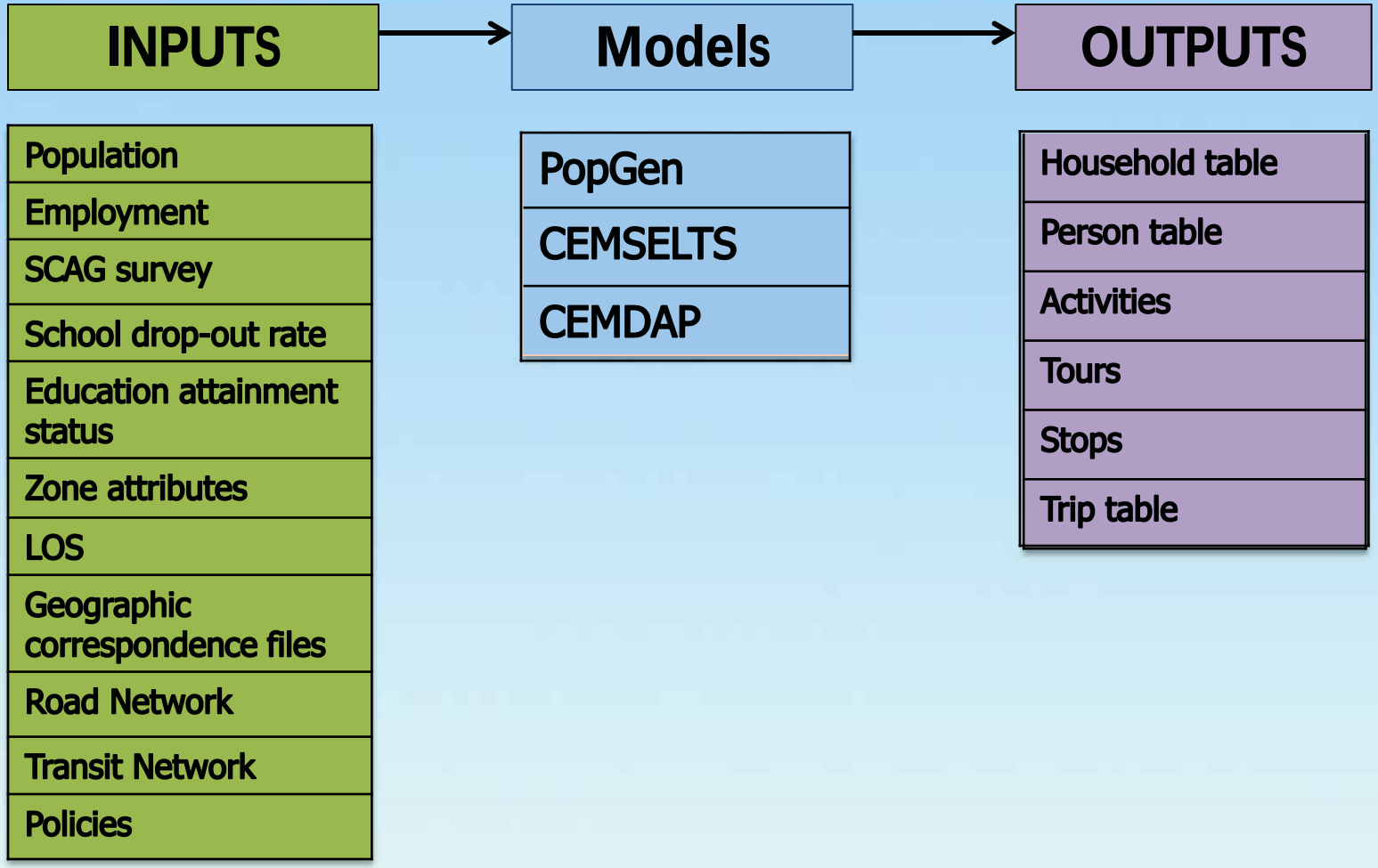
- Involves a portable and flexible object-oriented software architecture design
- Standard Window-based user interface
- Allows user to modify model parameters
- Provides a friendly interface to help the user understand the logic of the system and the underlying models

SCAG ABM Framework: SimAGENT

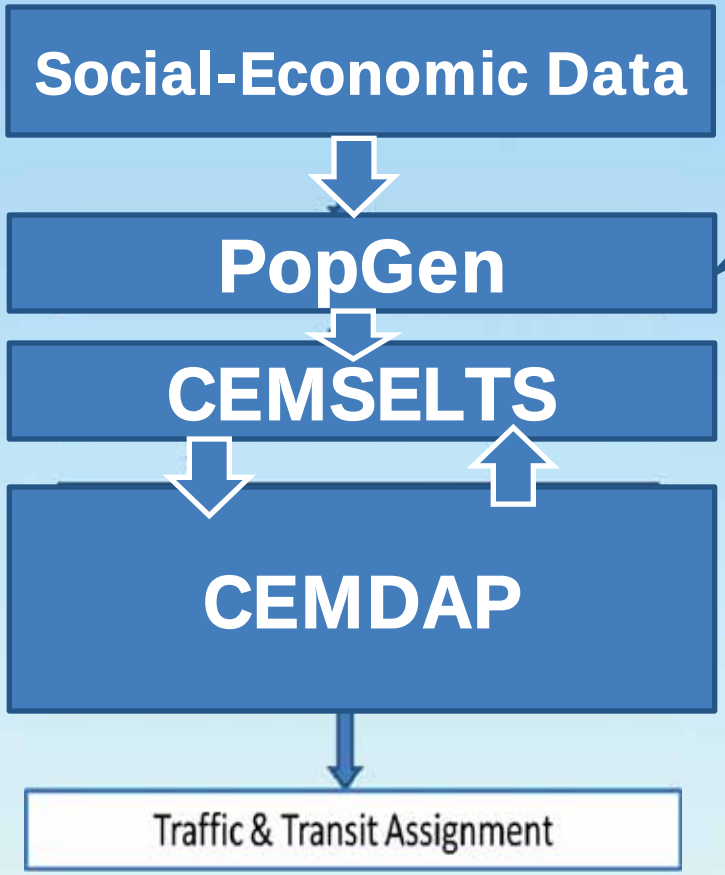
- **SimAGENT** (*Simulator of Activities, Greenhouse Emissions, Networks, and Travel*) is the base framework of SCAG ABM.

- **SimAGENT** is a model system that includes 3 core modules:
  - **PopGen**: a synthetic population generator,
  - **CEMSELTS**: a disaggregated socioeconomic module, including work location and vehicle ownership/type sub-models,
  - **CEMDAP**: a daily activity and travel scheduling module

SimAGENT Model System



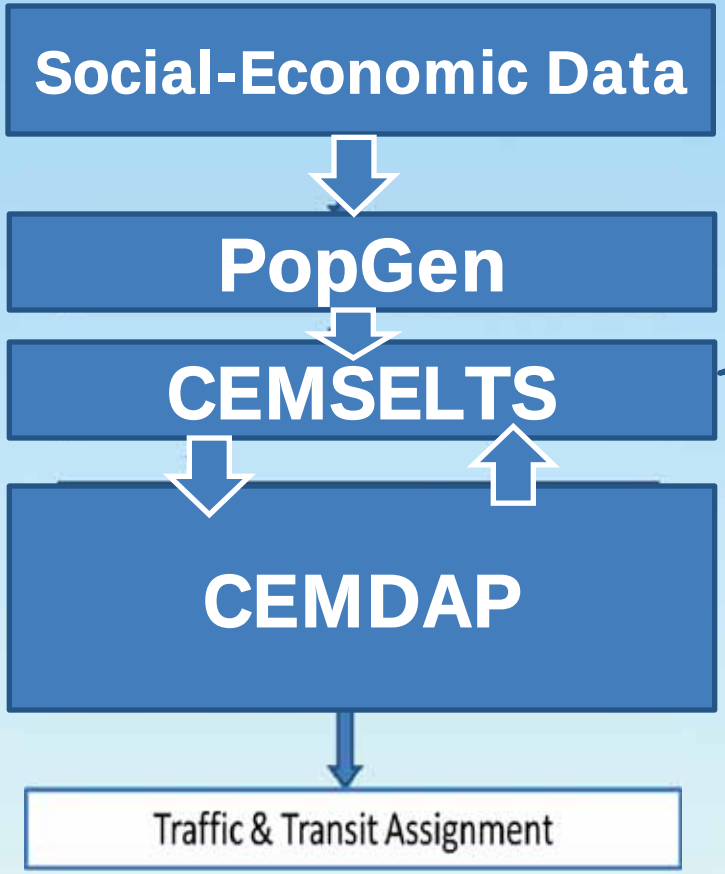
SimAGENT Sequence and Modules



PopGen generates eight basic socioeconomic attributes for each of the region's 18+ million population.

			Person Characteristis			*HHld Characteristis*	
HHID	**PerID**	**Res. TAZ**	**Age**	**Gender**	**Race**	**Hhsize**	**HH Type**
1	1	1121	36	Male	Hispanic	3	Married
1	2	1121	33	Female	Hispanic	3	Married
1	3	1121	9	Female	Hispanic	3	Married
2	1	1121	66	Female	Asian	1	Alone
3	1	2114	52	Male	White	4	Married
3	2	2114	48	Female	White	4	Married
3	3	2114	21	Male	White	4	Married
3	4	2114	17	Female	White	4	Married

SimAGENT Sequence and Modules

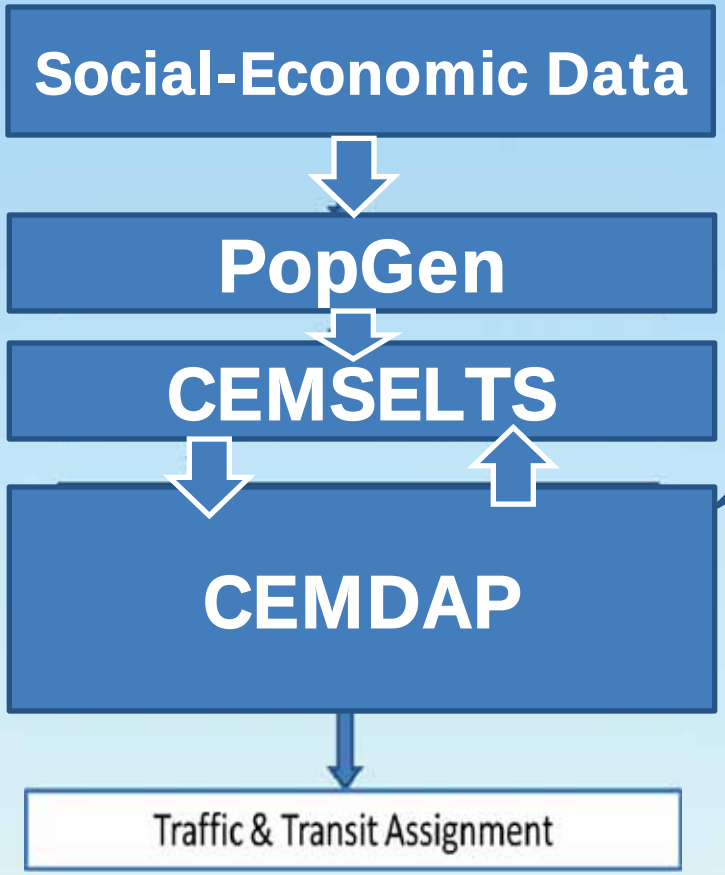


CEMSELTS* generates additional person and household socioeconomic attributes that fed to CEMDAP to simulate daily activity-travel patterns.

		Person Characteristis			*HHld Characteristis*		
HHID	PerID	Work/Scl Status	Education	Work/Scl TAZ	Hhid Inc	# Car	Housing Type
1	1	Worker	Master	1334	$75-$100K	2	SF
1	2	N-Worker	Master	n/a	$75-$100K	2	SF
1	3	Student	Elementery	1121	$75-$100K	2	SF
2	1	N-Worker	College	n/a	< $25K	0	MF
3	1	Worker	Bechalor	2145	> $100K	3	SF
3	2	Worker	Cechalor	2113	> $100K	3	SF
3	3	Student	College	1334	> $100K	3	SF
3	4	Student	High Scl	2114	> $100K	3	SF

** Comprehensive Econometric Microsimulator of Socio-economics, Land-use, and Transportation System*

SimAGENT Sequence and Modules



CEMDAP* is the core module that simulates activity schedule and travel characteristics for each individual of the region.

Household ID = 1; Person ID = 2

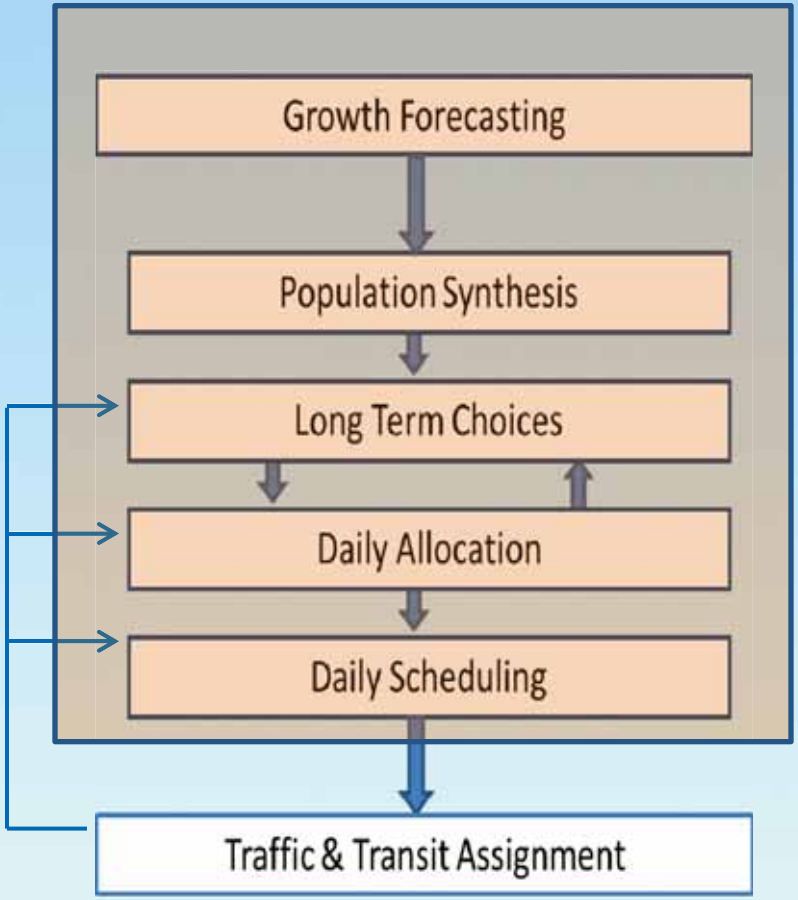
HH ID	Per. ID	Tour ID	Stop ID	Activity	Origin	Dest.	Start Time	Travel Time	Duration	Mode
1	2	1	1	P. Busi	1121	1126	8:30	10 mins	30 mins	Walk
1	2	1	2	Home	1126	1121	9:10	10 mins		Walk
1	2	2	1	Eating	1121	1156	11:40	20 mins	60 mins	Auto
1	2	2	2	Shopping	1156	2113	13:00	15 mins	45 mins	Auto
1	2	2	3	Home	2113	1121	14:00	20 mins		Auto

** Comprehensive Econometric Microsimulator of Daily Activity-Travel Patterns*

SimAGENT Sequence and Modules

- From SCAG ABM output, for each person, we have information about the type of activity, when, where, how long, how to travel, with whom, in what sequence, and interrelationships with other persons and locations in the engagement pattern.

Assignment



- CEMDAP output is converted to OD matrix as input for assignment
- Using the same assignment module from SCAG Trip-based Model in TransCAD
- Feedback LOS & accessibility

Current Status

Three Core Modules and Software

- PopGen, CEMSELTS, CEMDAP

67 Sub-Models

- Estimated Based on 2001 Travel Survey

Research

- Papers and Conference Presentations

Continuing Research and Model Enhancement

CORE MODULES

Population Synthesizer

PopGen – A Population Synthesizer

- Activity-based model estimates travel decisions for each person – need a population synthesizer to create socioeconomic data for each person
- PopGen is an advanced population synthesizer developed at Arizona State University.
- It uses Iterative Proportional Updating (IPU) method which can simultaneously control household and person attributes.

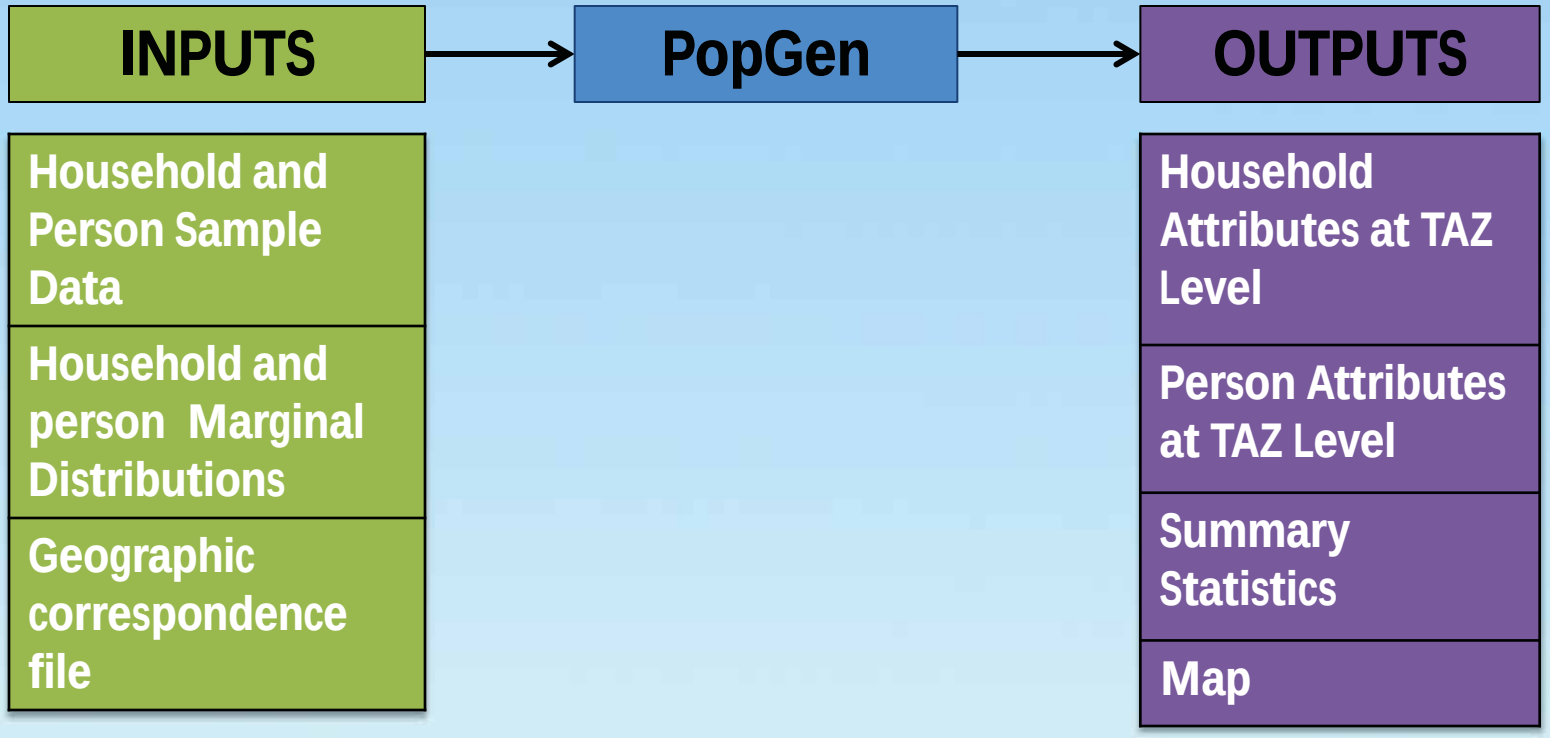
PopGen Procedure

- PopGen generates complete synthetic population by expanding the disaggregate sample data to mirror known aggregate distributions of household and person variables of interest.

  - Disaggregate sample data of the population
    - *PUMS, ACS, travel survey (SCAG uses ACS)*

  - Marginal distribution for the entire region: *census summary files, agency forecasts*
    - *SCAG Forecasting unit develops marginal distribution by TAZs*

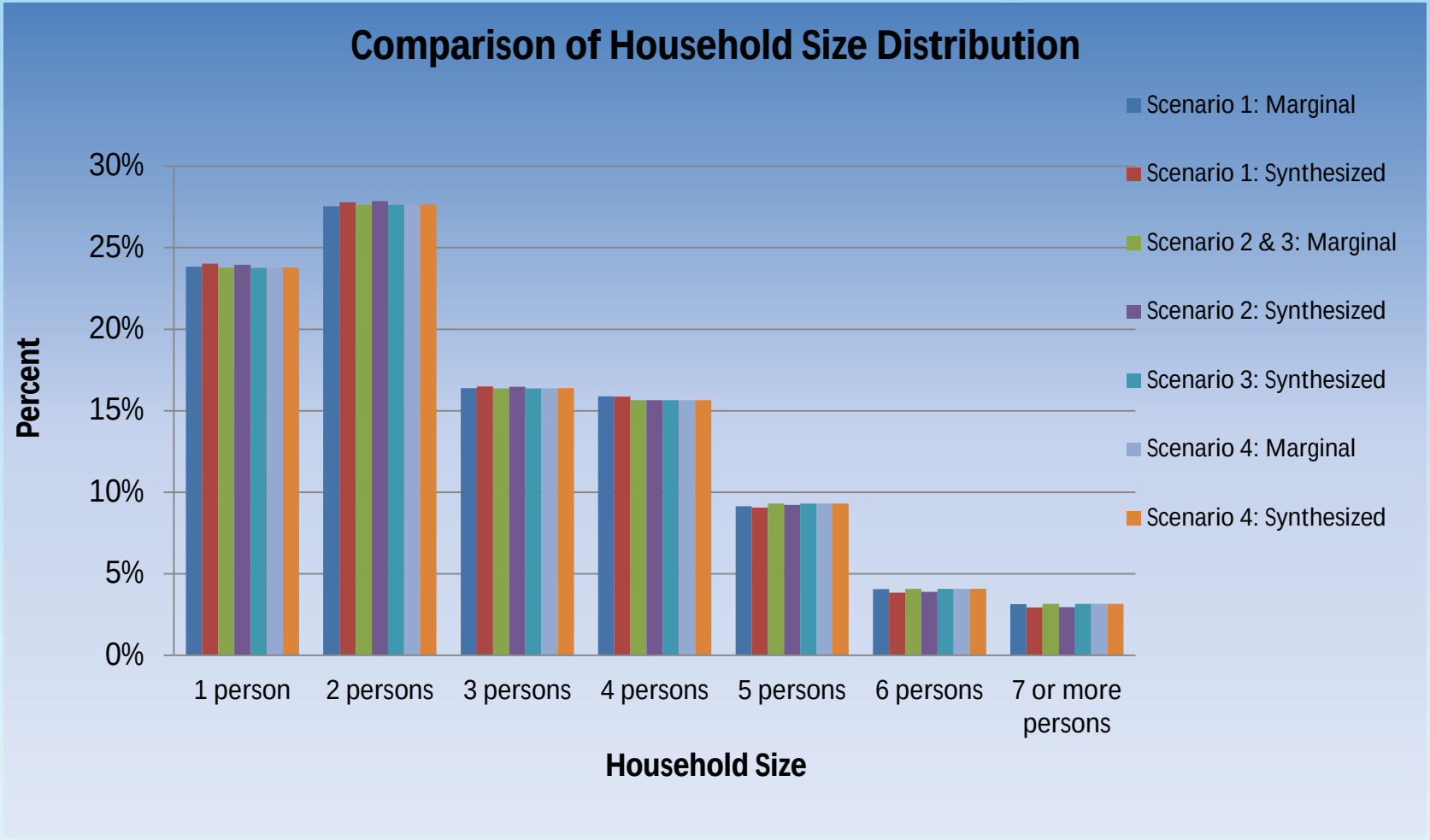
SCAG Population Synthesizer



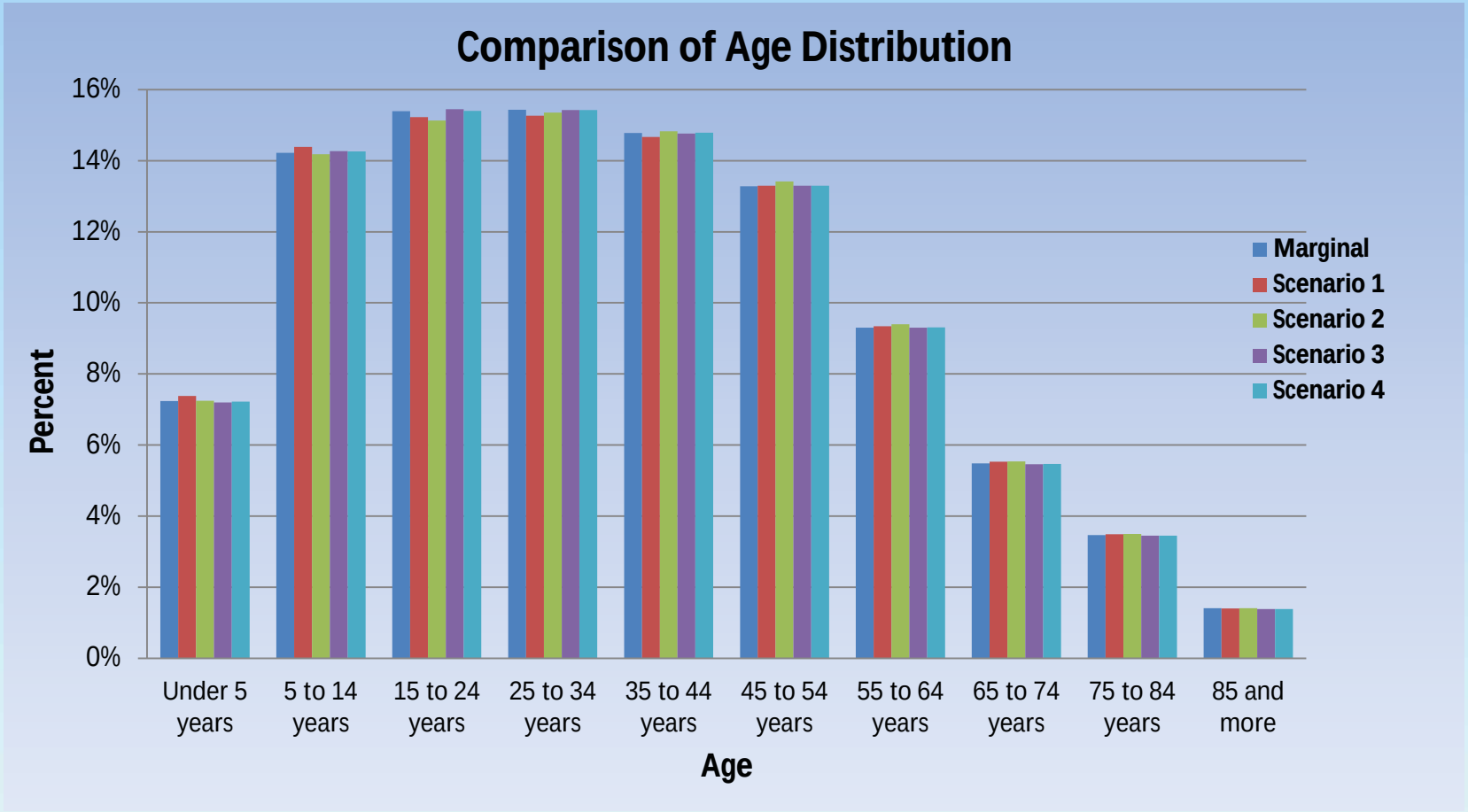
Features of PopGen

- Controls for both household and person attributes
- Automatically corrects for zero-marginal and zero-cell problems
- Computationally tractable method implemented in user-friendly Windows systems
- Provides goodness-of-fit measures to assess performance of population synthesis process

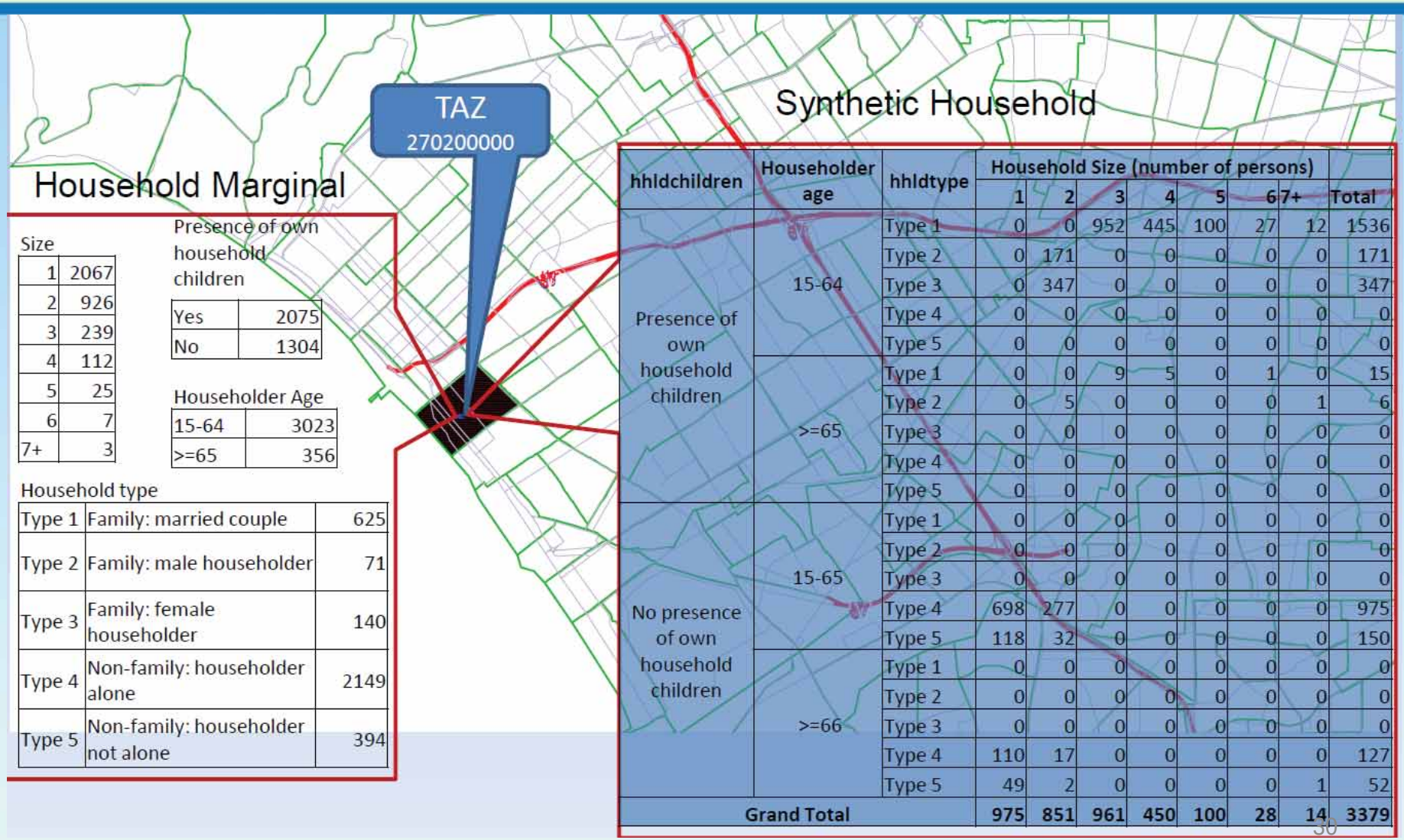
Results – Example of Household Outputs



Results – Example of Population Outputs



Household Attributes



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

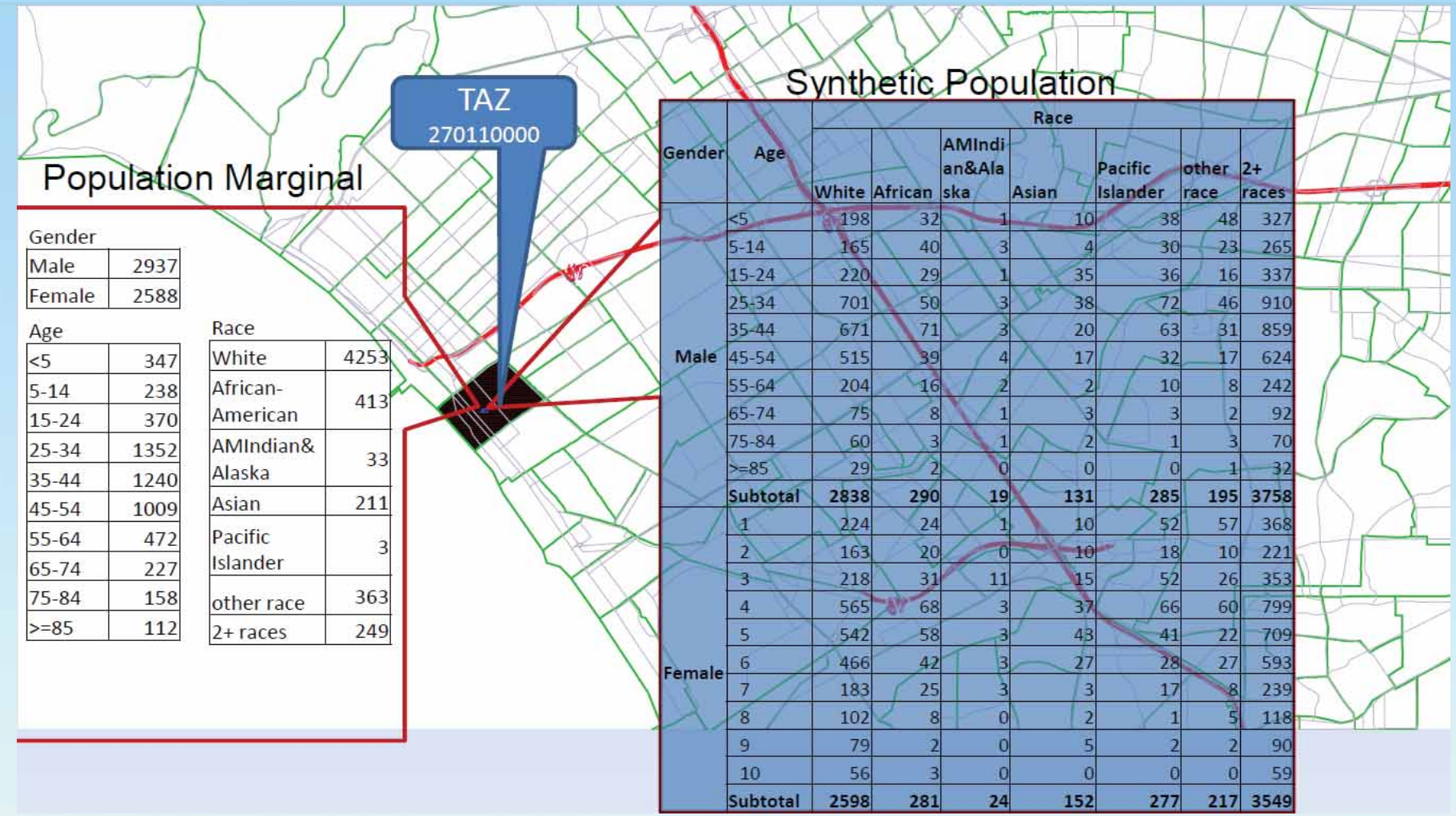
Household type

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

Synthetic Household

hhldchildren	Householder age	hhldtype	Household Size (number of persons) 1	2	3	4	5	6	7+	Total
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
	>=65	Type 1	0	0	9	5	0	1	0	15
		Type 2	0	5	0	0	0	0	1	6
		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
	>=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	1	52
Grand Total			975	851	961	450	100	28	14	3379

Person Attributes



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

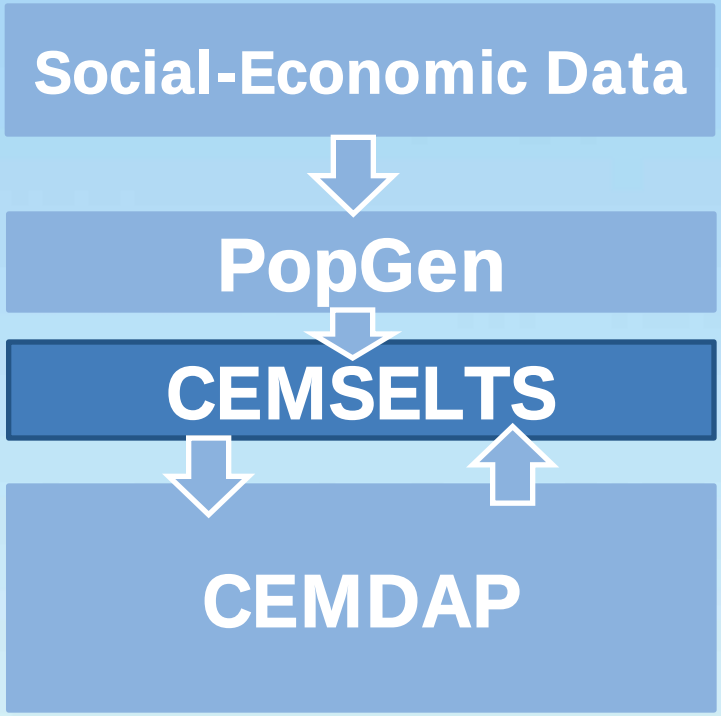
Race	
White	4253
African-American	413
AMIndian&Alaska	33
Asian	211
Pacific Islander	3
other race	363
2+ races	249

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
	Subtotal	**2838**	**290**	**19**	**131**	**285**	**195**	**3758**
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
	Subtotal	**2598**	**281**	**24**	**152**	**277**	**217**	**3549**

Richer Set of ABM Inputs Is Needed

- Synthesizing huge populations reduces variances in population characteristics
- Many key socio-economic attributes that may explain people and household choices are needed



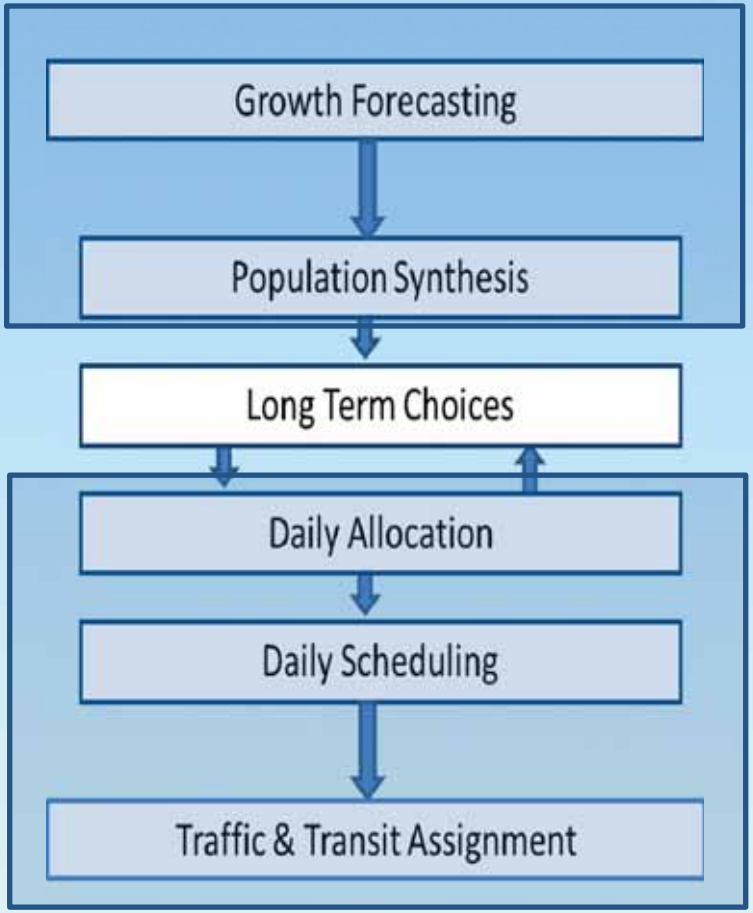
Next Step

CORE MODULES

CEMSELTS

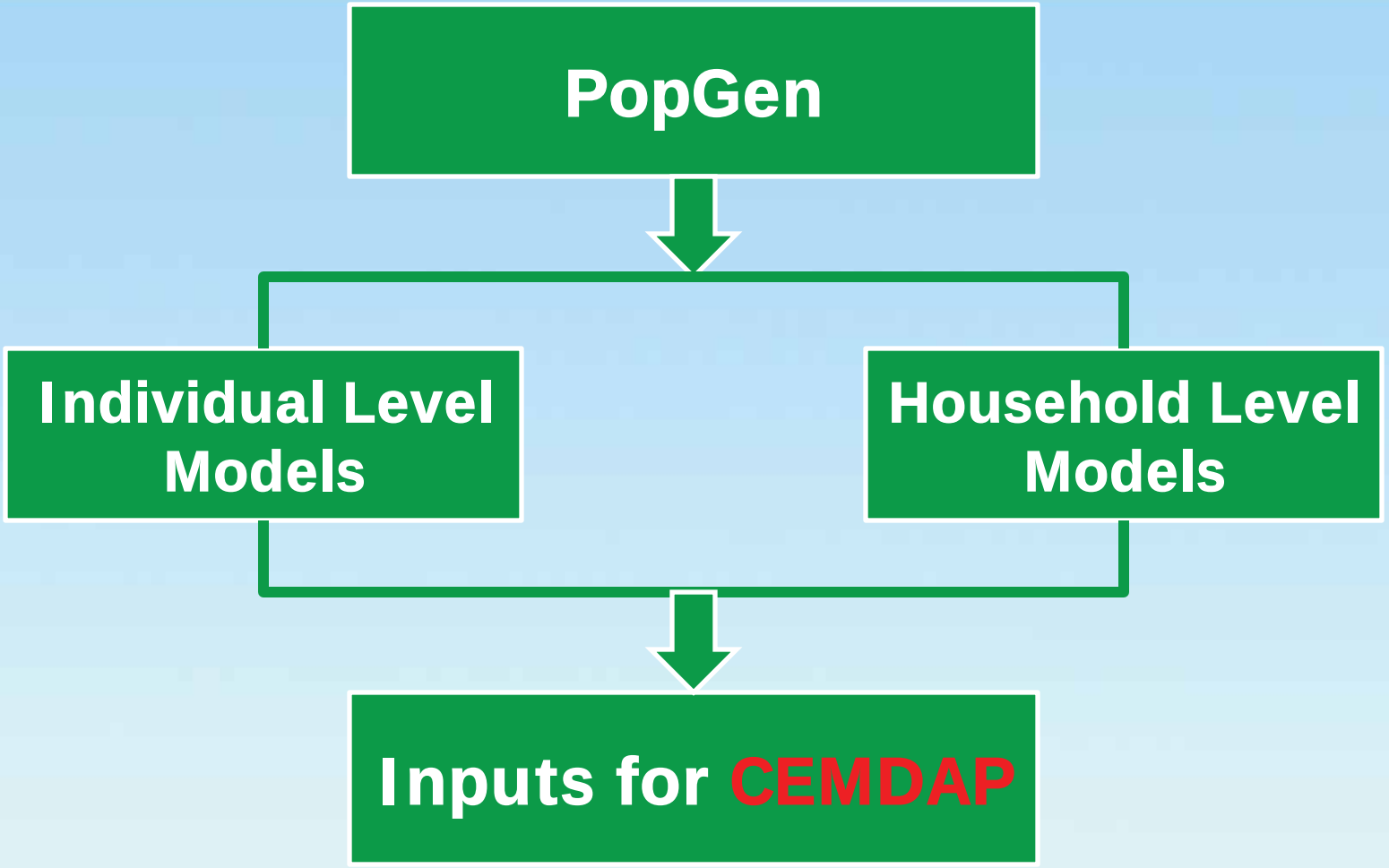
Comprehensive Econometric Microsimulator of Socio-economics, Land-use, and Transportation System

CEMSELTS



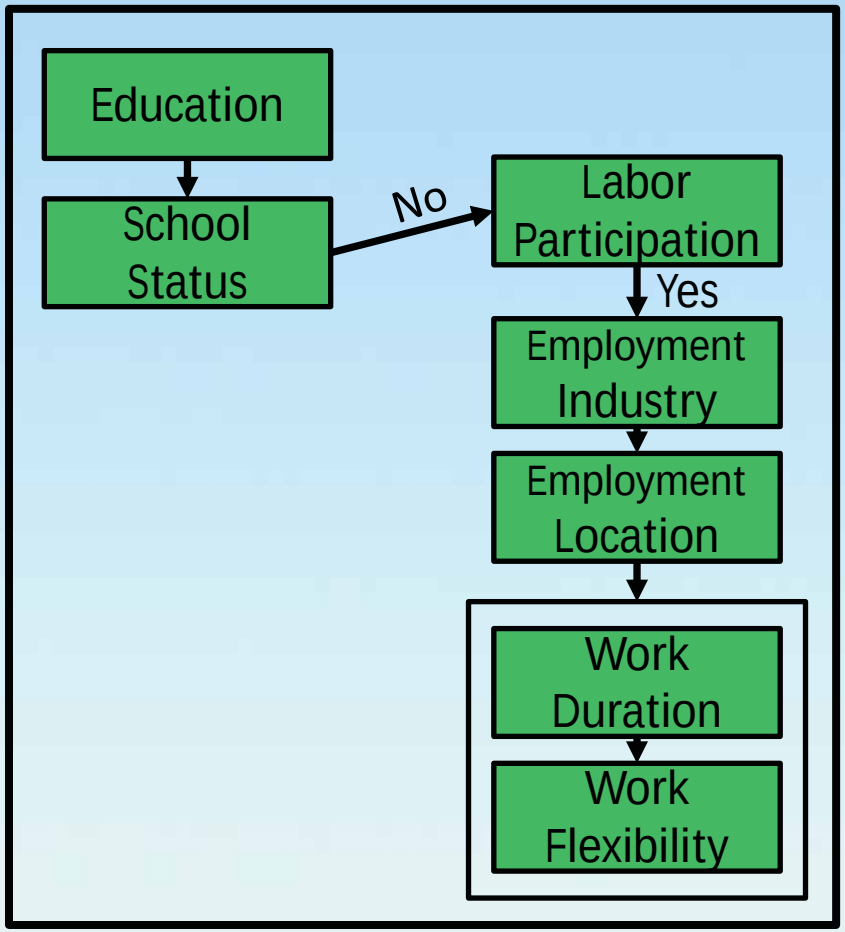
- **Create additional variables for each individual:**
  - Education Attainment
  - Job Status
  - Household Income
  - Housing Type
- **Create Long-Term Choice Variables**
  - Vehicle Ownership & Type
  - Job/School Location Choice

CEMSELTS Sequence

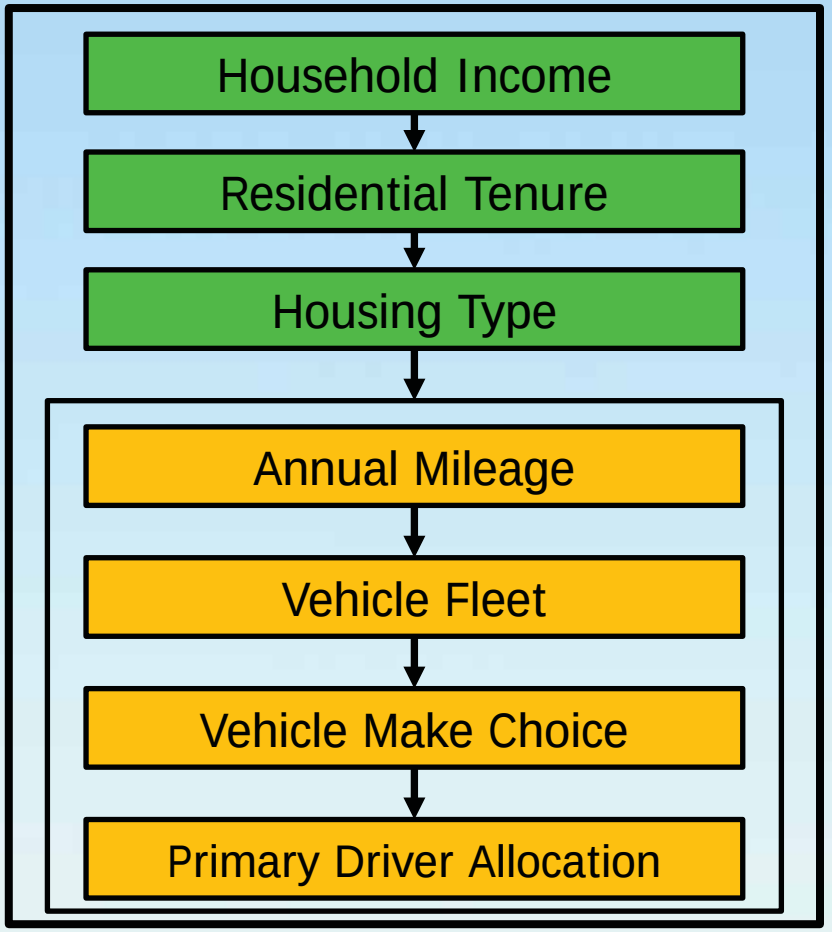


CEMSELTS Models

Individual Level Models



Household Level Models



CEMSELTS Individual Level Model Output

Comparison with ACS 2003 and Census 2000

Individual Socio-demographics	Values in Percent			Values in Percent		
	ACS 2003	CEMSELTS Predicted	Difference in Percentage	Census 2000	CEMSELTS Predicted	Difference in Percentage
Enrollment of Children (3 to 17 years)						
Preschool - Grade 3	37.07	44.59	7.52	41.17	44.59	3.42
Grade 4 - Grade 8	41.64	42.16	0.52	38.76	42.16	3.40
Grade 9 - Grade 11	21.29	13.25	-8.04	20.07	13.25	-6.82
Educational Attainment (Adults)						
Less than Grade 9	11.58	2.23	-9.35	13.14	2.23	-10.91
Grade 9 - Grade 12 (no diploma)	12.05	8.28	-3.78	14.71	8.28	-6.44
Completed High School	45.70	58.48	12.78	44.00	58.48	14.48
Associate or Bachelors	22.55	22.95	0.41	20.77	22.95	2.18
Graduate Degree (Masters or Ph.D)	8.12	8.06	-0.06	7.37	8.06	0.69
Labor Participation						
Employed	59.47	59.07	-0.40	56.81	59.07	2.26
Unemployed	40.53	40.93	0.40	43.19	40.93	-2.26
Employment Industry						
Construction and Manufacturing	19.92	14.46	-5.46	20.67	14.46	-6.21
Trade and Transportation	4.94	7.32	2.38	4.86	7.32	2.46
Personal, Professional and Financial	50.63	49.42	-1.21	49.34	49.42	0.08
Public and Military	3.94	5.07	1.13	4.04	5.07	1.03
Retail Trade	15.29	10.77	-4.51	15.60	10.77	-4.83
Other	5.28	12.96	7.68	5.49	12.96	7.47

CEMSELTS Household Level Model Output

Comparison with ACS 2003 and Census 2000

Household Socio-demographics	Values in Percent			Values in Percent		
	ACS 2003	CEMSELTS Predicted	Difference in Percentage	Census 2000	CEMSELTS Predicted	Difference in Percentage
Number of Vehicles						
Households with no vehicles	8.29	7.27	-1.02	10.07	7.27	-2.79
Households with 1 vehicle	33.34	31.32	-2.02	34.85	31.32	-3.55
Households with 2 vehicles	37.48	34.71	-2.77	37.16	34.72	-2.44
Households with 3 vehicles	14.10	15.17	1.07	12.59	15.17	2.59
Households with 4 or more vehicles	6.79	11.52	4.74	5.33	11.52	6.19
Number of Workers						
Households with no workers	12.21	16.84	4.63	11.31	16.84	5.53
Households with 1 worker	34.23	36.80	2.58	32.98	36.80	3.82
Households with 2 or more worker	53.57	46.36	-7.21	55.71	46.36	-9.35
Household Income						
$0- $9999	8.08	8.09	0.01	8.98	8.09	-0.89
$10,000-$34,999	28.85	40.45	11.6	29.56	40.45	10.89
$35,000-$49,999	15.05	14.47	-0.58	15.24	14.48	-0.76
$50,000-$74,999	18.53	13.58	-4.95	18.89	13.58	-5.31
$75,000 and more	29.49	23.4	-6.09	27.32	23.40	-3.93
Household Tenure						
Owner	55.74	61.05	5.30	54.78	61.03	6.25
Renter	44.26	38.95	-5.30	45.22	38.97	-6.25

CEMSELTS

Work Flow Distribution by Destination

Origin county	Within Origin County			Outside Origin County			Total		
	ACS2003 (%)	CEMSELTS 2003 (%)	Difference	ACS2003 (%)	CEMSELTS 2003 (%)	Difference	ACS2003 (%)	CEMSELTS 2003 (%)	Difference
Los Angeles	52.79	52.63	-0.16	3.86	5.29	1.43	56.65	57.92	1.26
Orange	15.61	14.28	-1.32	3.11	3.45	0.35	18.71	17.74	-0.98
Riverside	6.57	7.65	1.09	3.19	1.85	-1.35	9.76	9.50	-0.26
San Bernardino	6.88	7.58	0.70	3.18	2.60	-0.58	10.06	10.18	0.12
Ventura	3.73	3.67	-0.06	1.09	1.00	-0.09	4.82	4.67	-0.15
Total	85.57	85.81	0.24	14.43	14.19	-0.24	100	100	0.00

**Imperial County data are missing due to small sample size in 2003 ACS.*

CEMSELTS

Vehicle Type Choice Model Results

Body Type	Survey Data	CEMSELTS
Sub-compact Car	3.5	2.7
Compact Car	18.2	23.9
Medium Car	22.3	23.9
Large Car	5.7	3.3
Sports Car	5.6	4.1
Medium SUV	9.5	9.9
Large SUV	11	8.9
Van	7	5.9
Pickup	17.2	17.3

Summary

- **CEMSELTS** is a software/module that contains a series of choice models estimates for long-term choices & other attributes (14 sub-models).
- Vehicle type choice determines vehicle fleet mix; critical to *energy* and *emission* analysis.
- The resulting richer set of output is then fed to CEMDAP, the core activity-based modeling engine within SimAGENT to simulate complete daily activity-travel patterns for the population of the region.

Household Evolution Model

- A model that progress resident population year after year using smooth transitions instead of abrupt adjustments based on externally provided demographic data.

- It enables user to link demographic transition to behavioral change.

- The project will complete at June, 2013.
  - by SCAG ABM consultants

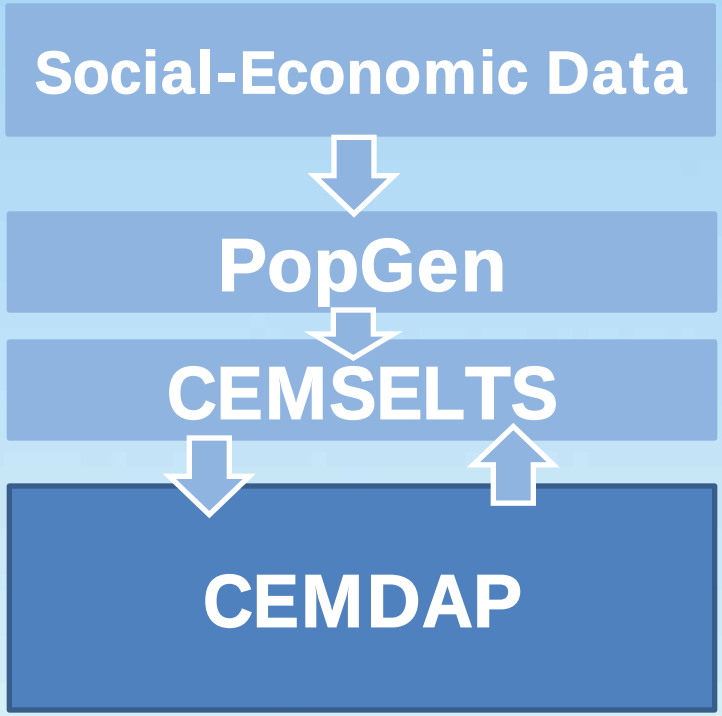
CORE MODULES

CEMDAP

Comprehensive Econometric Microsimulator of Daily Activity-Travel Patterns

CEMDAP Module

Comprehensive **E**conometric **M**icrosimulator of **D**aily **A**ctivity-Travel **P**atterns



- Simulates activity schedule and travel characteristics for each individual of the region
- Core module of SimAgent
- 52 sub-models
- Developed by UT Austin

Features of CEMDAP

- A policy responsive tool
- Continuous time scale
- Allows any number of zones
- Level of service data can be provided at any temporal resolution (5 time-of-day periods for SCAG ABM)
- Explicitly considers time-space constraints
- Changes in the activity-travel pattern of one individual in a household may bring about changes in activity-travel patterns of other household members
- MDCEV approach facilitates modeling activity participation at a household level with joint activity participation incorporated in a simple fashion

Features of CEMDAP

Recognizing Fixities

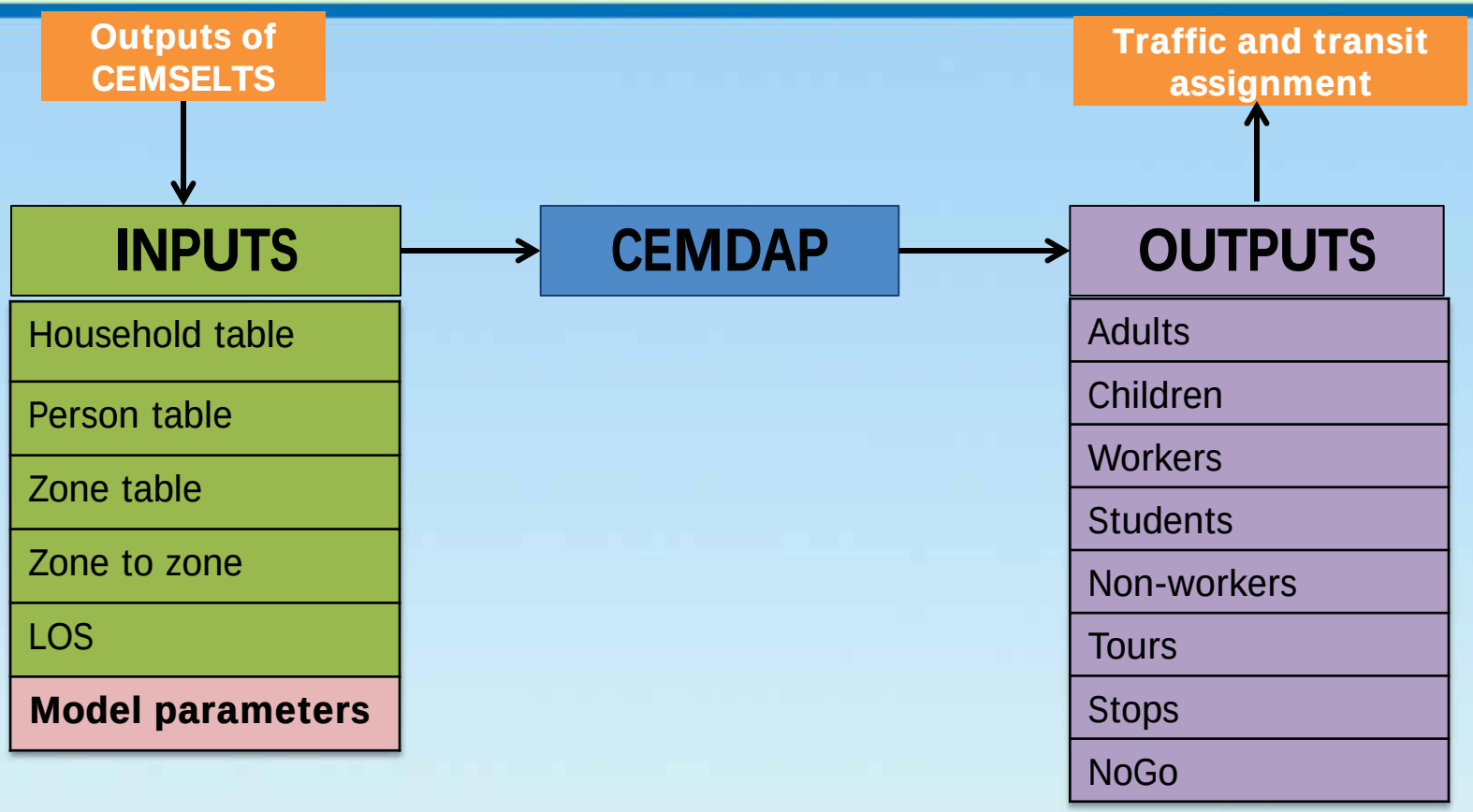
Non-Workers

- No obvious activity with spatial and temporal fixities
- Person more flexible in scheduling his/her activities

Workers

- The “work” activity has spatial and temporal fixities
- Person schedules his/her activities around the work activity

CEMDAP System

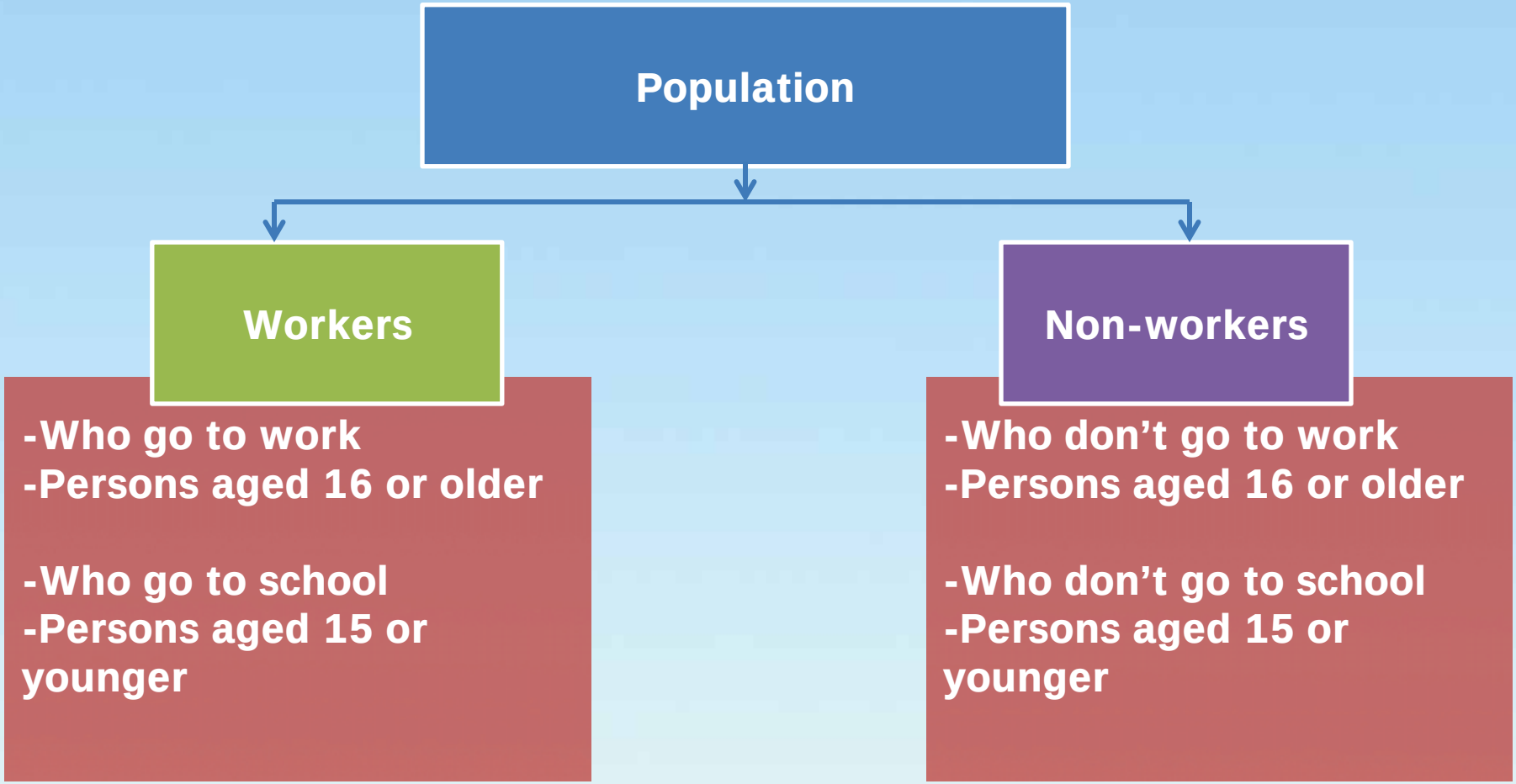


Tools for CEMDAP

- CEMDAP includes 52 sub-models

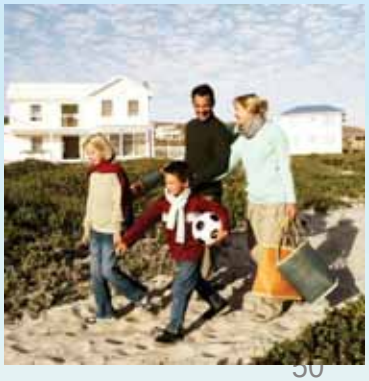
- The econometric structure for each sub-model falls under one of the eight econometric model categories:
  1. Multiple Discrete Continuous Extreme Value (MDCEV)
  2. Fractional split
  3. Binary logit
  4. Multinomial logit
  5. Hazard-duration
  6. Regression
  7. Ordered probit and
  8. Spatial location choice

Person type


Population
Workers
-Who go to work
-Persons aged 16 or older
-Who go to school
-Persons aged 15 or younger
Non-workers
-Who don't go to work
-Persons aged 16 or older
-Who don't go to school
-Persons aged 15 or younger

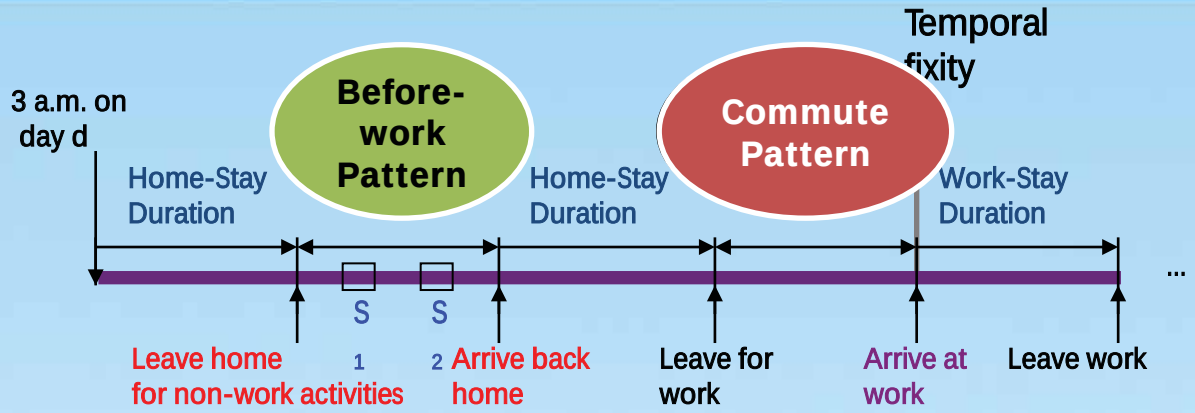
Activities/Travel purposes

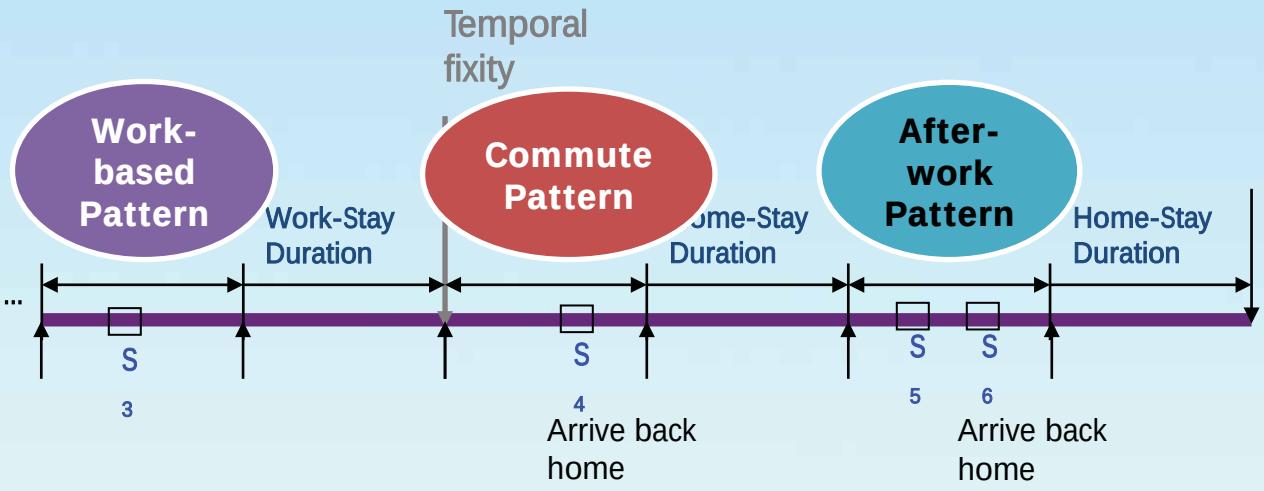
- Home
- Mandatory
  - Work
  - School
- Maintenance
  - Drop-off at school
  - Pick-up from school
  - Other serve-passenger
  - Shopping
  - Work-related
  - Household/personal business
- Discretionary
  - Joint discretionary
  - ❑ Children discretionary
  - ❑ Social recreation
  - ❑ Eating out



Representing Activity-Travel Patterns

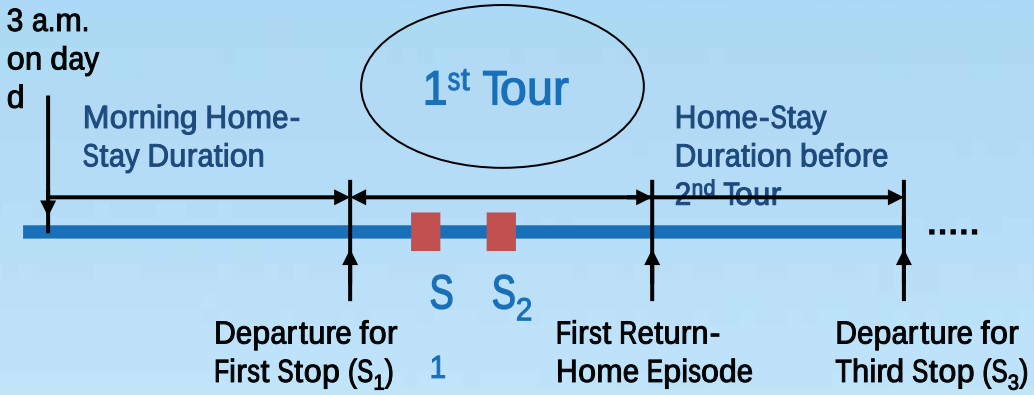
Workers

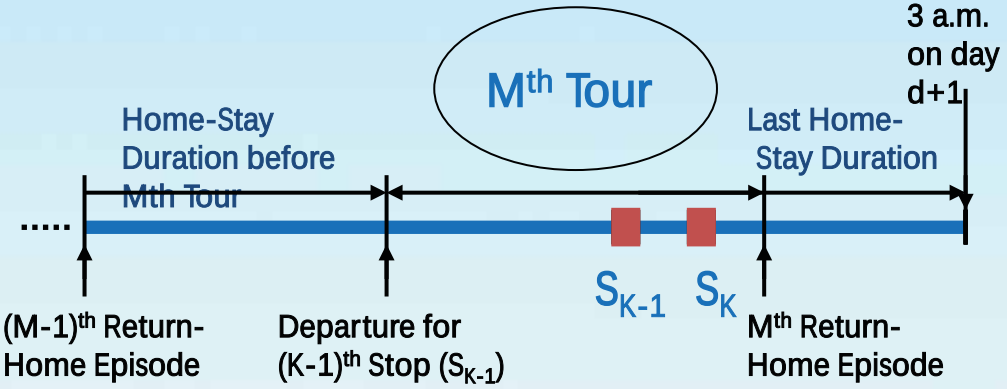




Representing Activity-Travel Patterns

Non-Workers

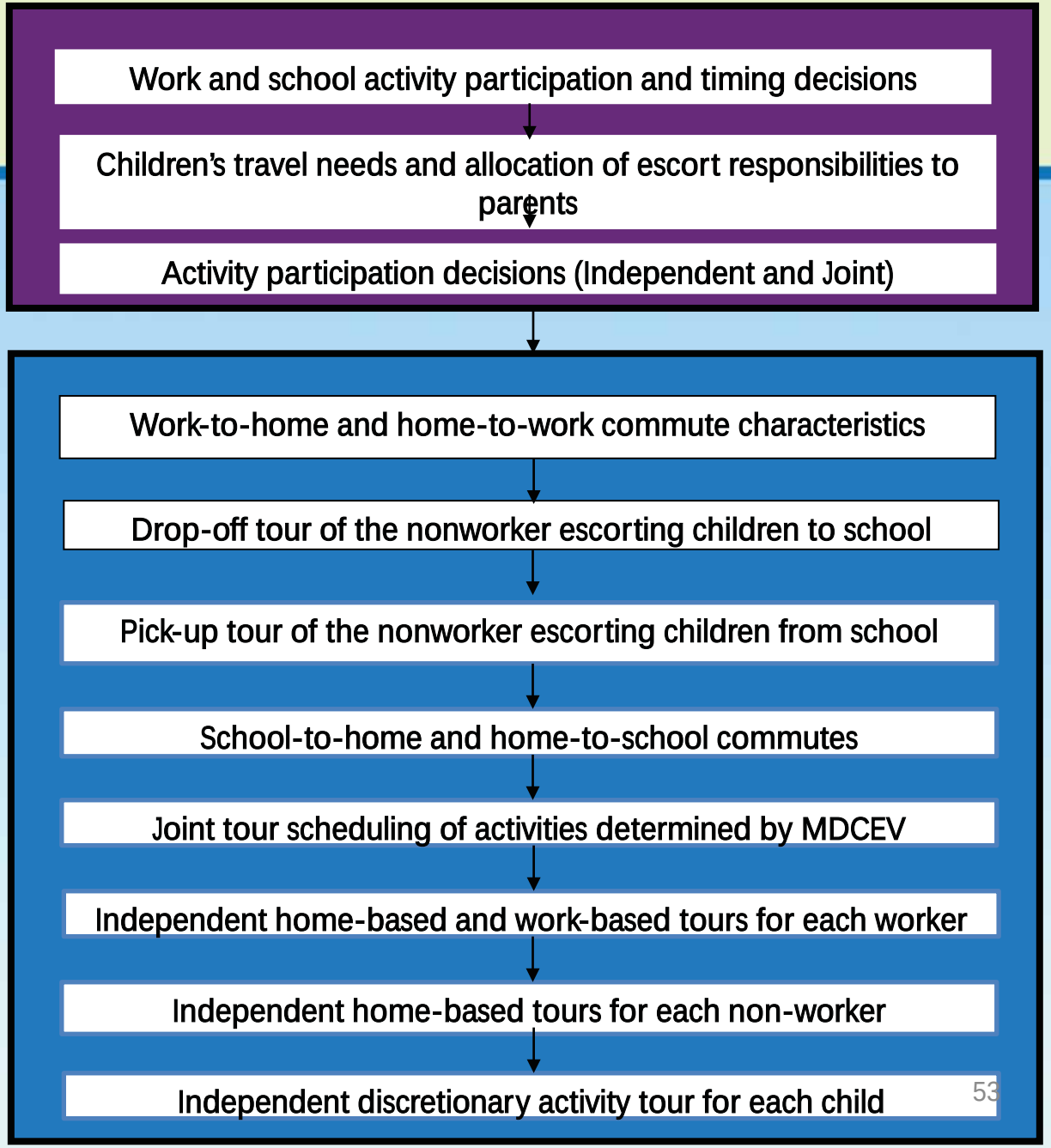




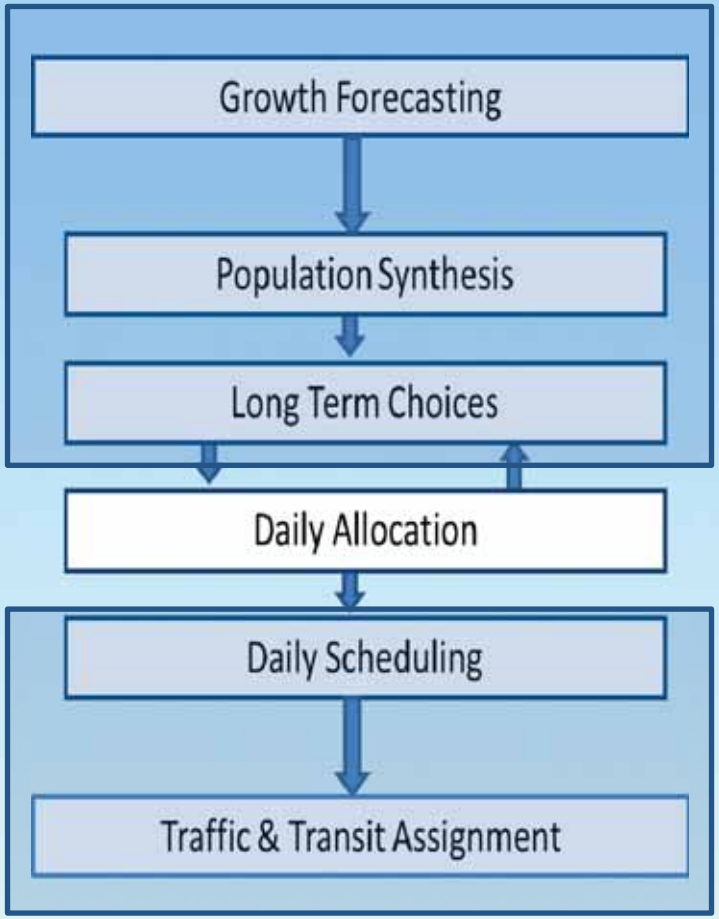
CEMDAP Modeling Framework

Two major steps:

1. **Generation Allocation**
2. **Scheduling**

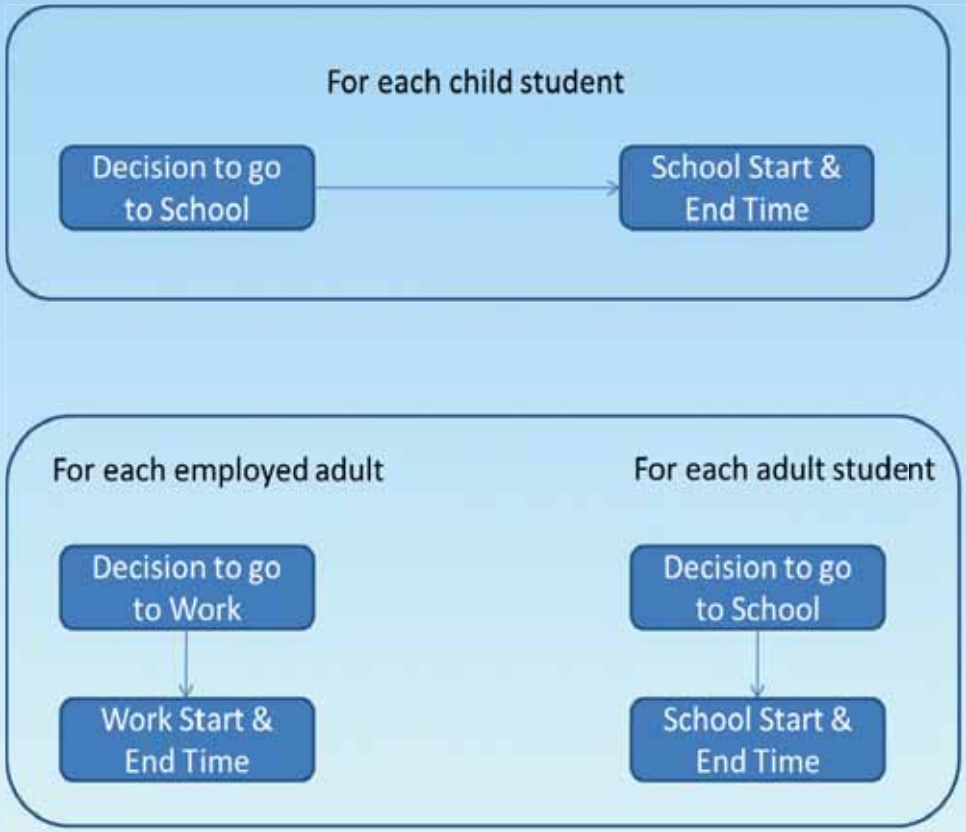


Activity Generation & Allocation



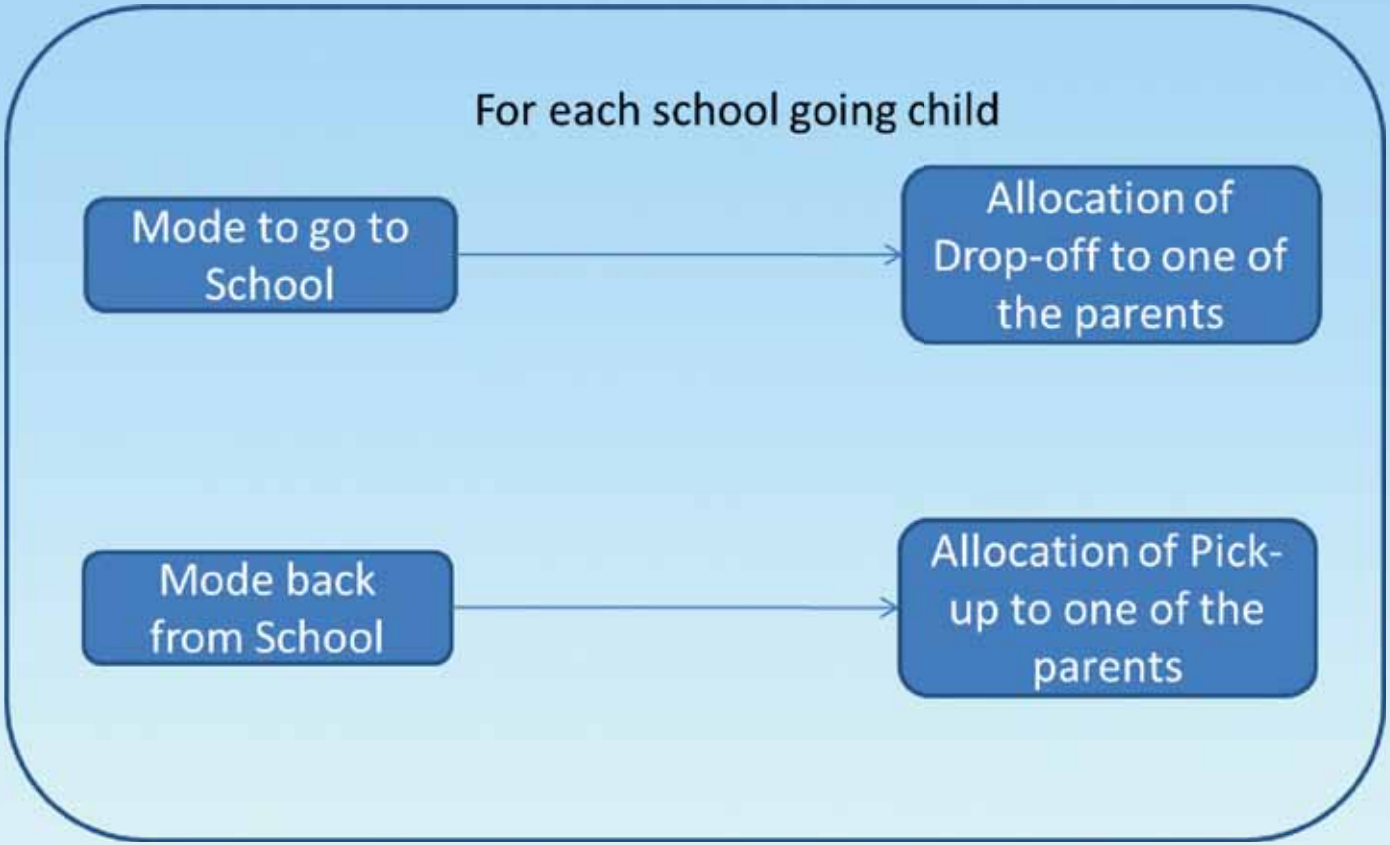
- **Determine each person's decision on daily activities:**
  - **Workers**: Commute
  - **Children**: Go to School
  - **Non-workers**: Non-work Activities
  - **Parents**: Pick up/Drop off
  - **All Household Members**: Joint Activity

GA module: Generation of Work and School Activity Participation

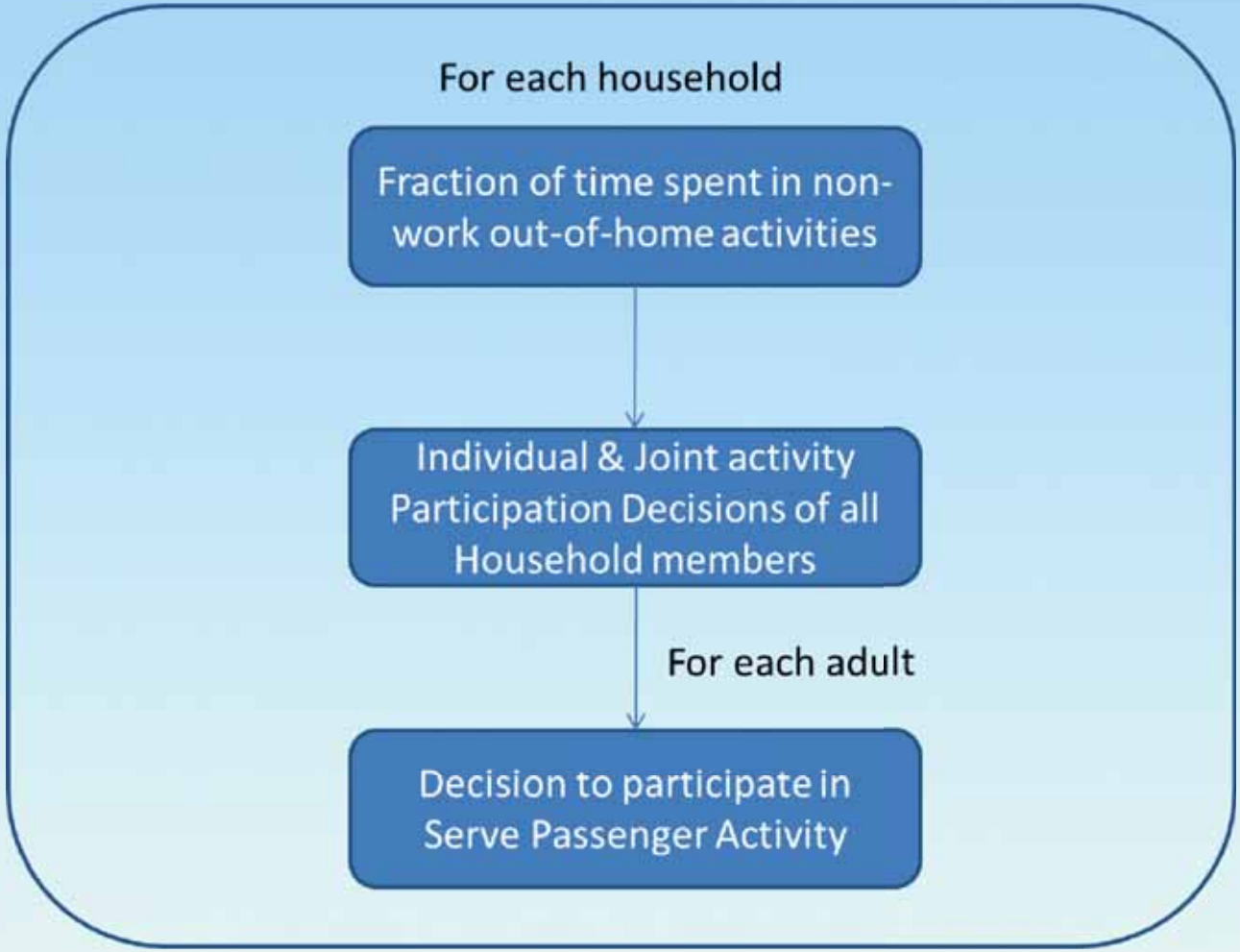


- Work and school activities are the greatest *space-time constraints* for most individuals
- Participation in these activities significantly influences an individual's participation in all other activities during the day

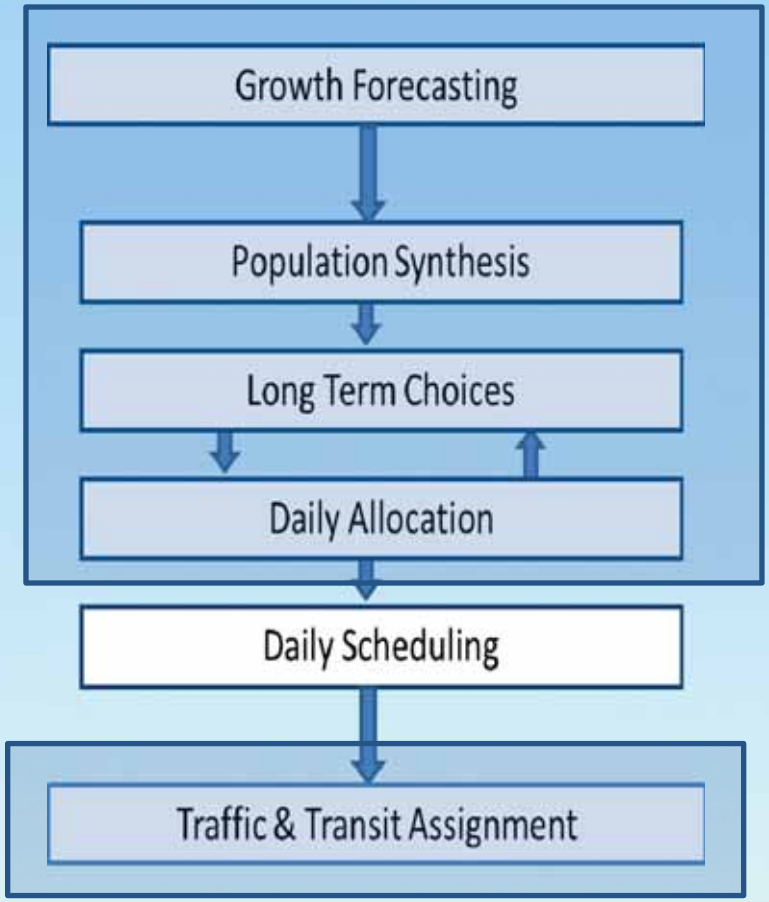
GA Module: Children's Travel Needs & Allocation of Escort Responsibilities



GA Module: Generation of Independent Activities for Personal and Household Needs



Activity & Travel Scheduling



- **Three level structure**
  - **Pattern-level model system**
    sequence of tours undertaken during the day
  - **Tour-level model system**
    chains of stops with home and/or work as anchor point (duration, number of stops, time of day)
  - **Stop-level model system**
    Out of home activity episodes that individual or household participate in (activity, duration(s), travel time, location)

Worker Scheduling Model System

Model ID	Model Name	Econometric Structure	Choice Alternative
WSCH1	Commute mode	MNL	Solo driver, Driver with passenger,
WSCH2	Number of before-work tours	Ordered probit	0 or 1
WSCH3	Number of work-based tours	Ordered probit	0, 1 or 2
WSCH4	Number of after-work tours	Ordered probit	0, 1 or 2
WSCH5	Before-work tour mode	MNL	Solo driver, Driver with passenger,
WSCH6	Work-based tour mode	MNL	Solo driver, Driver with passenger,
WSCH7	After-work tour mode	MNL	Solo driver, Driver with passenger,
WSCH8	Number of stops in a tour	Ordered probit	1,2,3,4, or 5
WSCH9	Home or work stay duration before the tour	Regression	Continuous time
WSCH10	Activity type at a stop	MNL	10 Activity purposes
WSCH11	Activity duration at stop	Regression	Continuous time
WSCH12	Travel time to a stop	Regression	Continuous time
WSCH13	Location of a stop	Spatial Location Choice	Choice alternatives based on estimated travel time

Non-Worker Scheduling Model System

Model ID	Model Name	Econometric Structure	Choice Alternatives
NWSCH1	Number of independent tours	Ordered probit	1, 2, 3, or 4
NWSCH2	Decision to undertake an independent tour before the pick-up or joint discretionary tour	Binary logit	Yes, No
NWSCH3	Decision to undertake an independent tour after the pick-up or joint discretionary tour	Binary logit	Yes, No
NWSCH4	Tour mode	MNL	Solo driver, Driver with passenger, Passenger, and Walk/bike
NWSCH5	Number of stops in a tour	Ordered probit	1, 2, 3 4, or 5
NWSCH6	Number of stops following a pick-up/drop-off stop in a tour	Ordered probit	0 or 1
NWSCH7	Home stay duration before a tour	Regression	Continuous time
NWSCH8	Activity type at stop	MNL	10 Activity purposes
NWSCH9	Activity duration at stop	Regression	Continuous time
NWSCH10	Travel time to stop	Regression	Continuous time
NWSCH11	Stop location	Spatial Location Choice	Choice alternatives based on estimated travel time

Children Scheduling Model System

Model ID	Model Name	Econometric Structure	Choice Alternatives
CSCH1	School to home commute time	Regression	Continuous time
CSCH2	Home to school commute time	Regression	Continuous time
CSCH3	Mode for independent discretionary tour	Binary logit	Drive by other, Walk/bike
CSCH4	Departure time from home for independent discretionary tour (time from 3 a.m.)	Regression	Continuous time
CSCH5	Activity duration at independent discretionary stop	Regression	Continuous time
CSCH6	Travel time to independent discretionary stop	Regression	Continuous time
CSCH7	Location of independent discretionary stop	Spatial Location Choice	Predetermined subset of the 4,109 zones

Joint Discretionary Tour Scheduling Model System

Model ID	Model Name	Econometric Structure	Choice Alternative
JASHCH01	Decision of Joint or Separate Travel	Binary Probit	Yes or No
JASHCH02	Joint Activity Start time	Regression	Continuous
JASHCH03	Joint Activity travel time to stop	Regression	Continuous
JASHCH04	Joint Activity location	Spatial Location Choice	Predetermined subset of the 4,109 zones
JASHCH05	Vehicle Used For Joint Home-Based Tour	MDCEV	Vehicle types based on body type and vintage

- Joint activities of **workers** scheduled in work-to-home commute or After-work period
  - Determined by the Joint Activity Start Time
- For **non-workers** participating in joint activities
  - Decision to undertake independent tour before pick-up or joint tour
  - Decision to undertake independent tour after pick-up or joint tour

CEMDAP Simulation Output

- **CEMDAP** produces *complete activity-travel patterns* for a day for every individual in the population of interest
- There are **nine** output files:
  - Adults: decisions to undertake activities of different types for adults
  - Children: decisions to undertake activities of different types for children
  - Workers: pattern-level attributes of the workers' (including adult students)
  - Students: pattern-level attributes of the child students
  - No-Go: list of people who stayed at-home the whole day
  - Non-workers: pattern-level attributes of non-workers
  - Tours: tour-level attributes
  - Stops: stop-level attributes
  - Activities: activity episode attributes

Initial validation results

CEMDAP

Average Number of Trips Per Household

Type of Trips	SimAGENT	Survey	SimAGENT (85% Work Scenario)
Home Based Work	1.27	1.33	1.68
Home Based Non-work	5.13	4.90	4.94
Non-home based	2.31	2.59	2.69
Total	8.71	8.82	9.30

Distribution of Number of Tours (Workers)

Number of Tours	Before Work		Work Based		After Work	
	Survey	SimAGENT	Survey	SimAGENT	Survey	SimAGENT
0	94.26	96.69	81.03	76.67	79.48	81.36
1	5.74	3.31	16.59	18.01	17.86	17.17
2	--	--	2.38	5.32	2.66	1.47

Distribution of Number of Tours (Non-Workers)

Number of Tours	Survey	SimAGENT
1	58.81	55.51
2	27.53	24.79
3	9.49	12.55
4	4.17	7.15

Average Number of Stops by Tour Type

Average number of stops	Survey	SimAGENT
Work Based tours	1.37	1.36
Before work tours	1.41	1.34
After work tours	1.40	1.36
Work-to-home commute	0.40	0.35
Home-to-work commute	0.26	0.18
Non-worker tour	1.78	1.66

Chaining Propensity

	Survey	SimAGENT
Worker		
Chaining Propensity	0.85	0.86
Non Worker		
Chaining Propensity	0.71	0.76

Tour Mode Shares

	Work-to-home		Work based		Before work		After work		Non-Worker	
	ABM	Survey	ABM	Survey	ABM	Survey	ABM	Survey	ABM	Survey
Drive alone	77.7	78.2	64.2	69.3	56.5	44.0	55.0	56.2	51.9	39.8
Drive as passenger	8.9	9.8	15.9	13.8	26.2	39.1	35.3	31.7	28.8	36.7
Shared ride	8.1	6.6	6.0	6.3	4.0	2.5	3.9	5.1	12.2	14.1
Walk or bike	2.7	2.9	13.7	10.1	12.7	13.9	4.9	6.3	5.7	7.5
Transit	2.6	2.5	0.2	0.5	0.6	0.5	0.9	0.7	1.4	1.9

Stage 2
ABM Development & 2012 Model Validation
for 2016 RTP/SCS

Schedule

March, 2013

Consultants RFP

Feb. 2014

TMIP Webinar Presentation

Dec. 2014

Year 2012 Model Validation Report

June, 2014

Peer Review

Model Estimation and Calibration

- **Model Estimation**
  - Data Based on
    - 2012 Statewide Travel Survey,
    - American Community Survey (ACS),
    - 2010 Census, and
    - Transit and SP Surveys

- **Calibration by December 2013**

Model Validation

- Year 2012 Model Validation, January 2014 – June 2014
- Sensitivity Testing & Analysis
- Additional Data Support
  - Land Use and Growth Forecast
  - Screenline Traffic Counts, Auto and Trucks
  - HOV/HOT/Toll Road Data
  - External Traffic Counts and Forecast
  - Transit LOS
  - Speed Inventory
  - HPMS VMT

Model Implementation

- Modeling System Integration
  - Trucks and Freight
  - Airports and Seaports
  - Interregional Travel
- Software Design and Optimization
- Model Coding and Testing
- Model Peer Review

Thank You

For more information, please contact
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213-236-1834
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SOUTHERN CALIFORNIA
ASSOCIATION of GOVERNMENTS