SCAG ABM
Activity Generation and Allocation

03/23/2016

SCAG Modeling Task Force

Modeling and Forecasting

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SOUTHERN CALIFORNIA ASSOCIATION of GOVERNMENTS

50 YEARS

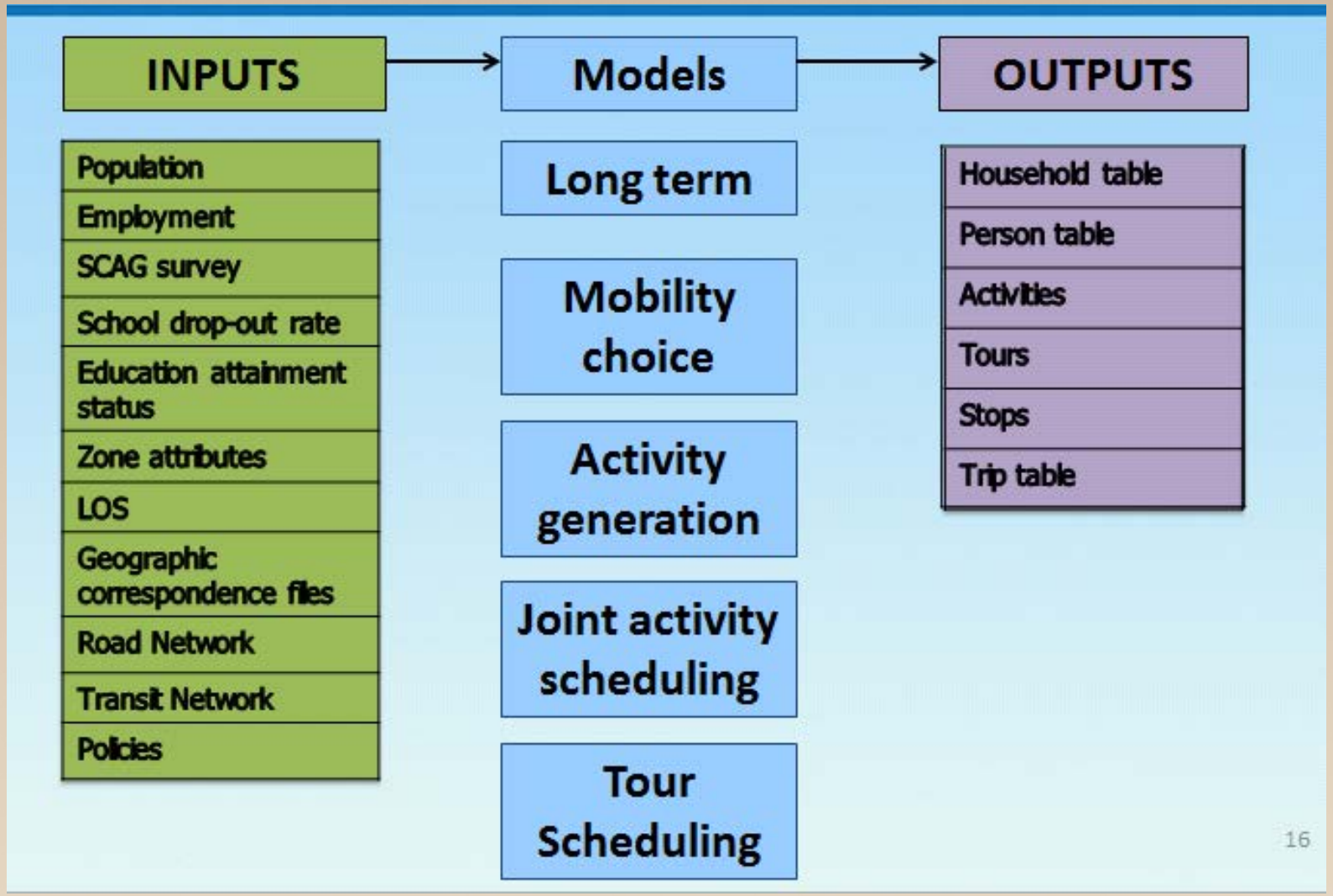
Outline

- Update on Long-term Choice and Mobility Models
- Framework of Activity Generation Module
- Mandatory Activity Generation

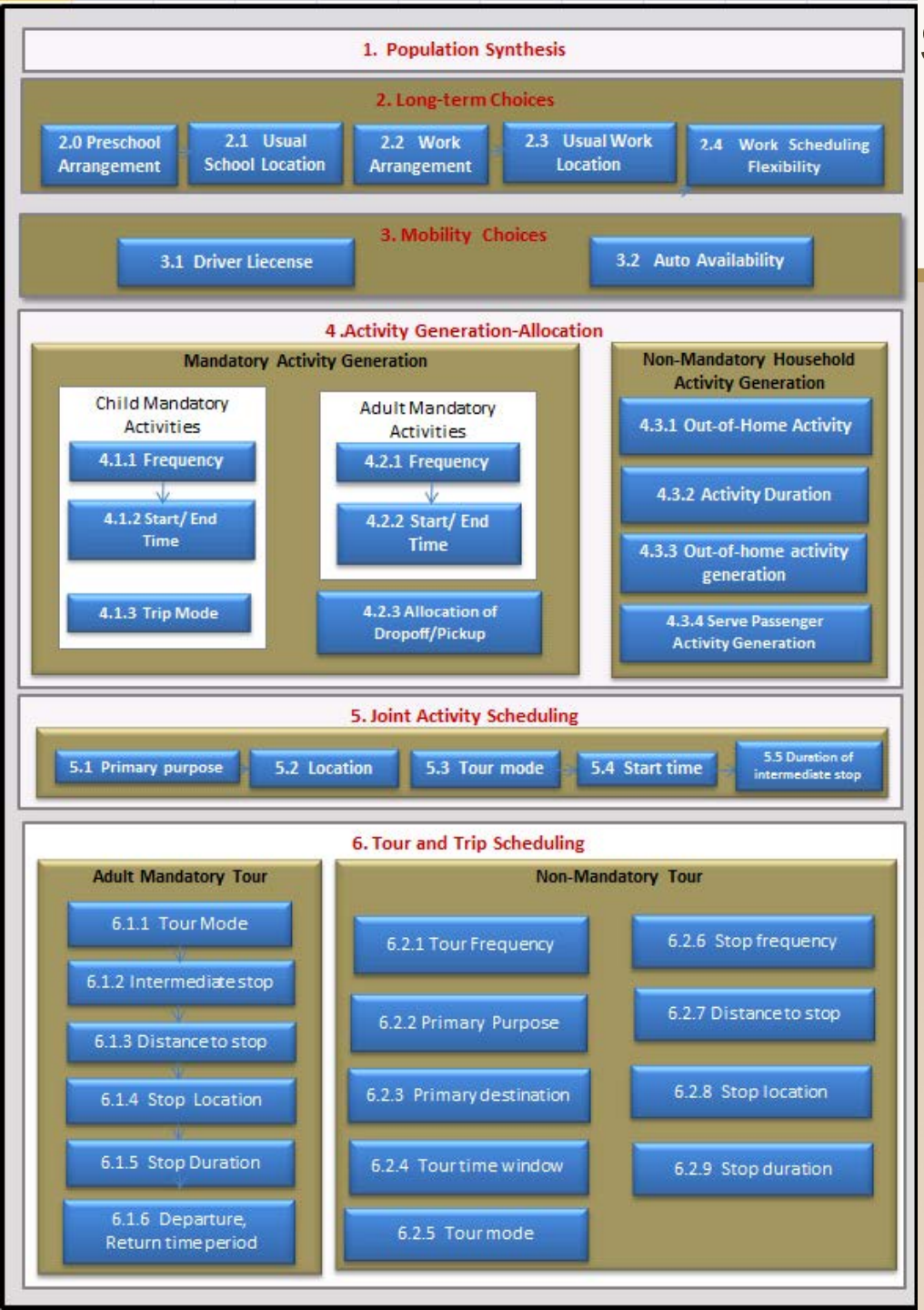
Background

- The activity-based approach views travel as a derived demand to pursue activities.
- Simulates the entire weekday travel pattern of each person in the SCAG region (18+ million):
  - derives travel from activity participation decisions
  - explicitly accounts for within household interactions
  - incorporates spatial and temporal constraints and influences when predicting activity participation and travel
  - operates on a detailed representation of the region's population, land use and transportation networks

Inputs & Output



SCAG Activity Based Model



Market segmentation

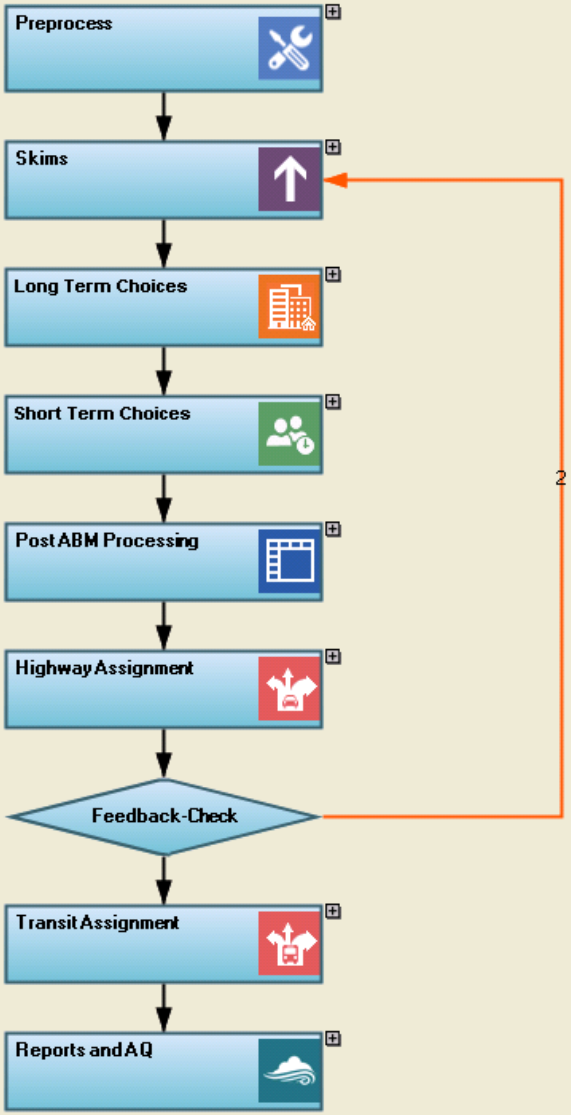
Person type	Name
1	Worker
2	Working college student
3	Non-working college student
4	Working HS student
5	Non-working high school student
6	Adult non-worker
7	Children 6-15 years old
8	Children 0-5
9	Non-school kids 6-15

Segmentation

- Activity types:
  - Work
  - School/College
  - Escort
  - Shopping
  - Maintenance
  - Social
  - Entertainment
  - Visiting family and friend
  - Active recreation
  - Eating out
  - Work related
  - Other

Temporal resolution

- Five time periods used for skimming and assignment
  - ✓ AM Peak (6:00 AM to 9:00 AM)
  - ✓ Midday (9:00 AM to 3:00 PM)
  - ✓ PM Peak (3:00 PM to 7:00 PM)
  - ✓ Evening (7:00 PM to 10:00 PM)
  - ✓ Night (10:00 PM to 6:00 AM)
- 15-minute and 30-minute resolution for scheduling primary activity of a tour, extended to continuous
- Continuous for scheduling all other activities

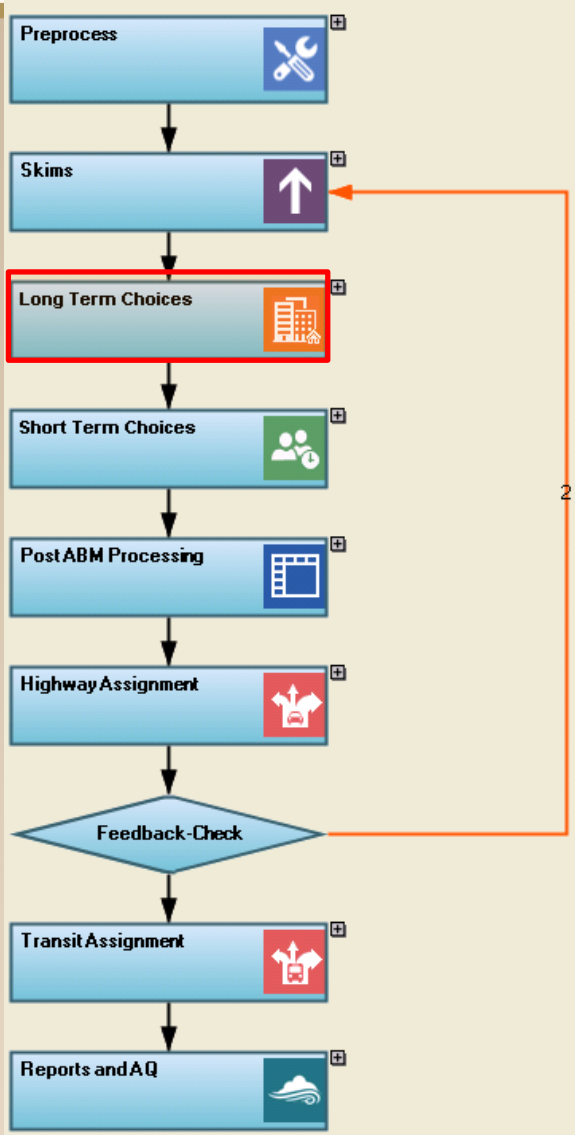


SCAG –ABM User Interface

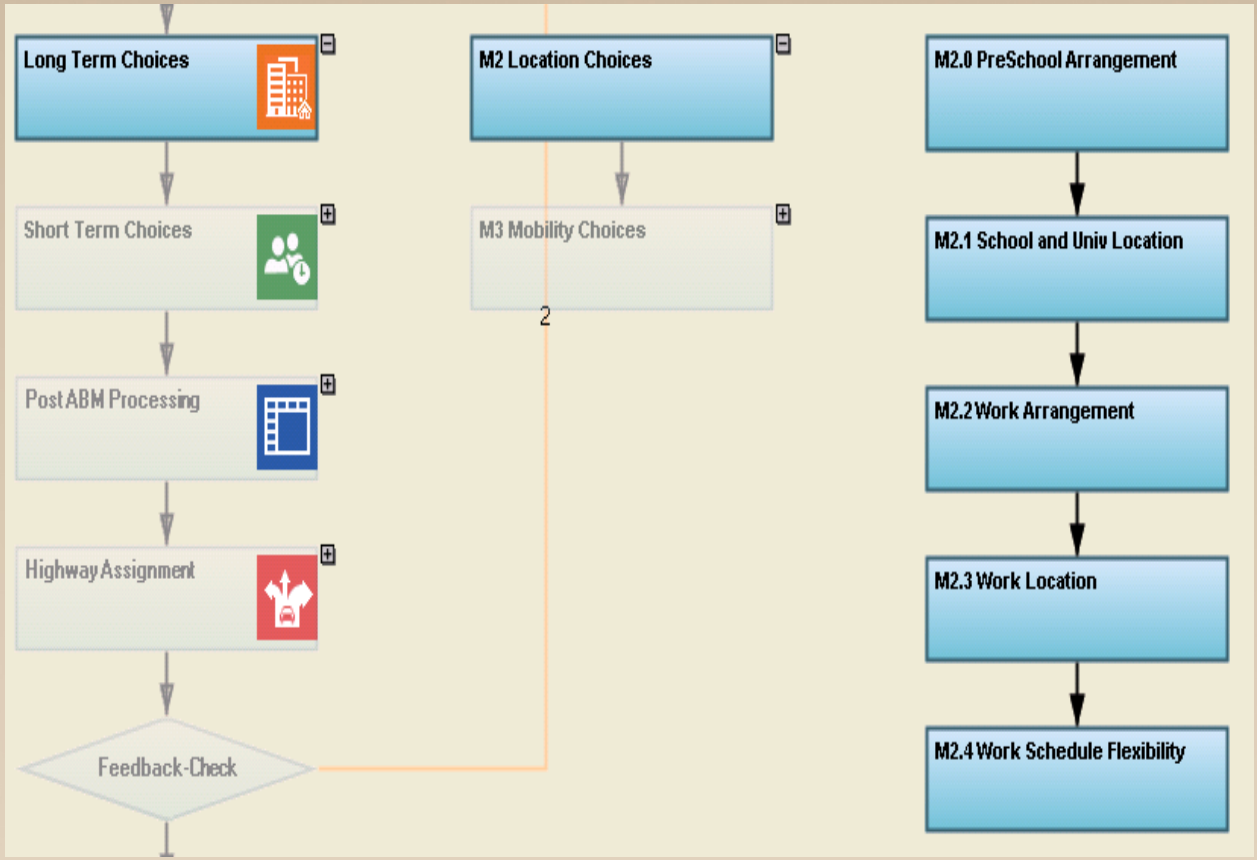
- Built in new TransCAD 7.0

SOUTHERN CALIFORNIA ASSOCIATION of GOVERNMENTS
SCAG Regional Activity-Based Model

Long Term Choice Models



Location Choice



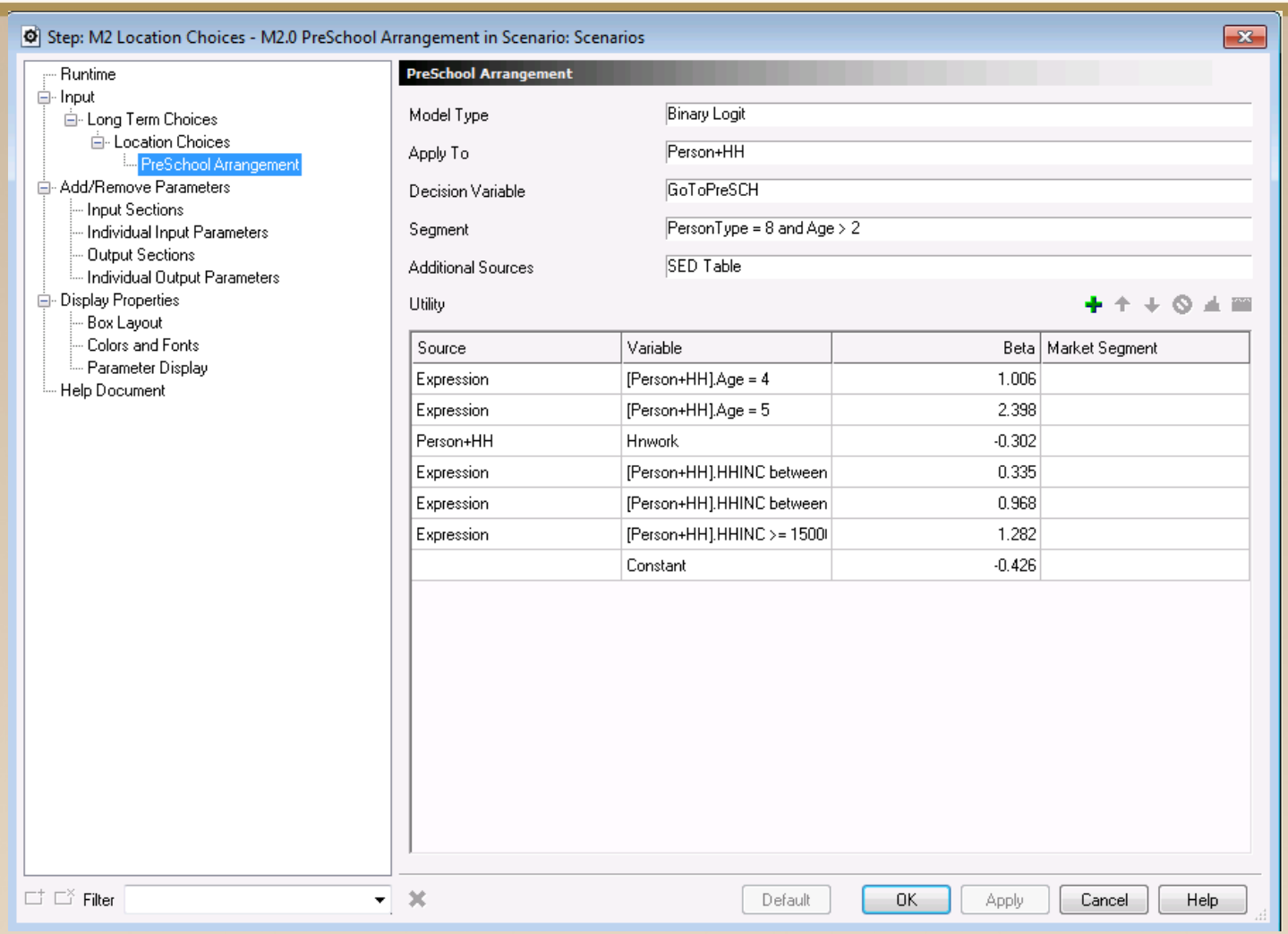
Workers

- 16 years old or older.
- SCAG region has about 7 million workers in 2012; 39% of total population of SCAG region.

Students

- About 5 million, 28% of total population
- Are categorized by 1) Preschool, 2) Grade K-8, 3) Grade 9-12, and 4) College/University

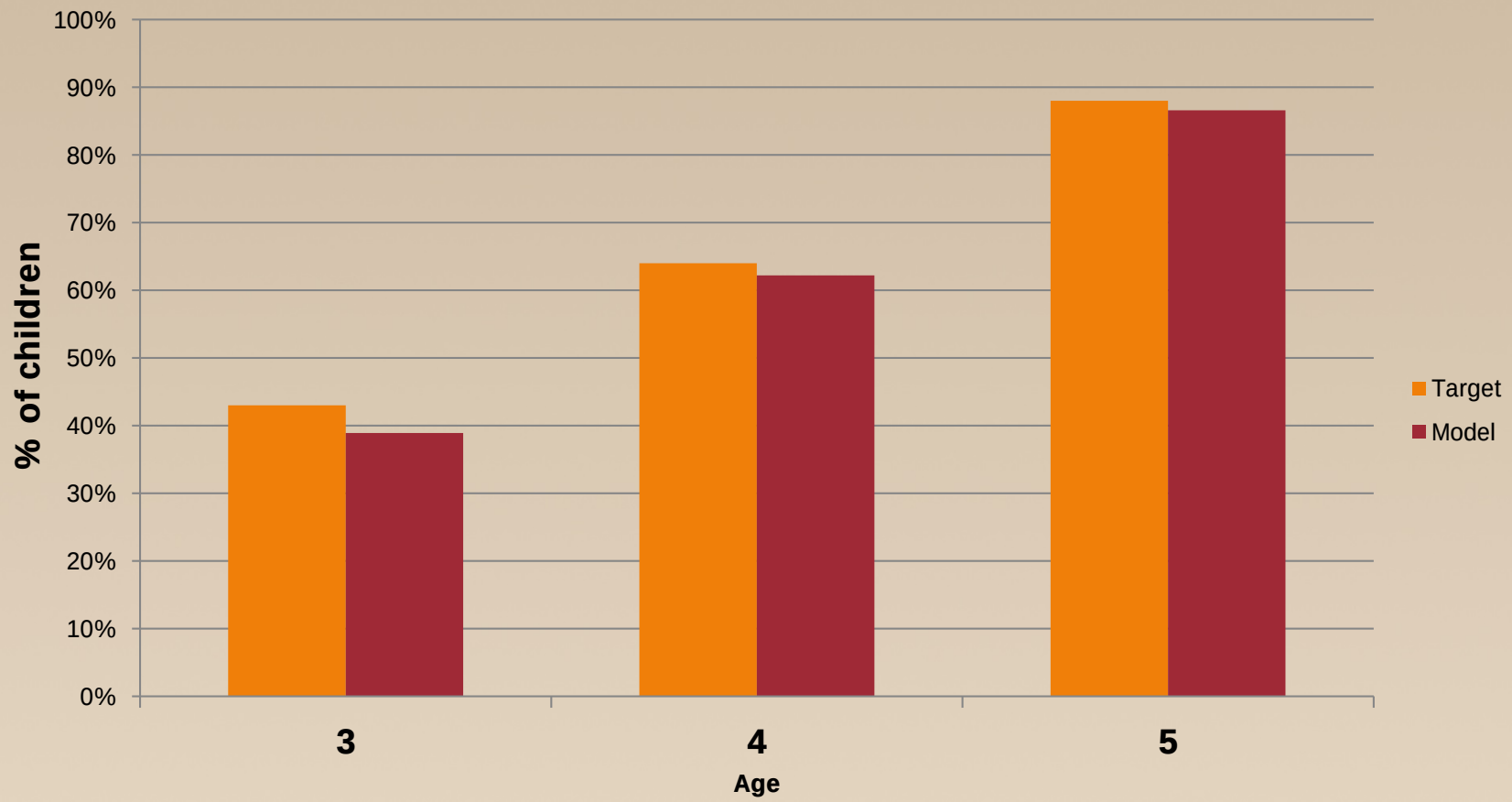
M2.0 Preschool arrangement



Model specification UI

For age < = 2, assumed not go to school

M 2.0 Preschool arrangement



M2.1 Usual School Location

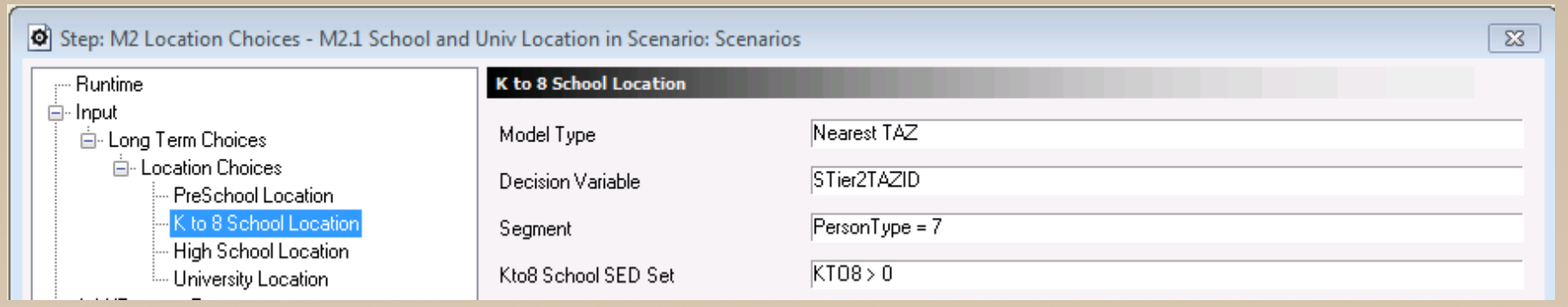
2.1a Preschool Location Model – MNL

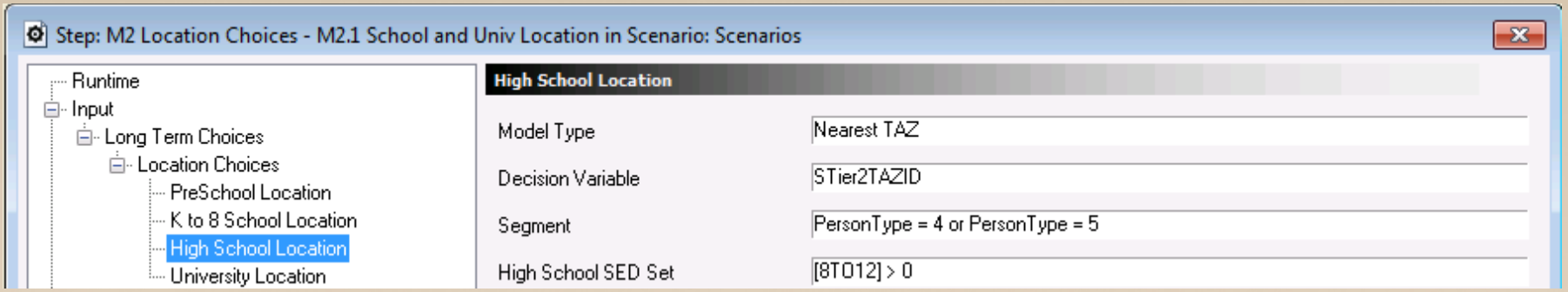
2.1b Usual School Location k-8 Rule based

2.1c Usual School Location 9-12 Rule based

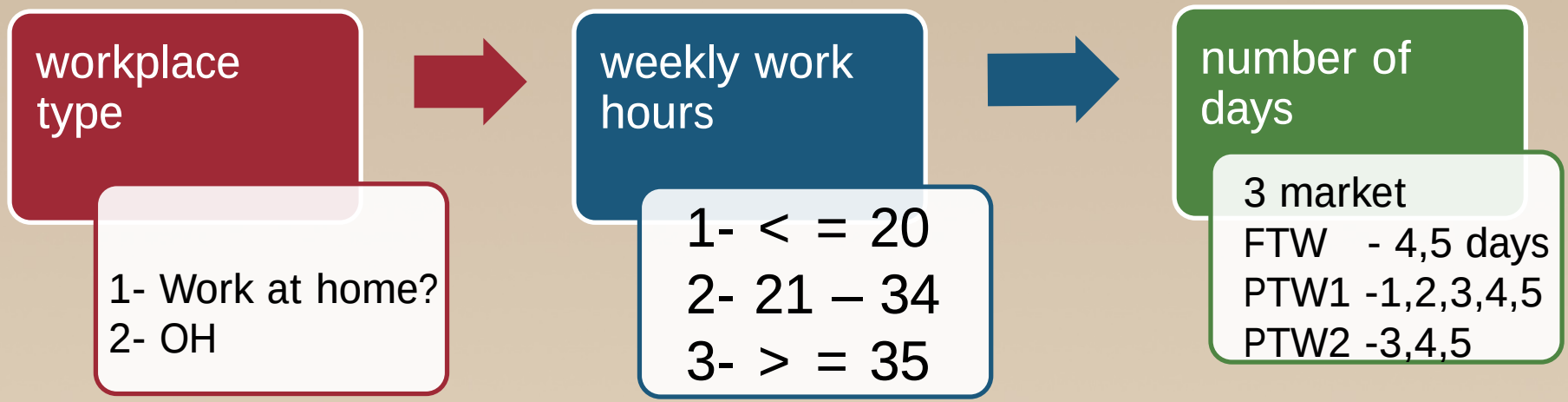
2.1d University Location- MNL

M2.1 Usual School Location: K-12





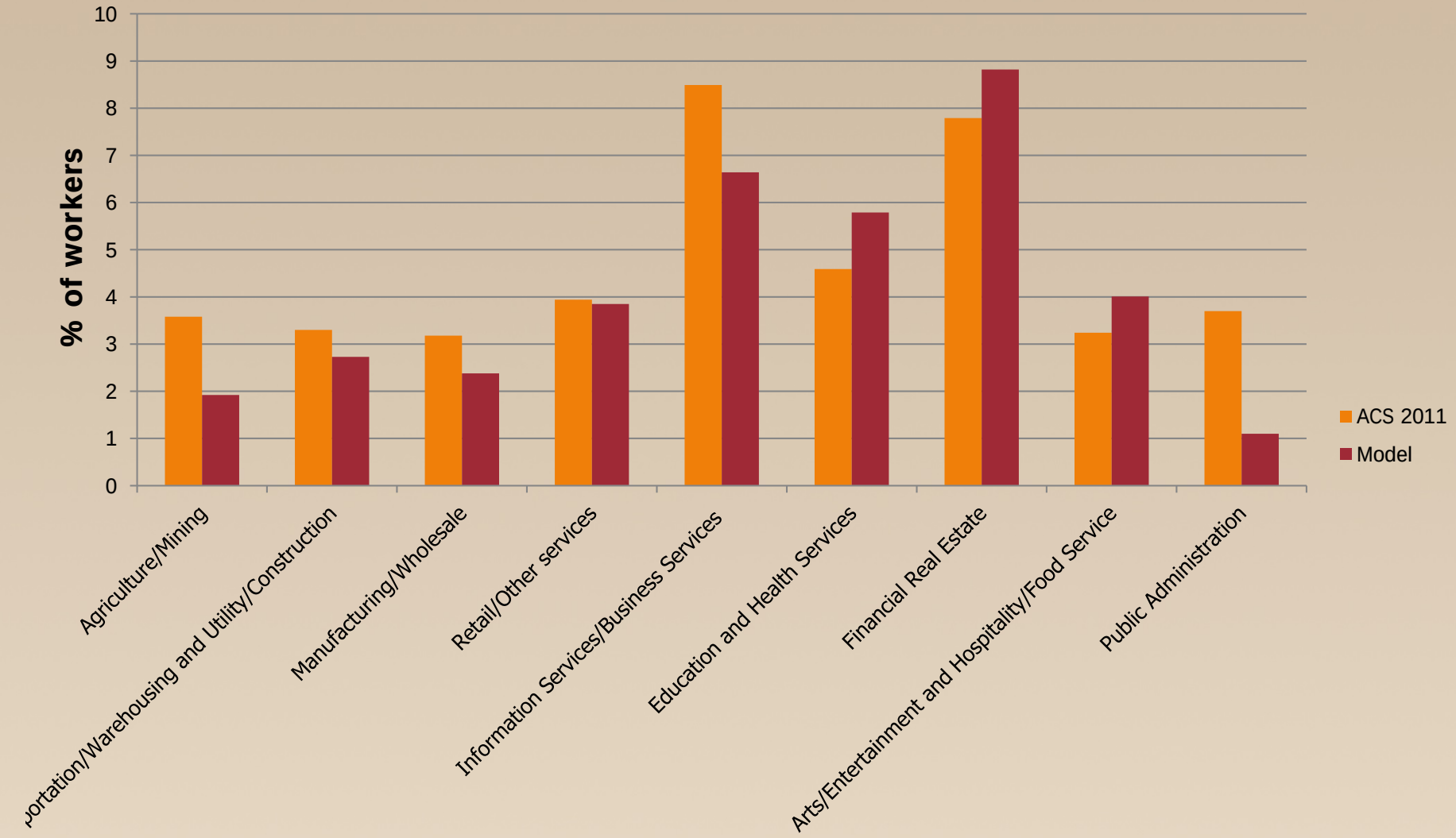
M2.2 Work Arrangement



M2.2.1 Work @ Home

	ACS 2011	Model
Age		
16-24	1.86%	3.67%
25-44	4.03%	4.07%
45-60	5.97%	5.87%
60+	9.39%	8.18%
Total	4.76%	4.97%

M2.2.1 Work @ Home



M2.2.2.1 Work Duration

Work Duration	Survey Analysis		Model Results				
Duration	Survey Freq	Survey Share	Initial ASC	Initial Share	Final ASC	Final Share	Final Count
1-20 hrs	658,413	10.14%	-1.920	13.26%	-2.274	10.36%	667,106
21-34 hrs	449,275	6.92%	-2.391	9.86%	-2.829	7.07%	454,806
35+ hrs	5,383,803	82.94%		76.88%		82.57%	5,315,259
	6,491,491						**6,437,171**

- MNL with 3 alternatives: 0-20hrs, 21-34hrs, 35+ hrs

M2.2.2.2 Work Days

Wdays	HTS	Model
4	6.64	6.6
5	93.36	93.4

Segment 1:
Full time workers
(35 hrs/wk and more)

Wdays	HTS	Model
1	9.98	9.7
2	17.28	16.8
3	24.19	23.6
4	14.37	14
5	34.18	36

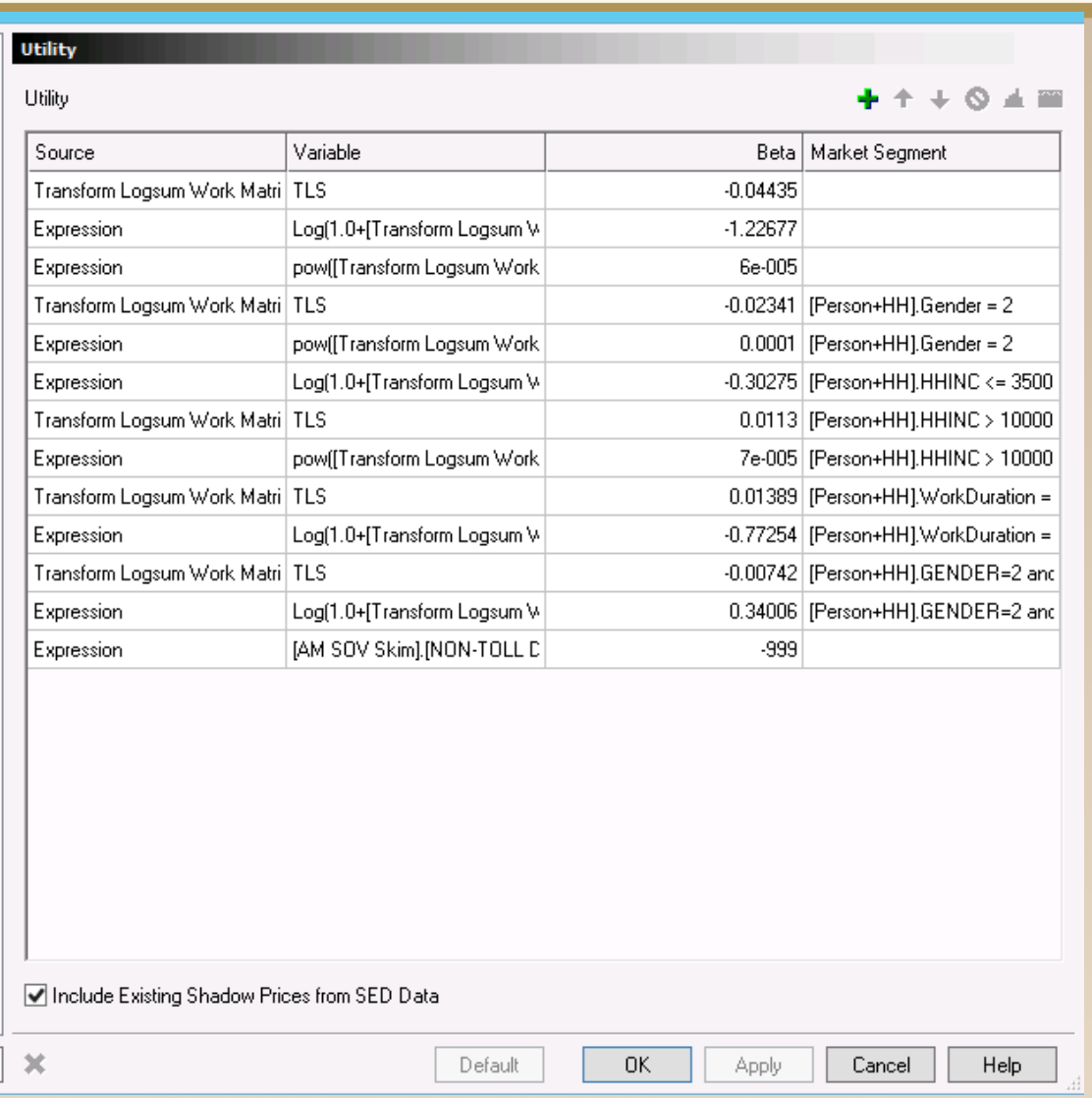
Segment 2:
Part time workers (1-20 hrs/wk)

Wdays	HTS	Model
3	18.01	17.8
4	34.05	33.5
5	47.94	48.7

Segment 3:
Part time workers (21-34 hrs/wk)

MNL on 3 Market Segments based on Work Duration

M.2.3 Work location



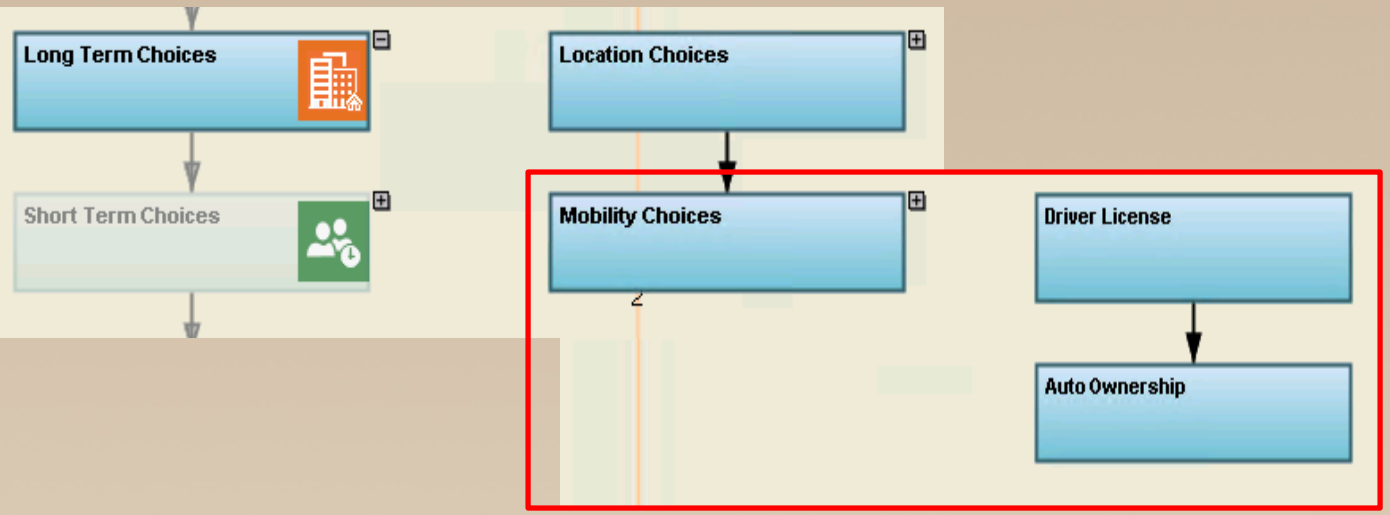
- Updating input files (skim and attraction rate)
- Re-estimate work location

M.2.4 Work Schedule Flexibility

WSCHED	HTS	Model
1	43.69	41.8
2	44.57	46
3	11.75	12.1

MNL with 3 alternatives: None, Moderate and High

Mobility Choice Models



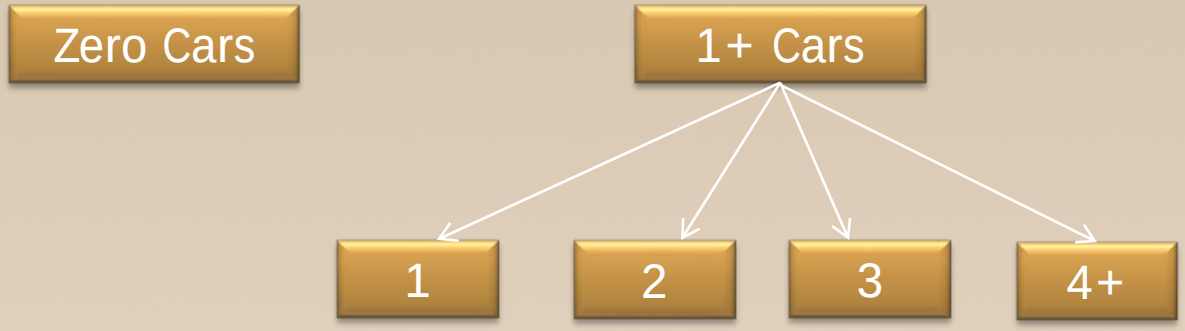
M.3.1 Drive License

Age	Yes	No	Percentage
16-18	708,401	170,602.00	80.6%
19-24	1,347,450	211,434.00	86.4%
25-29	1,116,940	159,182.00	87.5%
30-44	3,282,869	456,032.00	87.8%
45-60	3,371,269	438,643.00	88.5%
60-70	963,316	424,706.00	69.4%
70-80	355,602	452,071.00	44.0%
80+	192,438	289,123.00	40.0%
	11,338,285	2,601,793.00	81.3%

- Driver License
  - For Age >= 16,
  - Survey Share was 83.46%
  - Model Share was 81.0%

M.3.2 Auto Ownership

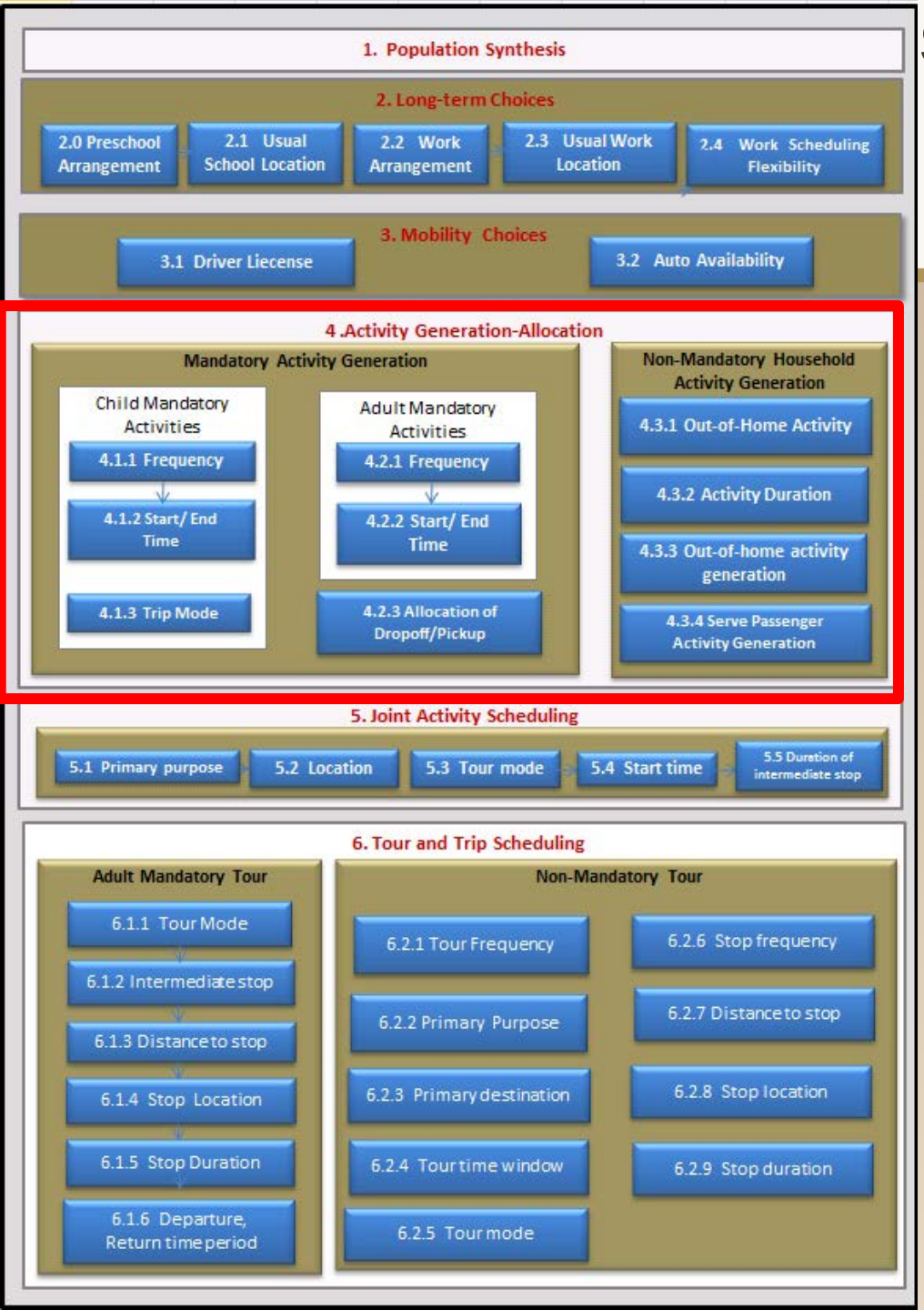
- Predicts number of household vehicles
- Nested Logit
- Households (HHs) with no licensed drivers should automatically be assigned 0 cars.



M.3.2 Auto Ownership

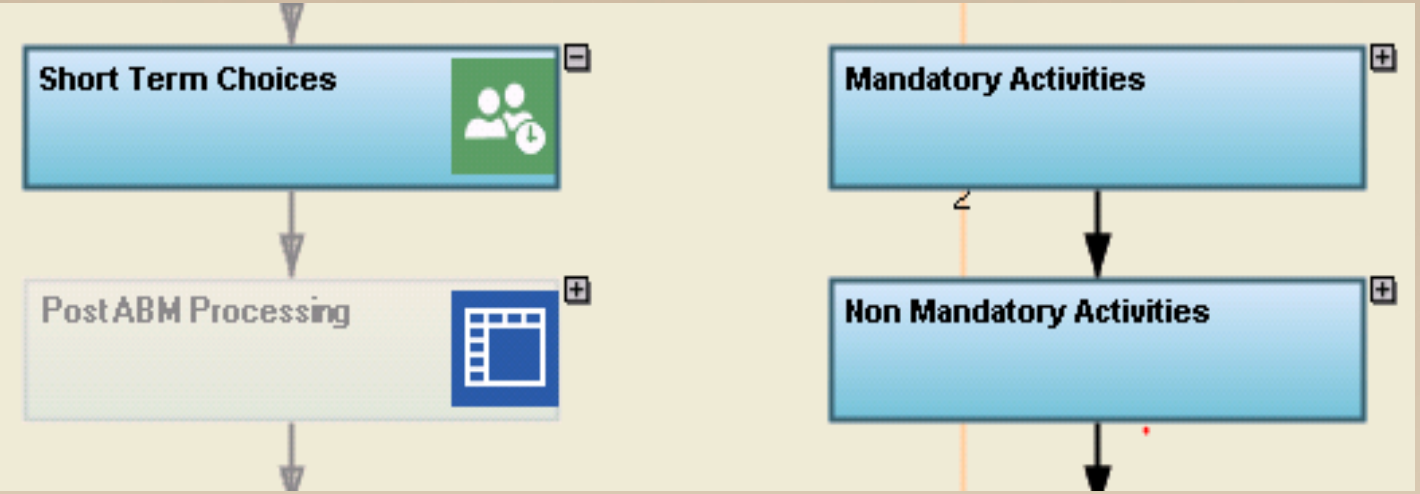
	0Cars	1Car	2Cars	3Cars	4+Cars	Total
ACS	7.65%	32.28%	37.22%	15.03%	7.81%	100.00%
HTS	7.56%	31.86%	38.88%	14.81%	6.89%	100.00%
(HTS) - Households have at least 1 license driver	3.53%	32.90%	40.79%	15.55%	7.23%	100.00%
Model*	**11.8**	**30.8**	**33.2**	**14.9**	**9.2**	**100.00%**

SCAG Activity Based Model



Activity Generation Module

Activity Generation Module



- First step in the prediction of daily activity and travel
- Travel being viewed as a derivative of out-of-home activity participation and scheduling decisions
- Mandatory and non-mandatory activities
- The predictions from these models are used later in the model chain to form mandatory and non-mandatory tours, as well as to predict the frequency and purpose of intermediate travel stops on tours

	Model Number	Model Component	Model Structure
Children	4.1.1	**Child Mandatory Activity Frequency**	Monte Carlo
	4.1.2	**Child Mandatory Activity Start/End Time**	
		a. Start Time	HD
		b. End Time	HD
	4.1.3	**Child School Mode**	
Workers	4.2.1	**Adult Mandatory Activity Frequency**	
		a. Work Activity	BL
		b. School & University Activity	BL
	4.2.2	**Adult Mandatory Activity Start/End Time**	
		a. Work Activity	MNL
		b. College Activity	MNL
	4.2.3	**Allocation of Escort Responsibilities**	Rule based
All	4.3.1	**Out-of-Home Activity Participation**	BL
	4.3.2	**NM activity time**	Regression
	4.3.3	**Out-of-Home Activity Generation**	
		a. Household size =< 5	MDCEV
		b. Household size > 5	MDCEV
	4.3.4	**Serve Passenger Activity Generation**	BL
	4.3.5	**Tour formation**	

- **Market segmentation**

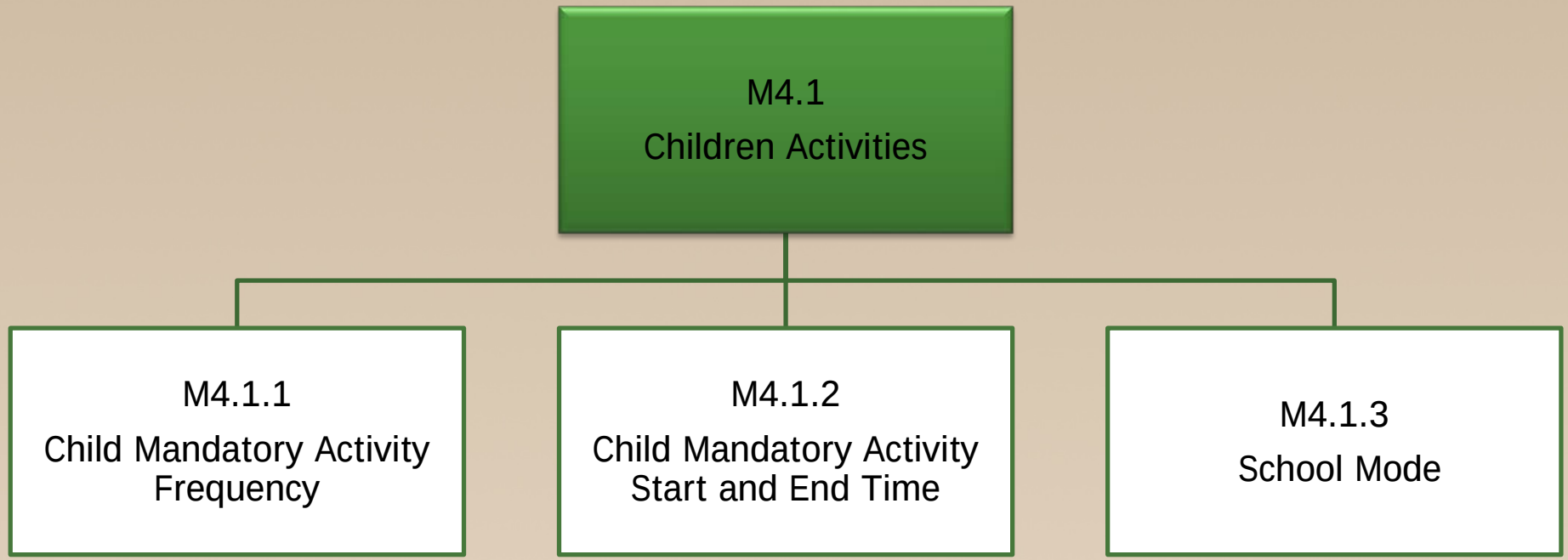
  Model components

  Model Structure

Mandatory Activities

- Crucial in shaping overall daily activity-travel pattern
- Serves a peg around other activities are scheduled
- Key constrain on non-mandatory activity generation
- Predicted before predicting non-mandatory activities

M4.1 Children Activities



M4.1.1 Child Mandatory Activity Frequency

Decision to attend school on a day

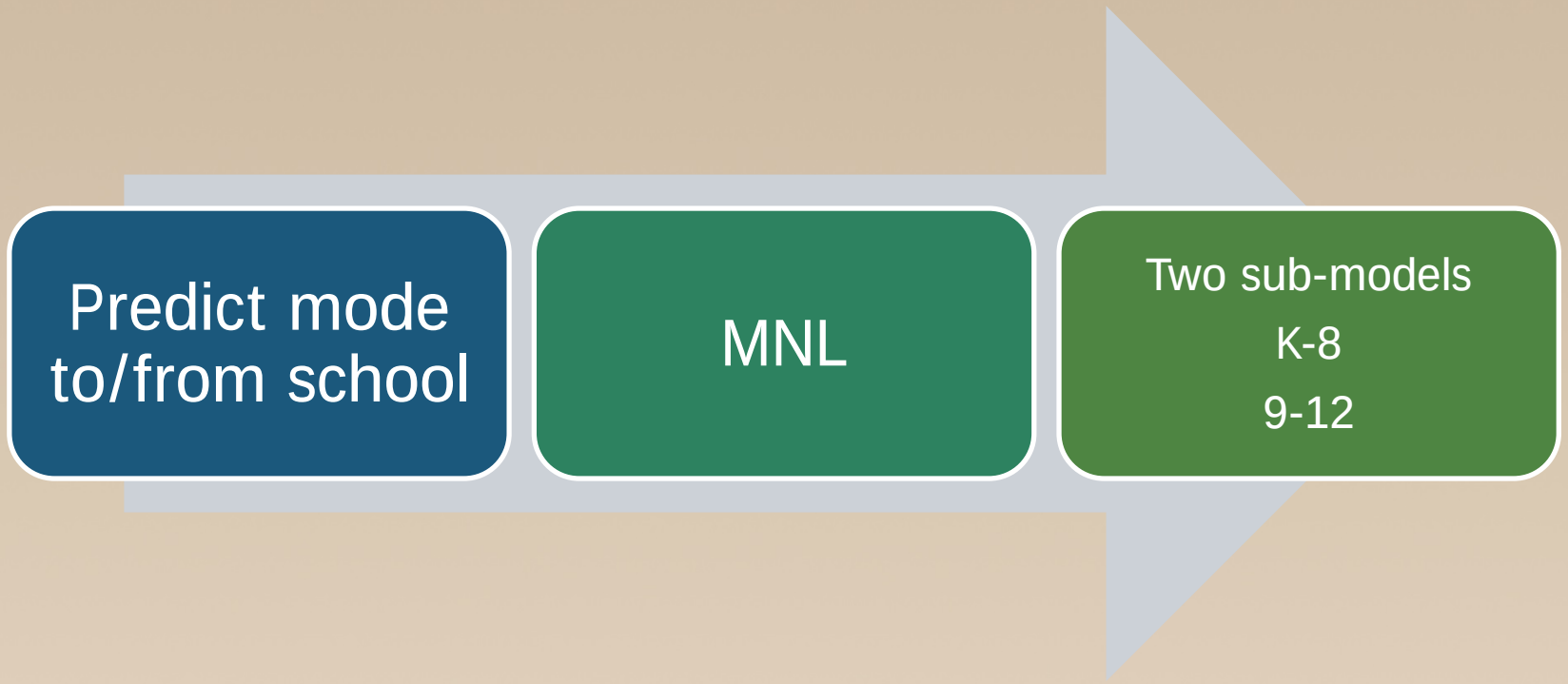
Monte Carlo simulation based on attendance rate of 0.85

All children 3 years and older

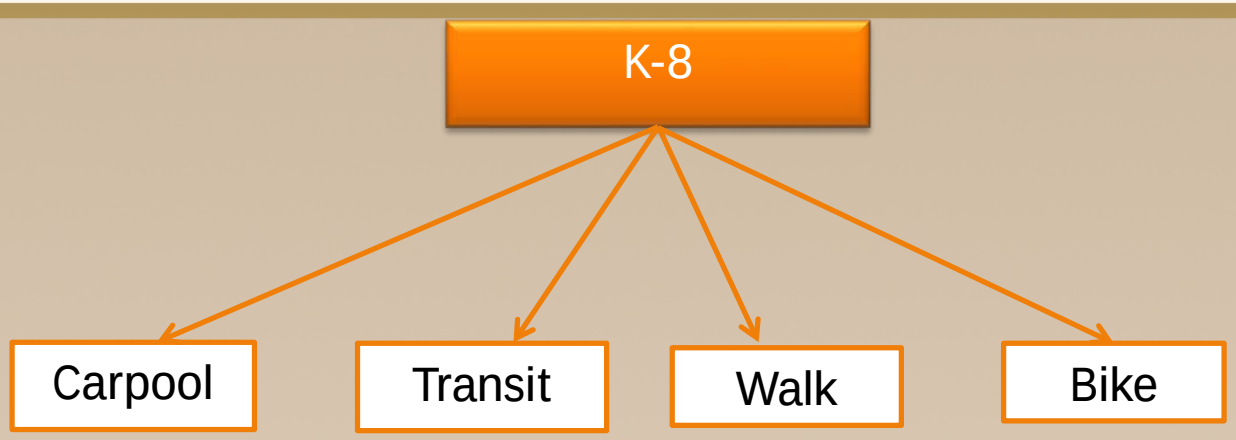
M4.1.2 School Start and End Time

- Predict children school start and end time
- Hazard Duration Models
  - Start time
  - End time
- Duration – calculated
- Choice alternative: Continues time
- Apply to: all children with non-zero activity frequency
- Age, grade level, household income and number of employed adults

M4.1.3 School Mode



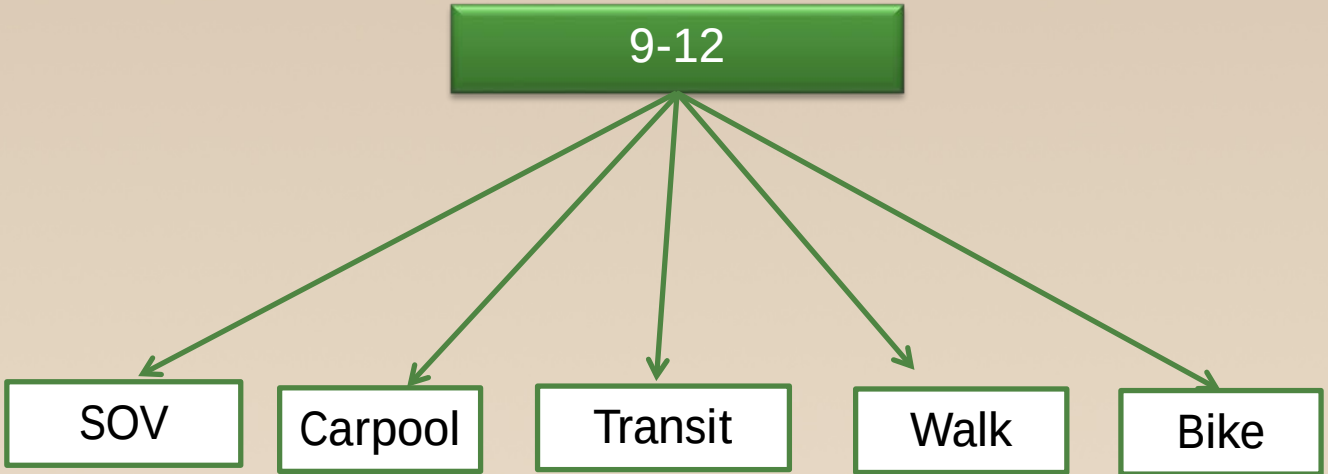
MNL with 4 alternatives



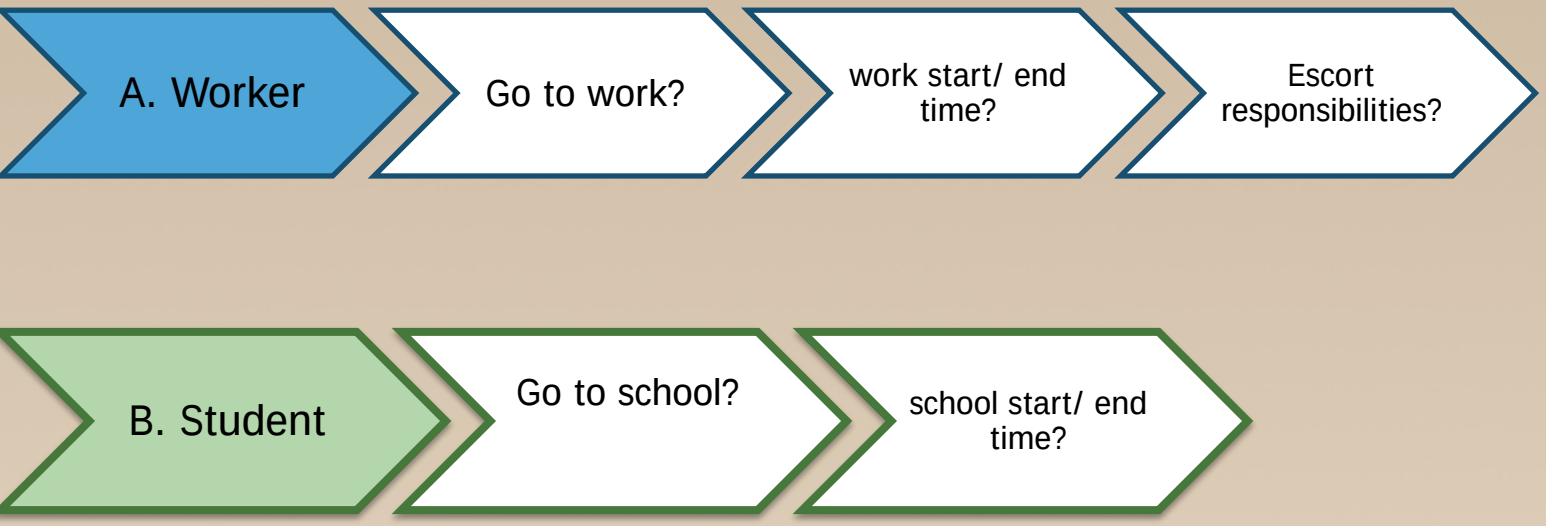
Step 1: Rule based “School Bus”

Step 2: MNL

MNL with 5 alternatives



M4.2 Adult Mandatory Activity



Decision tree

M4.2.1a Go to work

- Monte Carlo based on days of work from M2.2 for each market segment
- **Apply to**: Person.Pertype=1 who work outside of home

M4.2.1a Go to school

- Monte Carlo based on initial attendance rate=0.7
- **Apply to**: 'Individuals with Person.Pertype==2 and 3

M4.2.2a Work Start and End time

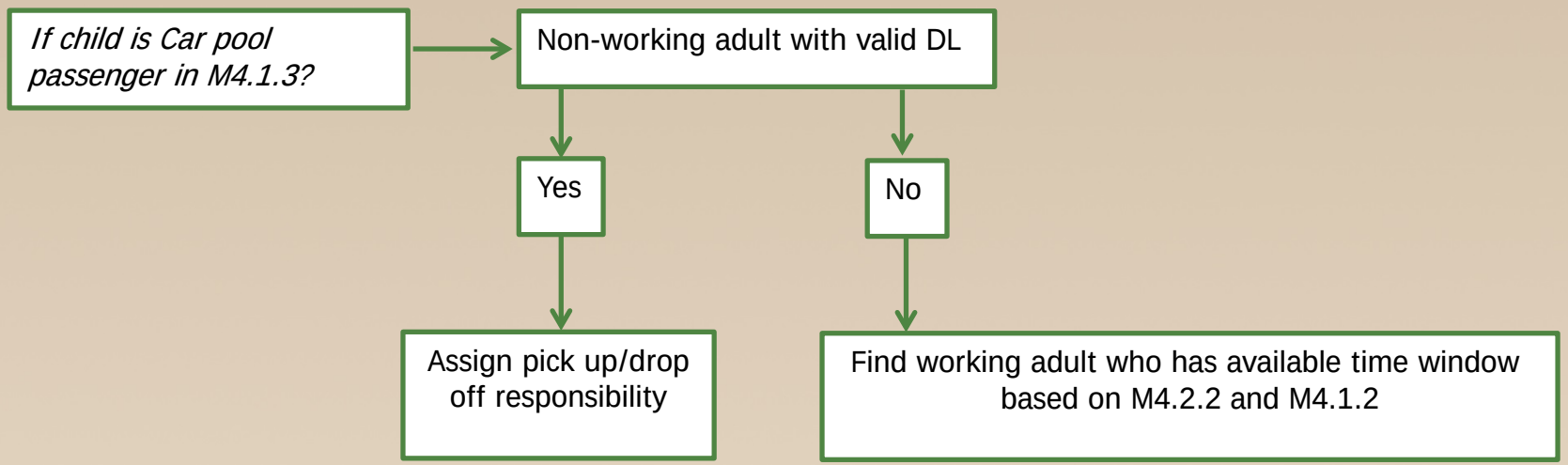
- Predict activity start time and end time at primary work place
- For all workers in a household who go to work on the given day
- Model structure: MNL
- Choice Alternatives: 48 bin (start from 3.00 am)
- Apply to: (Person.Pertype==1) who work outside of home
- Estimation data: SCAG HTS 2012

M4.2.2b College start and end time

- **Model structure**: MNL
- **Choice Alternatives**: 7 alternatives:
  - before 7.30
  - 7.30-8.29
  - 8.30-9.29
  - 9.30-10.29
  - 10.30-11.59
  - 12.00-3.59pm
  - 4pm-
- **Apply to**: All university students (Person.Pertype==2 and 3) who go to schoo
  on the day
- **Reference time**: 7.30-8.29

M.4.2.3 Escort responsibility

- Allocates children drop-off and pick up episodes to parents
- Rule based allocation



Thank You

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