

SBCAG Travel Model Upgrade Project 3rd Model TAC Meeting

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Outline

- **Model TAZs**
- **Highway and Transit Networks**
- **Land Use Database Development and “Greenprint” Data**
- **Trip Generation Models**
 - **Population Synthesis**
 - **Vehicle Availability**
 - **Trip Productions**
 - **Trip Attractions**
 - **Externals**
 - **Visitors**

Outline

- **Trip Distribution**
- **Mode Choice**
- **Time of Day**
- **Assignment**

Model TAZs Development

- **Small edits based on SBCAG and Local feedback**
- **InfoUSA employment points aggregated to TAZ**
 - **Employment-Agricultural, Industrial, Commercial, Office, Service**
- **Census block and block group 2010 data aggregated to TAZ**
 - **Households-Vehicles, Size, Income, Age 18 and under, Age > 65, Workers, Tenure**
 - **Person-Worker, Autos, Age**
- **4Ds values calculated by TAZ and block**

Variable	Description
Jobs_HH_Diversity	$1 - \frac{ABS(b*HH - EMP)}{(b*HH + EMP)}$, where b = regional employment / regional households. HH and Emp are the households and employment within a half mile buffer from the block centroid.
empwalk	The number of employment opportunities within 1.5 mile walking distance (straight line) from the block centroid.
TransitStop_Density	The density of transit stops within a half mile from the block centroid.

Highway Networks

- **Based on Spring, 2010**
- **17,550 links, 12,571 nodes**

Facility Class	Segments	Centerline		Segments in SB	Miles in SB
		Miles			
Freeway	1,008	503	387	185	
Other Principal Arterial	1,604	401	737	113	
Minor Arterial	2,517	961	1,543	284	
Urban Collector	2,867	404	2,048	226	
Rural Collector	965	519	523	302	
Local Road	4,567	711	4,547	691	
Ramp	1,103	180	331	52	
System Ramp	27	10	16	4	
Centroid Connector	2,606	931	2,526	789	
Bikeway	244	24	233	23	
Rail	29	239	9	109	
Transit Walk Link	13	1	5	0	

- **Links based on local links, current 2005 network, aerial photography**
- **Speeds, Capacities based on old model assumptions**
- **Centroid connectors based on local networks, closest 2 connections to midpoint outside of local areas**

Highway Networks

- **Input Attributes:**
 - Facility Type, Area Type, Lanes, Bike Class, Name, SignRoute, Auxiliary Lanes, Geoconstraint
- **Calculated Attributes:**
 - Free flow speed, free flow time, congested time, period capacities, County, Uplan type, walk time, bike time
- **Count Data:**
 - Compiled from SBCAG on 2000 network and transferred to 2010 network
 - Hour-by-hour counts, AADT, AM peak hour, PM peak hour
 - 2005-2010: most valid counts are stored
 - Still collecting count data

Transit Networks

- Based on 2010 paper route maps, local agency web sites
- 208 routes
- AM,PM,Midday Headways
- Route fares
- Includes routes that go into SLO and Ventura (Clean Air Express, Coastal Express, Amtrak, Greyhound, VISTA Express, SLO Regional Transit)

Land Use Data Development

- **Source, organize, and clean land use data**
- **Create raster layers at 50m cell resolution**
- **Three groups of data layers:**
 - Attractions
 - Discouragements
 - Masks
- **Provision of vector layers for use in TransCAD**

Greenprint Data

- **Review and process various Greenprint data layers**
- **Work with SBCAG, UPlan authors, and data providers on appropriate data to model**
 - E.g. Determine true extent of endangered habitats
- **Rasterize all layers for use with UPlan**

Integration with UPlan

- **Create UPlan runs for each of the forecast years**
- **Exploration of running a UPlan land use model forecast year from within TransCAD by calling ArcGIS/UPlan**
- **Exploration of returning an Excel TAZ table from ArcGIS/UPlan to TransCAD for use in the transportation model**
- **Assist SBCAG in setting up and running UPlan**

Population Synthesis

- **Model that creates person and household records with person and household socioeconomics**
- **ACS 2005-2009 PUMS data**
- **TransCAD's population synthesis procedure**
 - **2010 Census Block Layer marginals**
 - Households by Size, tenure, presence of persons aged under 18, presence of persons aged 65+
 - **Block Group Layer with ACS Data marginals**
 - Households by Income Category, Number of Vehicles
- **Result is household and person records which match block and block group marginals**

Population Synthesis

Dataview2 - HHFile_sbcag

HH_ID	Block_ID_2010	HHSIZE	Veh	IncCat	Tenure	R18	R65
1	42691109	6	1	3	3	1	0
2	42691109	5	2	4	3	1	0
3	42691109	4	2	7	3	1	0
4	42691341	2	1	3	3	0	0
5	42691341	2	1	3	3	0	0
6	42691341	2	2	3	3	0	0
7	42691341	2	2	3	3	0	0
8	42691341	2	1	4	3	0	0
9	42691341	2	2	4	3	0	0
10	42691341	2	2	6	3	0	0
11	42691341	2	1	3	4	0	1
12	42691341	2	2	3	3	0	1
13	42721506	5	1	3	3	0	0
14	42721506	4	2	3	3	1	0
15	42721603	1	1	2	3	0	1
16	42721603	1	1	3	4	0	1
17	42730553	1	3	4	1	0	1
18	42730553	2	2	7	1	0	1
19	42730553	2	1	3	3	1	0
20	42730553	4	1	3	3	1	0
21	42730553	5	2	3	3	1	0

Dataview1 - PFile_sbcag

HH_ID	PersonNumber	Age	ClassOfWorker	EmpStatus	SEX	SCH	Educ	Race	JW_Mode	JW_TimetoWork	JW_VehOccupancy
1	1	31	1	1	2	1	5	1	1	40	2
1	2	34	1	1	1	1	5	1	1	40	2
1	3	12	--	--	1	2	3	1	--	--	--
1	4	10	--	--	2	2	2	1	--	--	--
1	5	5	--	--	2	2	2	1	--	--	--
1	6	2	--	--	2	--	--	1	--	--	--
2	1	45	2	1	2	1	15	8	1	80	4
2	2	51	1	1	1	1	16	8	1	80	4
2	3	18	1	1	1	1	9	8	1	60	5
2	4	15	--	--	1	2	6	8	--	--	--
2	5	12	--	--	1	2	3	8	--	--	--
3	1	34	6	1	1	1	13	1	1	20	1
3	2	33	1	1	2	1	13	1	1	10	3
3	3	9	--	--	1	3	2	1	--	--	--
3	4	6	--	--	2	3	1	1	--	--	--
4	1	24	1	1	1	2	11	1	1	25	1
4	2	22	1	6	2	2	11	1	--	--	--
5	1	24	4	1	1	1	11	1	1	15	1
5	2	24	1	2	2	1	9	1	--	--	--
6	1	22	5	4	1	1	11	1	1	15	1
6	2	22	3	1	2	2	11	1	1	60	1



Vehicle Ownership

- Variables Used:

Variable	Description
VehChoice	Choice variable for the estimation 1 - Zero vehicles in HH 2 - One vehicle in HH 3 - Two Vehicles in HH 4 - Three plus vehicles in HH
HH_SizeSegment	The variable used for the market segments 1 - One person HH 2 - Two person HH 3 - Three person HH 4 - Four plus person HH
Tenure_Dummy	1 if HH is owned (as opposed to rented)
LowIncDummy	1 if HH income is below 50K, 0 otherwise
HighIncDummy	1 if HH income is above 100K, 0 otherwise
R18	1 if HH has one or more members 18 or under, 0 otherwise
Age65plus	1 if HH has one or more members over the age of 65, 0 otherwise

- 4Ds Variables (by Census Block)

Variable	Description
Jobs_HH_Diversity	$1 - \frac{[ABS(b*HH - EMP)]}{(b*HH + EMP)}$, where b= regional employment / regional households. HH and Emp are the households and employment within a half mile buffer from the block centroid.
empwalk	The number of employment opportunities within 1.5 mile walking distance (straight line) from the block centroid.
TransitStop_Density	The density of transit stops within a half mile from the block centroid.

Vehicle Ownership

1 Person HH

Logit Model Estimation: Seg1 - out_1perHH.mdl

```
graph TD; ROOT[ROOT] --> 0Veh[0Veh]; ROOT --> 1Veh[1Veh]; ROOT --> 2Veh[2Veh]; ROOT --> 3pVeh[3pVeh];
```

Logit Model Estimation - out_1perHH.mdl

Model Management

Model Name: 1Person_HH

Segment: Seg1

Sources Utilities Estimate

Field	Coefficient	Fix	0Veh	1Veh	2Veh	3pVeh
Availability	-					
Beta_tenure1	-2.571070	<input type="checkbox"/>	<input checked="" type="checkbox"/> Data1.Tenure_Dummy	<input checked="" type="checkbox"/> Data1.Tenure_Dummy		
Beta_tenure2	-1.219600	<input type="checkbox"/>		<input checked="" type="checkbox"/> Data1.Tenure_Dummy	<input checked="" type="checkbox"/> Data1.Tenure_Dummy	
Beta_tenure3	-0.486354	<input type="checkbox"/>			<input checked="" type="checkbox"/> Data1.Tenure_Dummy	
Beta_LowInc1	1.831450	<input type="checkbox"/>	<input checked="" type="checkbox"/> Data1.LowIncDummy			
Beta_LowInc2	0.534298	<input type="checkbox"/>		<input checked="" type="checkbox"/> Data1.LowIncDummy		
Beta_HighIncDun	0.642867	<input type="checkbox"/>				<input checked="" type="checkbox"/> Data1.HighIncDummy
Beta_Age65p	1.328550	<input type="checkbox"/>	<input checked="" type="checkbox"/> Data1.Age65plus			
Beta_Jobs_HH1	1.120560	<input type="checkbox"/>	<input checked="" type="checkbox"/> Data1.Jobs_HH_Diversity			
Beta_Jobs_HH2	0.656312	<input type="checkbox"/>		<input checked="" type="checkbox"/> Data1.Jobs_HH_Diversity		
Beta_Jobs_HH3	0.358496	<input type="checkbox"/>			<input checked="" type="checkbox"/> Data1.Jobs_HH_Diversity	
Beta_empwalk1	0.000035	<input type="checkbox"/>	<input checked="" type="checkbox"/> Data1.empwalk			
Beta_empwalk2	0.000017	<input type="checkbox"/>		<input checked="" type="checkbox"/> Data1.empwalk		
Beta_empwalk3	0.000013	<input type="checkbox"/>			<input checked="" type="checkbox"/> Data1.empwalk	
Beta_TransitStop	0.003294	<input type="checkbox"/>	<input checked="" type="checkbox"/> Data1.TransitStop_Density			
Beta_TransitStop.	0.001965	<input type="checkbox"/>		<input checked="" type="checkbox"/> Data1.TransitStop_Density		

Vehicle Ownership

2 Person HH

Logit Model Estimation: Seg2 - auto_owner_2perHH.mdl

```

    graph TD
      ROOT[ROOT] --> 0Veh[0Veh]
      ROOT --> 1Veh[1Veh]
      ROOT --> 2Veh[2Veh]
      ROOT --> 3pVeh[3pVeh]
  
```

Logit Model Estimation - auto_owner_2perHH.mdl

Model Management

Model Name: 2Person_HH

Segment: Seg2

Sources | Utilities | Estimate

Field	Coefficient	Fix	0Veh	1Veh	2Veh	3pVeh
Availability	-					
Beta_tenure1	-1.426750	<input type="checkbox"/>	Data 1.Tenure_Dummy			
Beta_tenure2	-1.144300	<input type="checkbox"/>		Data 1.Tenure_Dummy		
Beta_LowInc1	1.517520	<input type="checkbox"/>	Data 1.LowIncDummy			
Beta_LowInc2	0.846510	<input type="checkbox"/>		Data 1.LowIncDummy		
Beta_HighIncDun	0.651757	<input type="checkbox"/>				Data 1.HighIncDummy
Beta_Jobs_HH2	0.314246	<input type="checkbox"/>	Data 1.Jobs_HH_Diversity	Data 1.Jobs_HH_Diversity		
Beta_empwalk1	0.000027	<input type="checkbox"/>	Data 1.empwalk			
Beta_empwalk2	0.000007	<input type="checkbox"/>		Data 1.empwalk		
Beta_TransitStop	0.003426	<input type="checkbox"/>	Data 1.TransitStop_Density			
Beta_TransitStop	0.001713	<input type="checkbox"/>		Data 1.TransitStop_Density		
Beta_Under18	-2.450030	<input type="checkbox"/>			Data 1.R18	Data 1.R18
Beta_Over65	-0.714679	<input type="checkbox"/>			Data 1.Age65plus	Data 1.Age65plus



Vehicle Ownership

3 Person HH

Logit Model Estimation: Seg3 - auto_owner_3perHH.mdl

Logit Model Estimation - auto_owner_3perHH.mdl

Model Management

Model Name: 3_personHH

Segment: Seg3

Sources Utilities Estimate

Field	Coefficient	Fix	0Veh	1Veh	2Veh	3pVeh
Availability	-					
Beta_tenure1	-2.112680	<input type="checkbox"/>	Data 1.Tenure_Dummy			
Beta_tenure2	-1.158790	<input type="checkbox"/>		Data 1.Tenure_Dummy		
Beta_LowInc1	1.498860	<input type="checkbox"/>	Data 1.LowIncDummy	Data 1.LowIncDummy		
Beta_HighIncDun	0.644577	<input type="checkbox"/>				Data 1.HighIncDummy
Beta_Jobs_HH2	0.447168	<input type="checkbox"/>	Data 1.Jobs_HH_Diversity	Data 1.Jobs_HH_Diversity		
Beta_empwalk1	0.000035	<input type="checkbox"/>	Data 1.empwalk			
Beta_TransitStop	0.004118	<input type="checkbox"/>	Data 1.TransitStop_Density			
Beta_TransitStop:	0.003817	<input type="checkbox"/>		Data 1.TransitStop_Density		
Beta_Under18	-0.912554	<input type="checkbox"/>			Data 1.R18	Data 1.R18
Beta_Over65	-0.548984	<input type="checkbox"/>			Data 1.Age65plus	Data 1.Age65plus

Vehicle Ownership

4+ Person HH

Logit Model Estimation: Seg4 - out_4perHH.mdl

```
graph TD; ROOT[ROOT] --> 0Veh[0Veh]; ROOT --> 1Veh[1Veh]; ROOT --> 2Veh[2Veh]; ROOT --> 3pVeh[3pVeh];
```

Logit Model Estimation - out_4perHH.mdl

Model Name: 4plus_personHH
Segment: Seg4

Sources Utilities Estimate

Field	Coefficient	Fx	0Veh	1Veh	2Veh	3pVeh
Availability	-					
Beta_tenure1	-2.106640	<input type="checkbox"/>	Data 1.Tenure_Dummy			
Beta_tenure2	-1.751090	<input type="checkbox"/>		Data 1.Tenure_Dummy		
Beta_LowInc1	1.281320	<input type="checkbox"/>	Data 1.LowIncDummy	Data 1.LowIncDummy		
Beta_HighIncDun	0.673788	<input type="checkbox"/>				Data 1.HighIncDummy
Beta_Jobs_HH2	0.667454	<input type="checkbox"/>	Data 1.Jobs_HH_Diversity	Data 1.Jobs_HH_Diversity		
Beta_empwalk1	0.000035	<input type="checkbox"/>	Data 1.empwalk			
Beta_TransitStop	0.002301	<input type="checkbox"/>	Data 1.TransitStop_Density			
Beta_TransitStop:	0.002971	<input type="checkbox"/>		Data 1.TransitStop_Density		
Beta_Under18	-0.771613	<input type="checkbox"/>			Data 1.R18	Data 1.R18
Beta_Over65	-0.617934	<input type="checkbox"/>			Data 1.Age65plus	Data 1.Age65plus

Vehicle Ownership

- **Currently researching an Ordinal Logit model**
 - Choice is made “sequentially”
 - Consider 0 autos, if rejected, consider 1 auto, if rejected, consider 2 autos, etc.
 - Different than considering number of autos at the same time
 - More conducive to car buying logic

Trip Production

- **HBW, HBShop, HBSchool, HBOther, NHBWork, NHBOther**
- **Cross classification population-based trip rate model**
- **Variables used:**
 - **Workers in Household**
 - **Autos/Worker**
 - **HouseHold Size**
 - **Household Income**
 - **Autos/HouseHold**
 - **Worker or Not**
 - **Age**
 - **Kids under 18 in Household**

Trip Production

- Home-Based Work

Num Workers in HH	HHIncome	AutosPerWorker	Rate
1	[0, 25000)	All	1.230
1	[25000, 50000)	All	1.422
1	[50000, 75000)	All	1.452
1	[75000, 100k)	All	1.470
1	[100k, 150k)	All	1.003
1	[150k, inf)	All	1.335
2	[0, 25000)	< 1	1.335
2	[0, 25000)	>= 1	1.352
2	[25000, 50000)	< 1	0.392
2	[25000, 50000)	>= 1	1.733
2	[50000, 75000)	All	1.532
2	[75000, 100k)	All	1.262
2	[100k, 150k)	All	1.066
2	[150k, inf)	All	1.287
3+	[0, 50000)	All	1.085
3+	[50000, 75000)	< 1	1.700
3+	[50000, 75000)	>= 1	1.055
3+	[75000, 100k)	All	1.196
3+	[100k, 150k)	All	1.591
3+	[150k, inf)	All	1.207

Note: HBW Rates only apply to full time and part time workers

Trip Production

- Home-Based Shop

WorkerorNot	HHSize	HHIncome	HHAutos	Rate
0	1	[0, 50000)	0	0.118
0	1	[0, 50000)	1	0.622
0	1	[0, 50000)	2+	0.898
0	1	>= 50K	All	1.184
0	2	[0, 50000)	0 or 1	0.265
0	2	[0, 50000)	2+	0.763
0	2	[50000, 100k)	0 or 1	0.249
0	2	[50000, 100k)	2+	0.518
0	2	[100k, 150k)	All	0.974
0	2	[150k, inf)	All	0.593
0	3+	[0, 50000)	0 or 1	0.238
0	3+	[0, 50000)	2+	0.430
0	3+	[50000, 100k)	0 or 1	0.243
0	3+	[50000, 100k)	2+	0.127
0	3+	[100k, 150k)	All	0.308
0	3+	[150k, inf)	All	0.240
1	1	[0, 50000)	0 or 1	0.347
1	1	[0, 50000)	2+	0.164
1	1	[50000, 100k)	0 or 1	0.309
1	1	[50000, 100k)	2+	0.187
1	1	>= 100k	All	0.718
1	2	[0, 50000)	0 or 1	0.060
1	2	[0, 50000)	2+	0.495
1	2	[50000, 100k)	0 or 1	0.060
1	2	[50000, 100k)	2+	0.393
1	2	[100k, 150k)	All	0.775
1	2	[150k, inf)	All	0.260
1	3+	[0, 50000)	0 or 1	0.165
1	3+	[0, 50000)	2+	0.221
1	3+	[50000, 100k)	0 or 1	0.114
1	3+	[50000, 100k)	2+	0.303
1	3+	[100k, 150k)	All	0.244
1	3+	[150k, inf)	All	0.138

Trip Production

- Home-Based School

Age	Rate
< 3	0
[3-14]	1.125
[14-17]	0.902
[18-24]	0.729
24+	0.031

Trip Production

- Home-Based Other

WorkerorNot	HHSize	HHIncome	HHAutos	Rate
0	1	[0, 50000)	0	1.011
0	1	[0, 50000)	1	1.208
0	1	[0, 50000)	2+	2.163
0	1	>= 50K	All	1.464
0	2	[0, 50000)	0 or 1	1.189
0	2	[0, 50000)	2+	1.375
0	2	[50000, 100k)	0 or 1	1.037
0	2	[50000, 100k)	2+	1.870
0	2	[100k, 150k)	All	2.151
0	2	[150k, inf)	All	1.771
0	3+	[0, 50000)	0 or 1	0.849
0	3+	[0, 50000)	2+	1.801
0	3+	[50000, 100k)	0 or 1	1.280
0	3+	[50000, 100k)	2+	1.965
0	3+	[100k, 150k)	All	2.268
0	3+	[150k, inf)	All	2.033
1	1	[0, 50000)	0 or 1	1.731
1	1	[0, 50000)	2+	0.899
1	1	[50000, 100k)	0 or 1	1.245
1	1	[50000, 100k)	2+	1.033
1	1	>= 100k	All	2.699
1	2	[0, 50000)	0 or 1	0.996
1	2	[0, 50000)	2+	1.125
1	2	[50000, 100k)	0 or 1	1.413
1	2	[50000, 100k)	2+	0.927
1	2	[100k, 150k)	All	1.353
1	2	[150k, inf)	All	0.763
1	3+	[0, 50000)	0 or 1	1.333
1	3+	[0, 50000)	2+	1.282
1	3+	[50000, 100k)	0 or 1	0.328
1	3+	[50000, 100k)	2+	2.020
1	3+	[100k, 150k)	All	2.070
1	3+	[150k, inf)	All	1.582

Trip Production

- **Non-Home-Based Work**

HHSize	HHIncome	Num_Kids_under18	Rate
1	[0, 50000)	All	0.967
1	[50000, 100k)	All	1.260
1	>= 100k	All	1.972
2	[0, 50000)	All	0.658
2	[50000, 100k)	0	1.157
2	[50000, 100k)	1 or 2+	0.875
2	[100k, 150k)	All	0.526
2	[150k, inf)	All	0.757
3+	[0, 50000)	0	0.148
3+	[0, 50000)	1	0.379
3+	[0, 50000)	2+	0.815
3+	[50000, 100k)	0	0.555
3+	[50000, 100k)	1	0.698
3+	[50000, 100k)	2+	1.089
3+	[100k, 150k)	0	0.473
3+	[100k, 150k)	1	1.221
3+	[100k, 150k)	2+	2.036
3+	[150k, inf)	0	1.329
3+	[150k, inf)	1	0.816
3+	[150k, inf)	2+	1.549

Note: NHBW Rates only apply to full time and part time workers

Trip Production

- Non-Home-Based
Other

Age	HHSize	WorkerorNot	Rate
[0, 17]	1	All	0.000
[0, 17]	2	All	0.547
[0, 17]	3+	0	0.698
[0, 17]	3+	1	1.062
[18, 30]	1	All	0.438
[18, 30]	2	0	0.411
[18, 30]	2	1	0.475
[18, 30]	3+	0	0.424
[18, 30]	3+	1	0.191
[31, 40]	1	All	0.777
[31, 40]	2	0	1.498
[31, 40]	2	1	0.520
[31, 40]	3+	0	2.782
[31, 40]	3+	1	0.973
[41, 50]	1	0	2.523
[41, 50]	1	1	0.570
[41, 50]	2	0	0.992
[41, 50]	2	1	0.592
[41, 50]	3+	0	1.854
[41, 50]	3+	1	0.641
[51, 64]	1	0	0.724
[51, 64]	1	1	0.907
[51, 64]	2	0	1.192
[51, 64]	2	1	0.759
[51, 64]	3+	0	1.845
[51, 64]	3+	1	0.559
65+	1	0	0.731
65+	1	1	0.694
65+	2	0	0.667
65+	2	1	0.505
65+	3+	0	0.522
65+	3+	1	0.127

Trip Attraction

- **Local cities-mostly land-use based**
 - Local land uses aggregated into General Plan and Uplan land use categories
 - Land use rates summarized and weighted into rates by Uplan categories
 - Goleta and Santa Maria- Peak Hour Land use rates summarized into daily rates

UPLAN and General Plan Categories

Low Density Residential

High Density Residential

Low Density Commercial

High Density Commercial

Office

Institutional

Industry

Parks and Recreation

Agricultural

Trip Attraction

Land Use	Trip Rate (HBW)	Total Units	Total Trips	Collapsed Land Use	Collapsed Rate
Hospital	4.67	900	4203	Institutional	
Safety (Fire, Police)	1.53	9	13.74	Institutional	
Church	0.17	264	45.47	Institutional	
		1173	4262		3.63 (4264/1173)

- **Outside Local Areas-Same employment based rates as current model**

Trip Attraction

Land Use	Santa Barbara (Average)	Lompoc	Goleta	Santa Maria
Low Density Residential	1.74	0.66	0.86	1.71
High Density Residential	1.15	0.43	0.73	1.20
Low Density Commercial	72.97	40.59	64.91	27.29
High Density Commercial	22.86	12.98	27.35	26.68
Office	9.05	11.50	6.79	13.52
Industry	3.92	0.73	6.85	1.86
Institutional	17.79	7.03	7.06	16.43
Agricultural		0.93	0.92	
Elementary Student	1.68	1.16	1.69	0.57
High School Student	0.63	1.54	1.44	2.60
College	0.24	1.02		1.60
Parks and Open Space	0.60	1.27	2.93	2.34
Airport Planes		3.32		
Jail Inmates		1.79		
UCSB			0.68	
Student Housing			3.55	
Student Housing Off Campus			3.55	
Faculty/Staff			3.76	
Resort Hotel			5.00	
SB Airport			1.65	
La Cumbra Mall			29.90	
Golf			24.09	
Rooms				4.65
SERV_STATION				419.95
Agricultural Employment	1.62			
Commercial Employment	4.12			
Industrial Employment	3.50			
Office Employment	1.74			
Service Employment	3.28			



External Models

- Similar in concept to current models
- IX/XI Productions-Trips generated in SB County

$$\text{TripsSLO} = (0.01 * HH + 0.05 * (\text{ComEmp} + \text{OffEmp} + \text{ServEmp})) * 54.712 * \text{VenTime}^{-0.3197} * e^{-0.0}$$

$$\text{TripsVen} = (0.01 * HH + 0.05 * (\text{ComEmp} + \text{OffEmp} + \text{ServEmp})) * 54.712 * \text{SLOTime}^{-0.3197} * e^{-0.0928}$$

Where

HH = TAZ Households

ComEmp = Commercial Employment

OffEmp = Office Employment

ServEmp = Service Employment

VenTime = Weighted travel time from Ventura County border node to internal TAZ

SLOTime = Weighted travel time from SLO County border node to internal TAZ

External Models

- IX/XI Attractions-Trips generated outside of SB County

San Luis Obispo:

$$(0.66 * HH + 0.36 * Emp) * K * 0.8925 * (TimetoSB)^{-3.3222} * e^{-0.06796 * TimetoSB}$$

Ventura:

$$(0.66 * HH + 0.36 * Emp) * K * 1.0601 * (TimetoSB)^{-5.9882} * e^{-0.09728 * TimetoSB}$$

- Where K is the K-factor correction factor

Visitor Models

- **Source: 2008 Santa Barbara County Visitors Survey**
 - <http://www.santabarbaraca.com/includes/media/docs/Visitor-Survey-and-Economic-Impact.pdf>
- **Model structure similar to current model but key stats (day trippers vs. overnights, where visitors stayed, etc.) were updated**
- **Linear regression models for both productions and attractions based on households, hotels/motels, service employment, commercial employment**

Visitor Productions and Attractions

$\text{Alpha} * \text{Households} + \text{Beta} * \text{Hotels/motels} + \text{Gamma} * \text{Service Employment}$

with the constraints being:

- The total number of visitor trips equals 69,552.
- The term $\text{Gamma} * \text{Service Employment}$ summed over all zones contributes to about 33% of the total trips.
- The term $\text{Alpha} * \text{Households}$ summed over all the zones is approximately 1/1.65 of the term $\text{Beta} * \text{Hotels/Motels}$ summed over all the zones.

$\text{Visitor_P} = 0.138 * \text{Households} + 2.560 * \text{Hotels/Motels} + 0.250 * \text{Service Employment}.$

$\text{Alpha} * \text{Households} + \text{Beta} * \text{Service Employment} + \text{Gamma} * \text{Commercial Employment}$

with the constraints being:

- The total number of visitor trips equals 69,552.
- 14.7% of trips are connected to the household.

$\text{Visitor_A} = 0.075 * \text{Households} + 0.445 * \text{Service Employment} + 0.301 * \text{Commercial Employment}.$

Trip Distribution

- **Currently under development**
- **Destination choice models for HBW, HBShop, HBO**
- **Gravity models for HBSchool, NHBWork, NHBOther, Visitor, External**
- **Introduction of 4Ds variables**
- **Visitor will use friction factors of HBO, similar to current model**
- **External will use similar friction factors to current model but use K factors derived from Census Longitudinal Employment Dynamics (LED) data aggregations**

Mode Choice

- **Currently under development**
- **All model estimation datasets created**
 - 2003 survey datasets, UCSB transit survey, initial highway and transit skims, zonal demographics
 - Addition of 4Ds variables

Time of Day Models

- **Departure and return rates estimated for every hour by trip purpose**
- **Flexible determination of time periods**
- **Candidate time periods:**
 - AM Peak Period (~7-9am)
 - PM Peak Period (~4-6pm)
 - Off Peak Period (~9am-12pm)
 - Lunchtime (12-2pm)
 - Afternoon Shoulder Period (~ 2-4pm)
 - Evening Shoulder Period (~6-9pm)
 - Night Period (~9pm-7am)

Time of Day Models

HOURL	DEP_HBW	RET_HBW	DEP_HBShop	RET_HBShop	DEP_HBSch	RET_HBSch	DEP_HBOth	RET_HBOth	DEP_NHBW	RET_NHBW	DEP_NHBO	RET_NHBO	DEP_IXXI	RET_IXXI	DEP_Visitor	RET_Visitor
0	0.00	0.33	0.00	0.10	0.00	0.00	0.00	0.09	0.11	0.08	0.07	0.00	0.00	0.00	0.07	0.00
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.44	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00
4	0.97	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.09	0.00	0.00	0.19	0.00	0.00	0.00
5	1.91	0.09	0.13	0.00	0.00	0.00	0.56	0.00	0.09	0.37	0.00	1.18	0.00	2.54	1.18	1.18
6	6.68	0.00	0.61	0.00	0.94	0.00	1.74	0.26	0.37	1.96	1.18	3.12	2.54	4.27	1.18	3.12
7	15.44	0.00	0.60	0.16	25.07	0.00	6.59	1.20	1.96	3.45	3.12	4.27	4.27	0.70	3.12	4.27
8	11.17	0.53	1.53	0.38	18.22	0.12	6.98	2.89	3.45	2.52	4.27	2.12	0.70	4.74	4.27	2.12
9	3.65	0.53	2.88	3.61	3.03	0.00	3.14	1.37	2.52	3.50	2.12	2.63	4.74	4.79	2.12	2.63
10	1.35	0.63	5.13	3.72	1.59	0.00	2.55	2.05	3.50	4.15	2.63	4.76	4.79	2.98	2.63	4.76
11	1.03	0.83	5.63	8.87	0.18	1.35	2.36	2.08	4.15	4.27	4.76	6.43	2.98	3.54	4.76	6.43
12	3.00	3.33	2.54	6.58	0.37	0.71	1.88	2.57	4.27	3.28	6.43	5.72	3.54	2.70	6.43	5.72
13	2.85	1.33	1.67	2.75	0.82	2.66	1.96	2.03	3.28	5.70	5.72	5.18	2.70	2.24	5.72	5.18
14	1.17	1.41	4.90	2.36	0.10	13.95	4.14	3.95	5.70	6.23	5.18	4.61	2.24	4.94	5.18	4.61
15	0.90	4.53	1.78	4.64	0.14	15.12	3.01	4.57	6.23	4.51	4.61	4.10	4.94	5.59	4.61	4.10
16	0.57	7.43	3.24	8.71	0.21	4.26	4.88	4.53	4.51	4.04	4.10	3.38	5.59	3.69	4.10	3.38
17	0.68	13.76	1.72	5.90	1.96	3.11	3.29	6.59	4.04	2.47	3.38	1.67	3.69	4.61	3.38	1.67
18	0.24	5.53	2.96	5.56	1.28	0.92	4.59	4.08	2.47	1.85	1.67	0.32	4.61	1.42	1.67	0.32
19	0.26	2.32	1.38	3.79	0.25	0.73	2.19	2.71	1.85	0.94	0.32	0.18	1.42	0.56	0.32	0.18
20	0.48	1.27	1.36	3.32	0.14	0.90	0.54	3.78	0.94	0.21	0.18	0.00	0.56	0.24	0.18	0.00
21	0.06	1.73	0.29	0.42	0.00	1.72	0.17	2.71	0.21	0.12	0.00	0.26	0.24	0.27	0.00	0.26
22	0.00	0.87	0.00	0.37	0.00	0.14	0.26	1.07	0.12	0.15	0.26	0.00	0.27	0.00	0.26	0.00
23	0.07	0.49	0.21	0.20	0.00	0.00	0.00	0.52	0.15	0.11	0.00	0.07	0.00	0.00	0.00	0.07



Trip Assignment

- **Highway Assignment**
 - Bi-Conjugate User Equilibrium
 - Investigation of introducing node delays
- **Transit Assignment**
 - Pathfinder, similar to current model
- **Bike Assignment**
- **Walk Assignment**

Questions?

