Trip Generation Models

Overview

This chapter details the findings of the trip generation analysis and how trips generated differed between the existing and alternative scenarios. We used NHTS data to estimate three regression models that were then used to predict the number of home-based work trips, home-based other trips, and non-home-based trips per household in the San Jose MSA. These models estimate all person trips, including both motorized and non-motorized trips.

For the three trip types, the explanatory variables that had a statistically significant effect at the 95 percent confidence level on the number of trip productions included household size and ratio of workers who worked from home. Zero-vehicle households and household income were initially included but were not found to be statistically significant and did not substantially change the R2 value so were ultimately excluded.

Home-Based Other Trips

Home-based other (HBO) trips refer to trips that either originate at home to go to a location other than a person's place of work, or end at home coming from a location other than a person's place of work. The regression model used to estimate the trips produced in each zone in the San Jose MSA is included below as Fig. 1. The regression model suggests that the larger the household, the more average daily HBO trips are made, holding all else equal. Households with one person make almost six fewer HBO trips on average than households with four or more people. Additionally, the model suggests that the average household in zones with a high WFH ratio will make almost one additional HBO trip per day than zones with a low WFH ratio. This finding seems logical because individuals need to run errands and perform

other various activities that other people who do not work from home may perform with a trip originating at the office, for example stopping at the grocery store on the way home from work.

**Figure 1 - Regression Model for HBO Trips.**

	Full model		Reduced model	
(Intercept)	8.01 ***	(p = 0.00)	7.67 ***	(p = 0.00)
zero_veh_TRUE	-0.83	(p = 0.13)		
size_one	-5.67 ***	(p = 0.00)	-5.84 ***	(p = 0.00)
size_three	-2.33 ***	(p = 0.00)	-2.44 ***	(p = 0.00)
size_two	-4.45 ***	(p = 0.00)	-4.49 ***	(p = 0.00)
inc_quint_2nd	-0.17	(p = 0.85)		
inc_quint_3rd	-1.01	(p = 0.16)		
inc_quint_4th	-1.06	(p = 0.13)		
inc_quint_5th	0.13	(p = 0.83)		
wfh_int_high	0.60	(p = 0.13)	0.89 *	(p = 0.02)
wfh_int_mid	-0.46	(p = 0.45)	-0.23	(p = 0.69)
N	906		939	
R2	0.27		0.25	

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

After applying the regression model to the analogous household-level variables in each of the zones, we estimated the HBO trip productions and subsequently the HBO trip attractions for each zone in the San Jose MSA. Estimating the trip attractions also required balancing them so the regional total of attractions matched the total number of trip productions estimated by the regression model. The zones with the highest amount of productions and attractions are, as would be expected, in line with the zones with the highest populations. Figure 2 below shows the HBO trip productions and attractions in each zone for the existing conditions, where each dot represents 3,000 trip productions and attractions, respectively.

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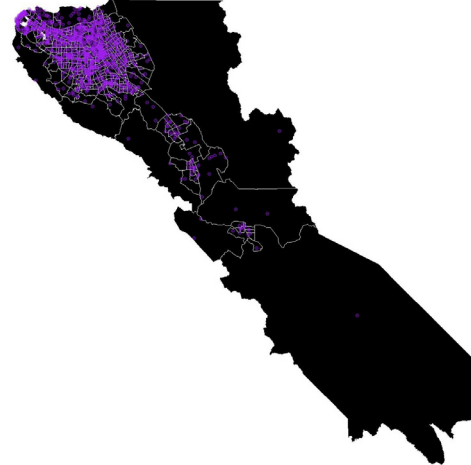
Existing HBO Production
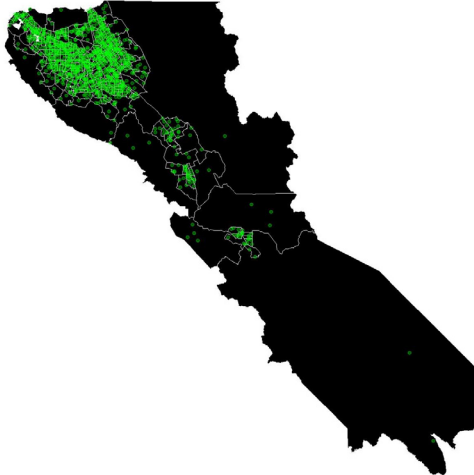
Existing HBO Attraction

Figure 2 - HBO Trip Productions and Attractions.

The HBO productions and attractions by zone are in line with expectations, but more interesting is the potential change in attractions and productions from the existing scenario to the alternative scenario. Figure 3 below shows the percent change by zone for HBO trips. All of the zones increased their WFH ratio in the alternative scenario, so naturally all of the HBO trips increased, as suggested by the regression model. However, the variation in percent increases had a much wider range for trip attractions than for trip productions, indicating that in the alternative scenario, people have fewer reasons to travel to the downtown zones for HBO trips.
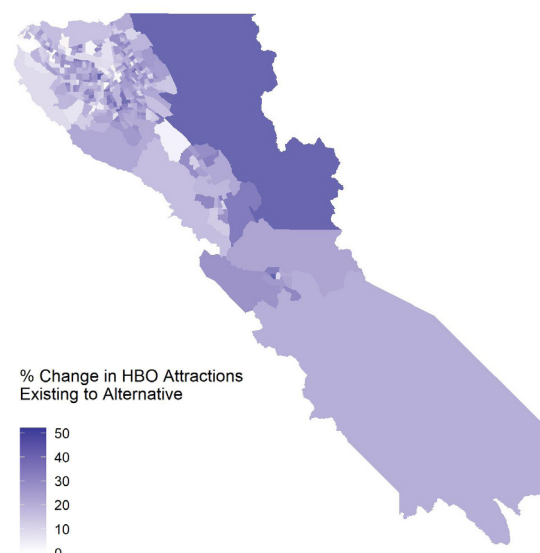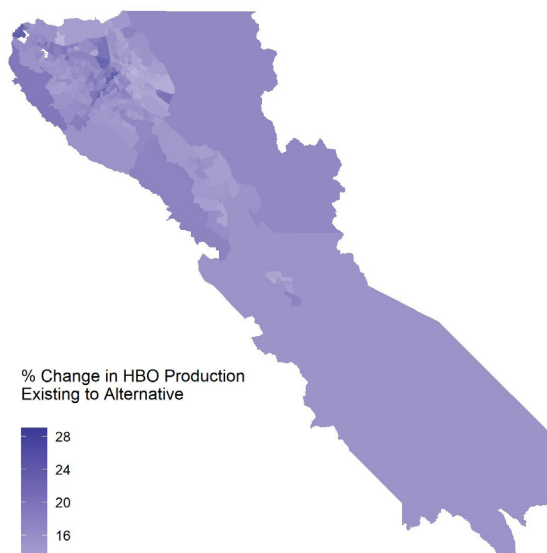

% Change in HBO Production
Existing to Alternative

28
24
20
16

% Change in HBO Attractions
Existing to Alternative

50
40
30
20
10
0

Figure 3 - Percent Change of HBO Trips from Existing to Alternative Conditions.

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Home-Based Work Trips

Home-based work (HBW) trips refer to those that originate at home to go to a person's place of work, or vice versa. The associated regression model is included below as Fig. 4. The significant variable in this model is again household size: the smaller the household, the fewer daily HBW trips, all else being equal. The WFH ratio is not a statistically significant variable in explaining variations in HBW trips.

**Figure 4 - Regression Model for HBW Trips.**

	Full model		Reduced model	
(Intercept)	1.65 ***	(p = 0.00)	1.49 ***	(p = 0.00)
zero_veh_TRUE	0.13	(p = 0.68)		
size_one	-1.08 ***	(p = 0.00)	-1.01 ***	(p = 0.00)
size_three	0.02	(p = 0.92)	0.07	(p = 0.75)
size_two	-0.41 *	(p = 0.02)	-0.40 *	(p = 0.02)
inc_quint_2nd	-0.09	(p = 0.81)		
inc_quint_3rd	-0.15	(p = 0.71)		
inc_quint_4th	-0.22	(p = 0.58)		
inc_quint_5th	-0.12	(p = 0.75)		
wfh_int_high	-0.14	(p = 0.37)	-0.13	(p = 0.37)
wfh_int_mid	0.18	(p = 0.37)	0.22	(p = 0.26)
N	906		939	
R2	0.09		0.09	

*** p < 0.001; ** p < 0.01; * p < 0.05.

Existing HBW Production
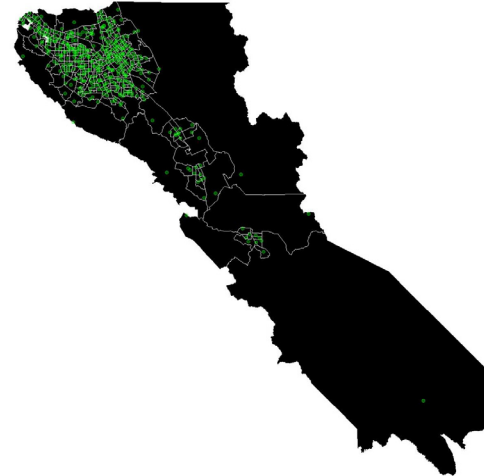
Existing HBW Attraction

Figure 5 - HBW Trip Productions and Attractions.

The process for estimating the HBW trip productions and attractions by zone was identical to the HBO process. The findings are shown below in Figure 5, which again tracks logically with population.

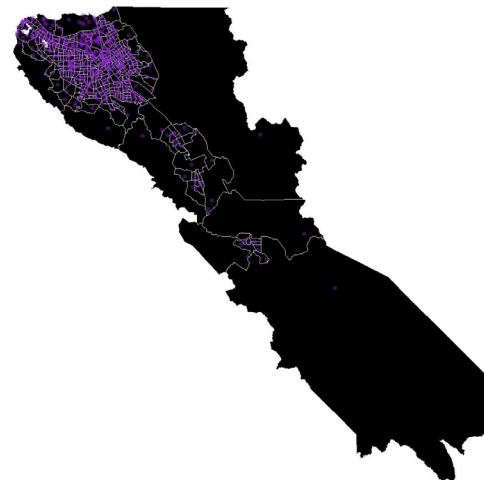The HBW productions decreased in every zone in the alternative scenario, which is in line with the main condition in the alternative scenario which decreases the amount of jobs that require commuting. However, the HBW attractions also decreased in most zones but did increase in a few zones as well. This is perhaps an area for further examination, as it implies that there are more jobs that require commuting in those zones in the alternative scenario than in the existing scenario. These findings are shown below in Figure 6.
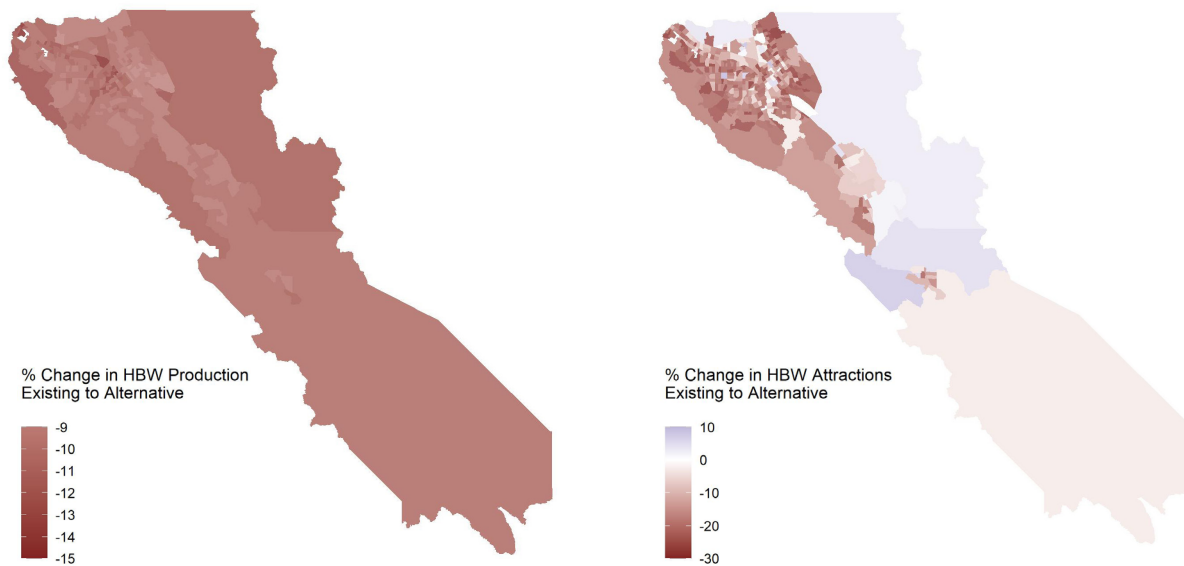
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Figure 6 - Percent Change of HBW Trips from Existing to Alternative Conditions.

Non-Home Based Trips

Non-home based (NHB) trips are trips that neither originate or end at home. The regression model used to estimate the NHB trip productions by zone is included as Figure 7 below. In terms of significant variables, the regression model suggests that in the San Jose MSA, a household with one person will make 2.15 fewer NHB daily trips per household compared to households with four or more people, all else being equal. Additionally, the average household in zones with a high WFH ratio will make almost one additional NHB trip per day than zones with a low WFH ratio. This finding is perhaps counterintuitive, as one might expect NHB trips to be higher for individuals who leave their homes regularly to commute to work and thus have more opportunities to make trips neither originating nor ending at home. It is possible that there is a link between working from home and trip-chaining, although this would need further exploration.

Figure 7 - Regression Model for NHB Trips.

	Full model		Reduced model	
(Intercept)	2.70 ***	(p = 0.00)	3.33 ***	(p = 0.00)
zero_veh_TRUE	0.09	(p = 0.89)		
size_one	-2.12 ***	(p = 0.00)	-2.15 ***	(p = 0.00)
size_three	-0.12	(p = 0.80)	-0.17	(p = 0.73)
size_two	-0.75	(p = 0.08)	-0.72	(p = 0.09)
inc_quint_2nd	1.33	(p = 0.08)		
inc_quint_3rd	0.25	(p = 0.66)		
inc_quint_4th	0.79	(p = 0.24)		
inc_quint_5th	0.74	(p = 0.14)		
wfh_int_high	0.80 *	(p = 0.05)	0.94 *	(p = 0.02)
wfh_int_mid	0.27	(p = 0.58)	0.26	(p = 0.57)
N	906		939	
R2	0.07		0.06	

*** p < 0.001; ** p < 0.01; * p < 0.05.

Trip Generation Models

Existing NHB Production
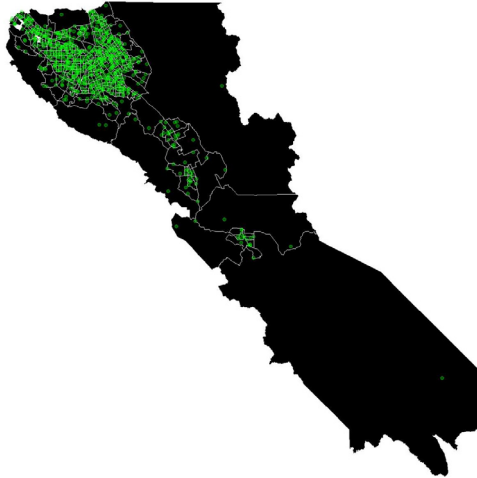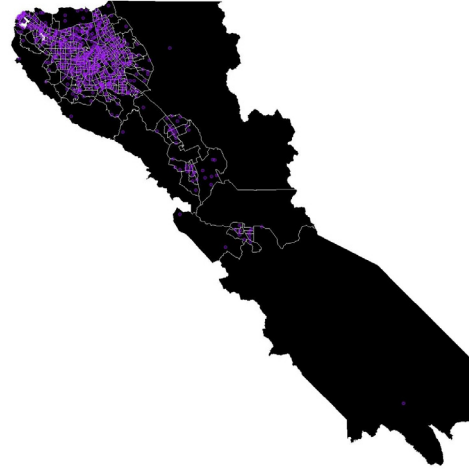
Existing NHB Attraction

Figure 8 - NHB Trip Productions and Attractions.

The process for estimating the NHB trip productions and attractions by zone was identical to both processes described for the HBO and HBW trips. The findings are shown above in Figure 8, which again tracks logically with population.

The changes in trip productions and attractions from the existing to alternative scenarios by zone for NHB trips are similar to the changes observed for HBO trips, as seen in Figure 9. The trips increase in every zone for both trip types, but the range of increases for trip productions across zones is much more narrow than the range for trip attractions, suggesting an increase in flexibility allowed by the new WFH scenario.

% Change in NHB Production
Existing to Alternative

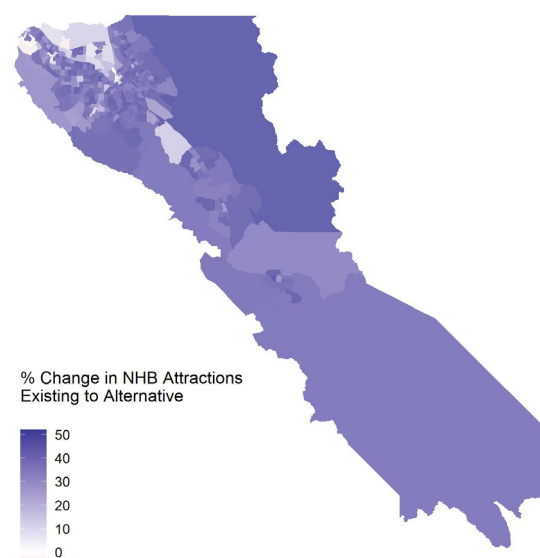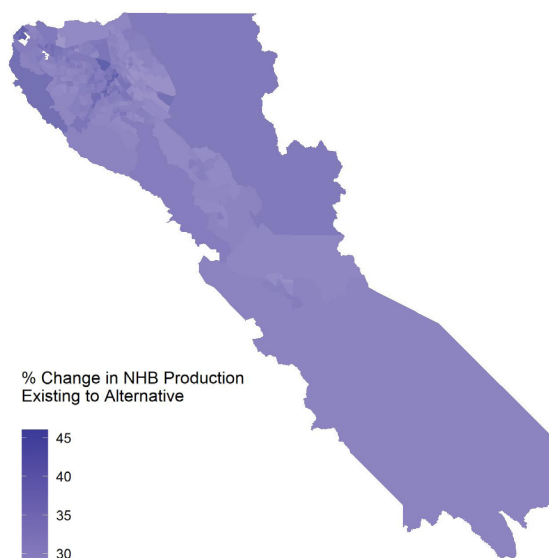% Change in NHB Attractions
Existing to Alternative

Figure 9 - Percent Change of HBW Trips from Existing to Alternative Conditions.