FEHR PEERS

Memorandum

Date: November 16, 2022

To: Suzanne Peterson, Christopher Gray, and Chris Tzeng – WRCOG

From: Mike Wallace, Eleanor Hunts, and Jason Pack – Fehr & Peers

Subject: **WRCOG Residential Trip Generation**
Contract No. 2022-65-1400-004 / Task Order No. 2022-65-1400-004-003

OC22- 0864

This memo summarizes the goals, data and analysis, key findings, and recommendations relating to the evaluation of vehicle trip generation and residential development characteristics. Specifically, this memo is intended to inform the Transportation Uniform Mitigation Fee (TUMF) guidelines on the relationship between residential trip generation and home size (square footage) as prescribed in California Assembly Bill 602 (AB 602). This draft memo will be followed-up with a phone call to discuss the recommendations and the memo will be revised and finalized based on the call.

Key Findings

Questions answered through the analysis and the findings are listed below.

- Is home size a key predictor of residential vehicle trip generation? **Yes, for homes of 2,500 square feet or less the trips increase with the larger home size. After 2,500 square feet the number of trips stay constant with home size, all else being equal.**
- Are there other characteristics that have a higher predictive relationship than home size? **Yes, the trip generation increases with the total household population, average number of children, and average number workers. Home size accounts for approximately 50% of the increase in home size for homes less than 2,500 square feet with the remaining 50% explained by multiple factors of the people within the home.**
- Does the location (i.e. TUMF zone) change the relationship of home size or the other characteristics? **No, the home location may influence the size, number of people, or household income, and/or the distance the trips travel, but does not influence the trips generated.**

- Are there recommended changes to the TUMF based on the findings? If so, what is the potential impact to the TUMF collection and home owners? **Yes, it is recommended that smaller homes pay a fee based on home size. The appropriate fee should be evaluated by the TUMF fee consultant to determine the potential impact to fee collected compared to the current fee expectation. Smaller homes paying less could potentially make home ownership less expensive overall compared to larger homes.**

Data Collection

This section describes the data that were used to evaluate the trip generation. Specifically, the identification and selection of study areas, method for obtaining and results of the travel activity, and collection of residential characteristics.

Study Area Selection

To determine the home characteristics that might influence trip generation, representative residential neighborhoods in each of the TUMF zones were identified. The criteria used for selecting neighborhoods included the following:

- Residential land use could be isolated from other uses
- Minimal cut through traffic
- As close to Census Blocks or Block Groups as possible to obtain demographic information
- Minimal construction activity that would change the number of units
- Diverse home size, household income

Based on local knowledge, aerial photos, Census geography, and home information from Zillow, WRCOG staff identified a preliminary list of potential study locations in each TUMF zone. Through discussions and review of each location, Fehr & Peers narrowed down the list of study locations to 23 neighborhoods, shown on **Figure 1**.

Travel Activity

StreetLight Data from smart phones were collected at 23 residential neighborhoods shown on Figure 1 were collected for trips that started or ended within each neighborhood. This method excluded trips that cut through the neighborhood. To avoid holidays, vacations, and to reflect travel when school is in session, data from March 1st through April 30th and September 1st through October 31st for all weekdays in 2019 were collected to represent the average vehicle trips per day for all homes within each study area.

Since StreetLight Data are based on location-based services (LBS) derived from cellular phone applications, 48-hour traffic counts were conducted at eight of the 23 study area locations as a point of comparison. The eight representative count locations were selected to have at least one

location in each TUMF zone, minimize the number of roadways accessing the land use, and to allow the most accurate representation of trips associated with the residential homes without capturing cut through traffic. The eight locations where 48-hour counts were collected are shown on **Figure 2**.

As shown on **Figure 3**, the 48-hour traffic count variation from day to day and the StreetLight Data average are very similar, giving confidence that the StreetLight Data for all study areas would be representative.

Residential Characteristics

The number of homes and characteristics for the homes within each study area were obtained from multiple sources, as summarized in **Table 1**. To identify outliers and the range of values for each variable that would be used to estimate the trip generation, plots of each study location by TUMF zone were developed and are summarized below with reference to the appropriate figure.

- **Figure 4 – Median Square Footage**: good distribution across study areas and within each TUMF zone
- **Figure 5 – Average Persons per Household**: good distribution across study areas and within each TUMF zone
- **Figure 6 – Average Children per Household**: good distribution across study areas and within each TUMF zone, including one study area that has very high children per household and another study area that has very low children per household
- **Figure 7 – Average Workers per Household:** good distribution across study areas and within each TUMF zone
- **Figure 8 – Median Cost per Square Foot**: good distribution across study areas and within each TUMF zone

Based on the review of each variable, the range across the study areas and within each TUMF zone are appropriate for use in the trip generation analysis.

Trip Generation Results

The StreetLight Data daily vehicle trips were used to visually display the relationship of each home characteristic for each study area and within each TUMF zone. The appropriate figure number and conclusion for the relationship are listed below.

- **Figure 9 – Daily Vehicle Trips per Median Square Footage**: slight increase in vehicle trips as median square footage increases
- **Figure 10 – Daily Vehicle Trips per Average Persons per Household**: slight increase in vehicle trips as total number of people per household increases

- **Figure 11 – Daily Vehicle Trips per Average Children per Household**: slight increase in vehicle trips as average number of children per household increases
- **Figure 12 – Daily Vehicle Trips per Average Workers per Household:** slight increase in vehicle trips as average number of workers per household increases
- **Figure 13 – Daily Vehicle Trips per Median Cost per Square Foot**: no clear relationship between average number of workers and trip generation

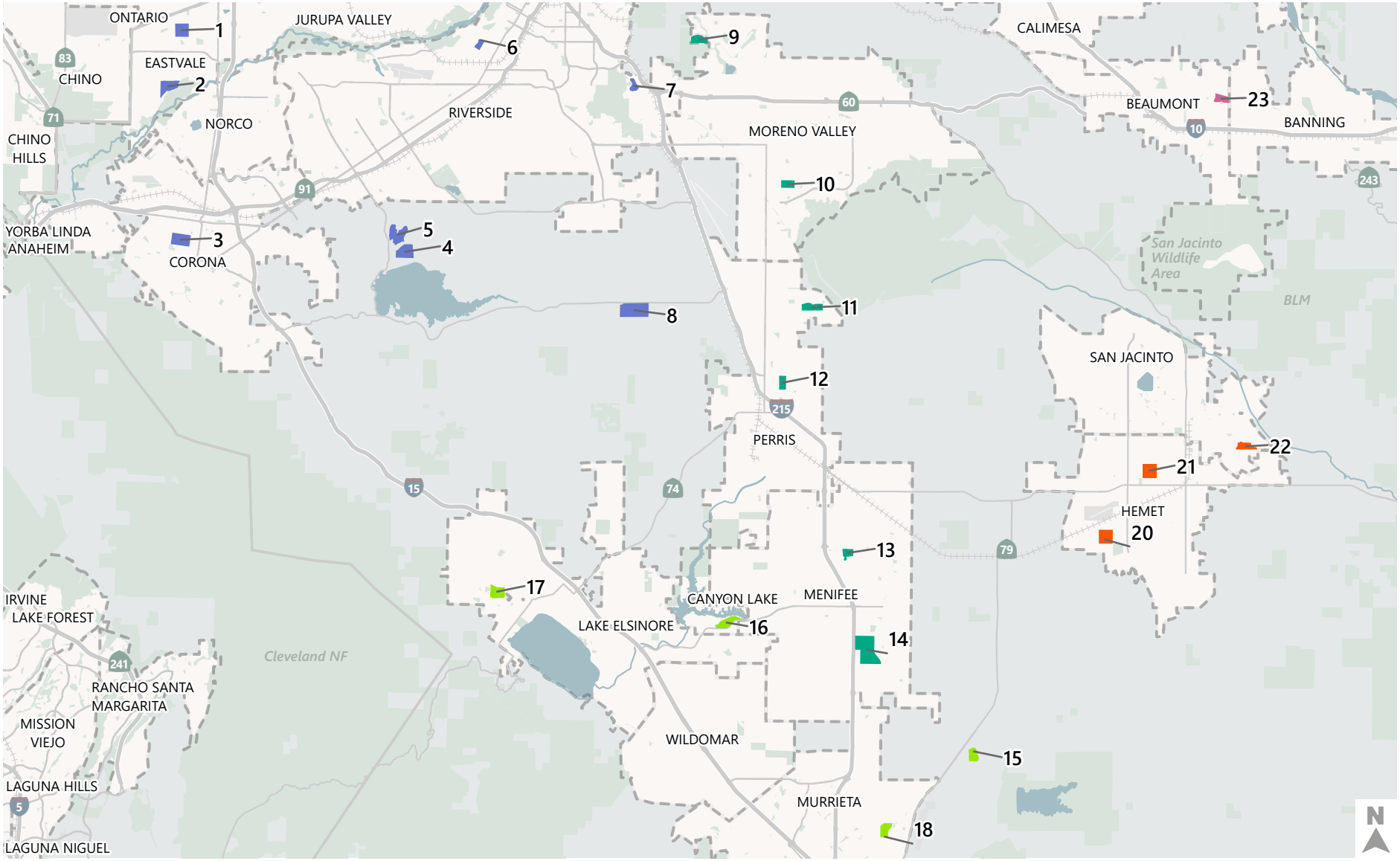
In addition to visual representations of the data, statistical analysis was performed to obtain the correlation between the variables to daily vehicle trips and to determine the regression equations.

Figure 16 – Correlation Matrix for All Variables: the correlation values in the green box for average and median home size of 0.7 indicate a strong positive correlation and mean as home size increases the number of trips increase. The correlation value of 0.7 results in an R-square of 0.49, meaning nearly half of the increase in trip generation is related to home size.

Based on Figures 10 and 11, the relationship between trip generation appeared to be linear, with the relationship possibly changing around 2,500 square feet. The linear regression analysis of average home size was performed for all home sizes, homes 2,500 square feet or smaller, and homes larger than 2,500 square feet. The results of the analysis are summarized in **Table 2**. The results show for home sizes of 2,500 square feet or less, the influence of the home size (represented by the coefficient) is nearly double that when all home sizes are included in the regression. The nearly zero coefficient and very high constant for the regression of home sizes above 2.500 square feet indicate that the trip generation is nearly constant for homes above 2,500 square feet.

Recommendations and Next Steps

Although home characteristics other than square footage have a slight increase in trip generation, the ability to forecast or control all of the characteristics other than home square footage is very difficult. Based on the results of trip generation and discussions with WRCOG regarding the feasible size of homes being constructed in the region, WRCOG will work with the TUMF fee consultant to identify and recommend appropriate fee adjustments based on square footage.



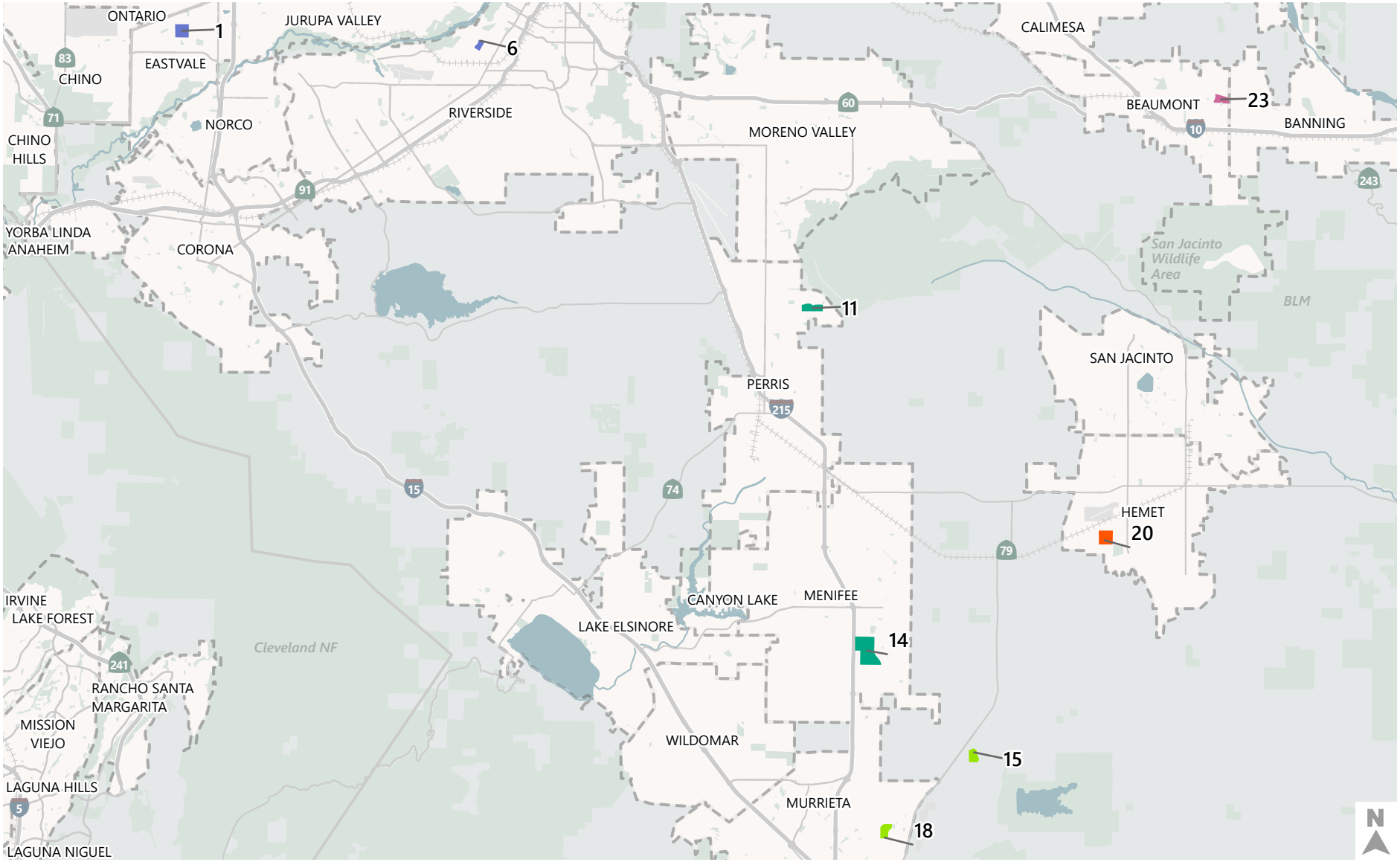
Study Location by TUMF Zone

- Central
- Hemet/San Jacinto
- Northwest
- Pass
- Southwest

City Boundaries

Figure 1

StreetLight Data Collection Locations



Study Location by TUMF Zone

- Central
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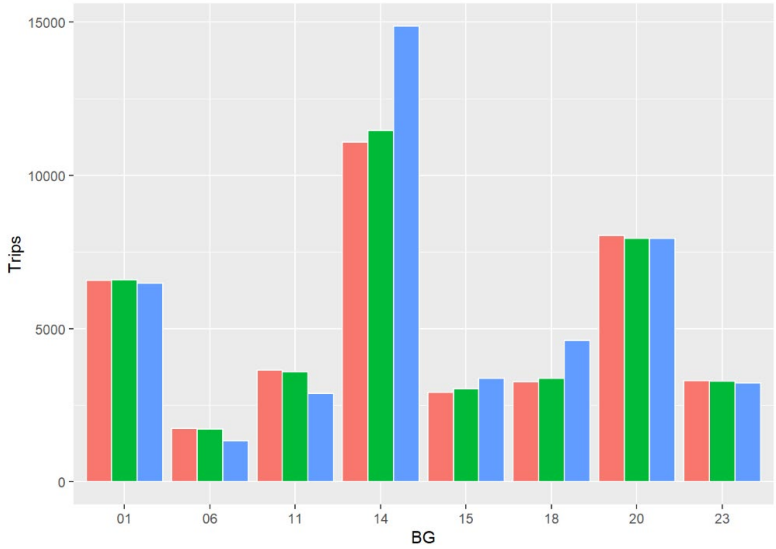
City Boundaries

Figure 2

Traffic Count Data Collection Locations

Figure 3 – Comparison of Individual Traffic Counts and StreetLight Data Average



Note: Red and green are the two days of manual count collection and blue are the StreetLight Data average. The BG number corresponds to the number on Figure 2.

Figure 4 – Median Square Footage

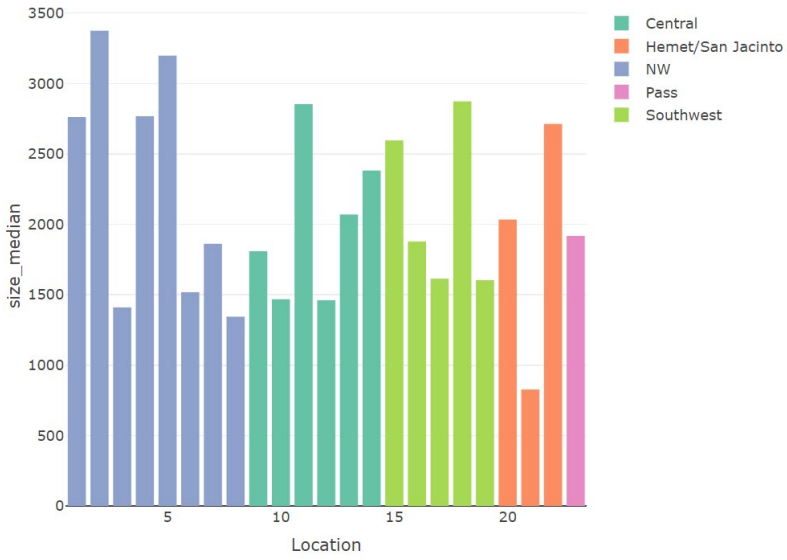


Figure 5 – Average Persons per Household

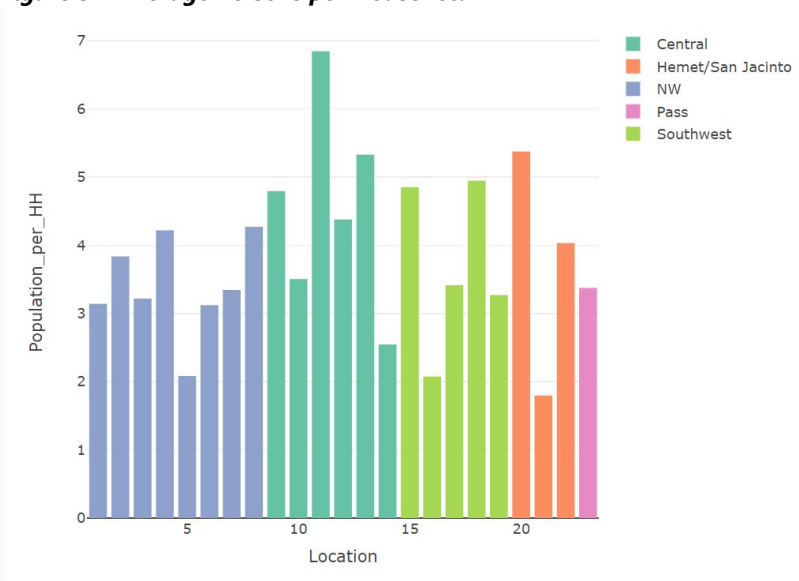


Figure 6 – Average Children per Household

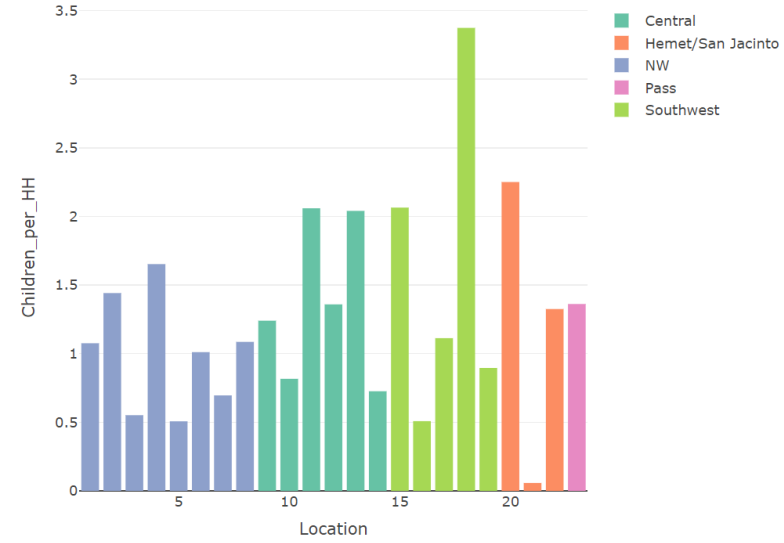


Figure 7 – Average Workers per Household

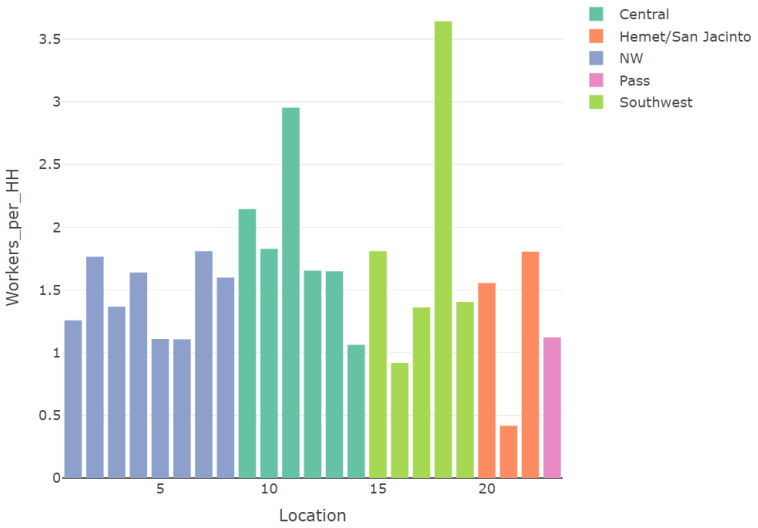


Figure 8 – Median Cost per Square Foot

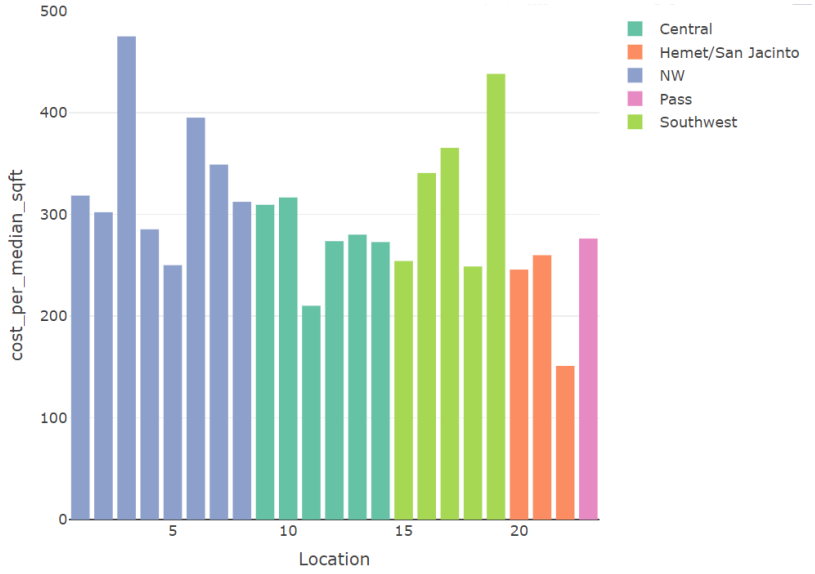


Figure 9 – Daily Vehicle Trips per Median Square Footage

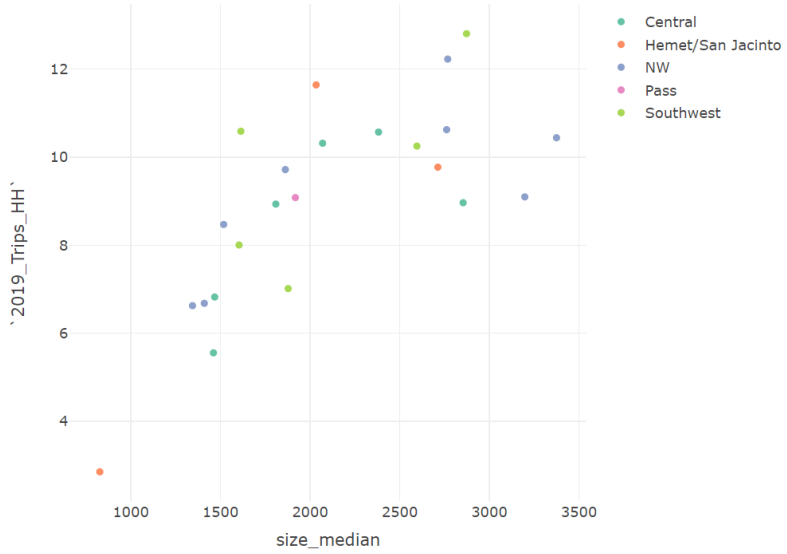


Figure 10 – Daily Vehicle Trips per Average Persons per Household

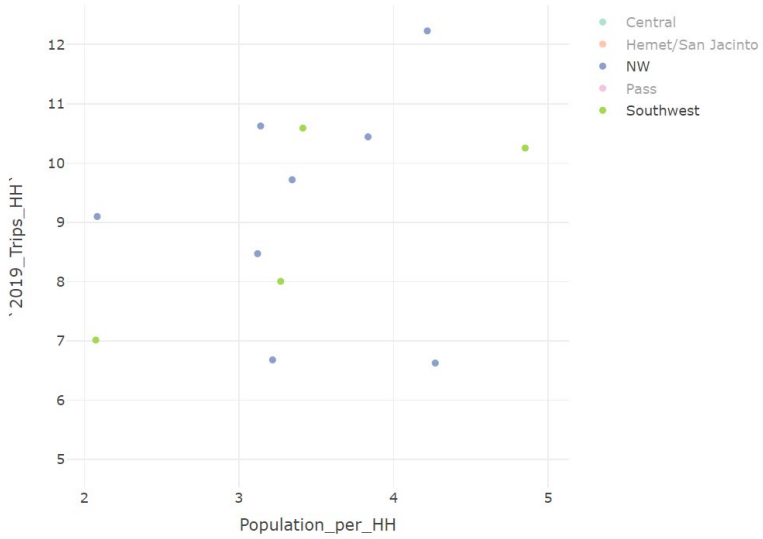


Figure 11 – Daily Vehicle Trips per Average Children per Household

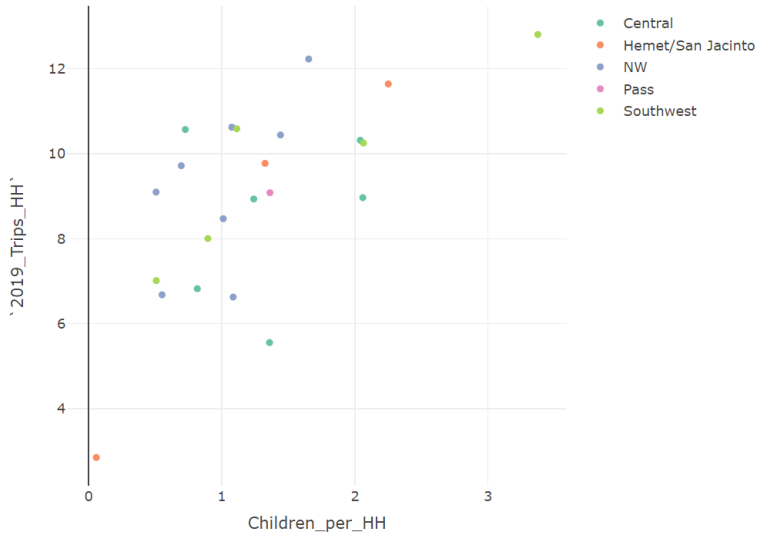


Figure 12 – Daily Vehicle Trips per Average Workers per Household

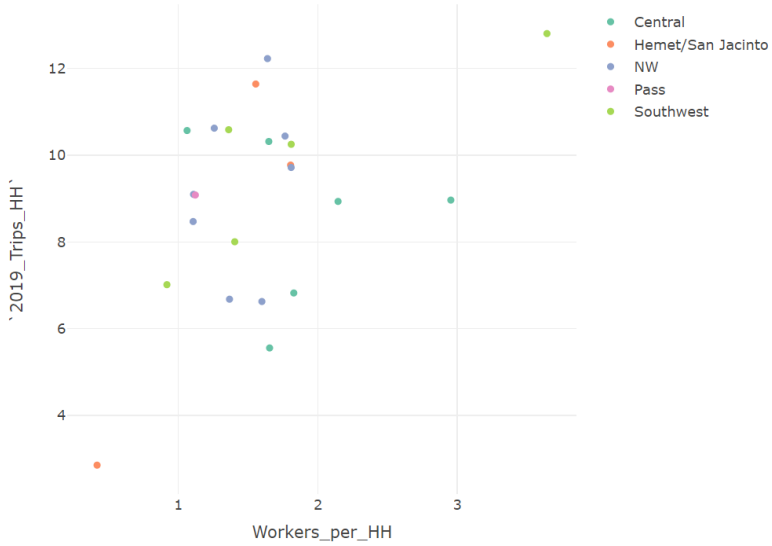


Figure 13 – Daily Vehicle Trips per Median Cost per Square Foot

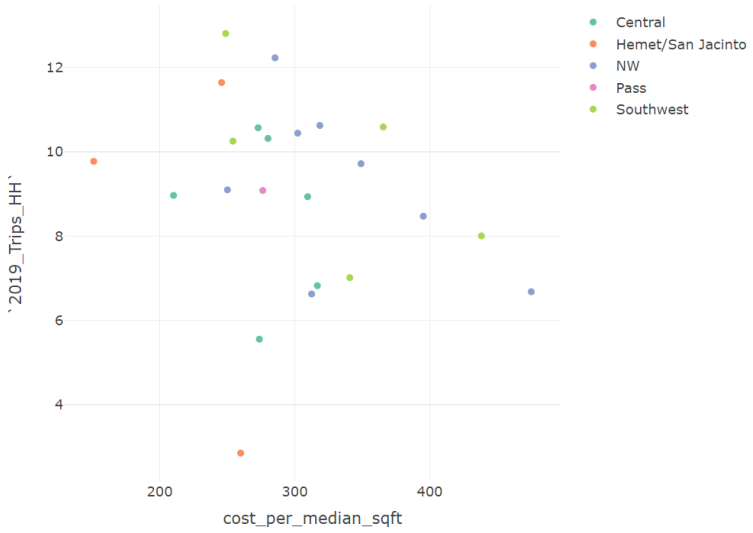


Figure 14 – Correlation Matrix for All Variables

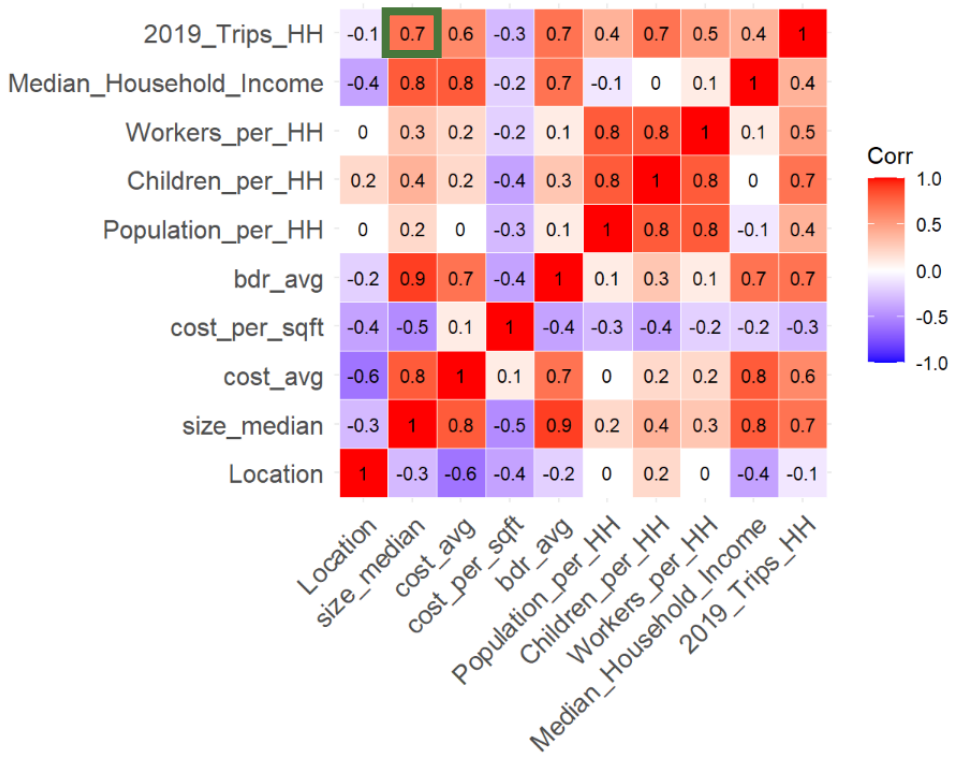


Table 1: Residential Home Data and Sources

Value	Source
Median Home Size	Zillow
Average Home Rooms	Zillow
Average Household Population	ACS 5 year and 1 year
Average Number of Children	ACS 5 year and 1 year
Average Number of Workers	ACS 5 year and 1 year
TUMF Zone	WRCOG
Average Household Income	ACS 5 year and 1 year

Table 2: Daily Total Vehicle Trip Regression Equation Summary

Home Size Variable	Coefficient	Constant	R-Squared
All home sizes			
Median Home Size (KSF)	2.26	4.22	0.507
Homes 2.5 KSF or smaller			
Median Home Size (KSF)	4.11	1.22	0.553
Homes over 2.5 KSF			
Median Home Size (KSF)	-0.3	11.57	0.007

Notes: KSF= Thousand Square Feet

Regression Equations

All home sizes.
Daily total vehicle trips = 2.26 * Median Home Size in Thousand Square Feet + 4.22

Homes l 2.50 thousand square feet or less.
Daily total vehicle trips = 4.11 * Median Home Size in Thousand Square Feet + 1.22

Homes more than 2.50 thousand square feet.
Daily total vehicle trips = -0.3 * Median Home Size in Thousand Square Feet + 11.57