

## Appendix 1. Data on car free and low mileage households

The demand for car free housing is indicated by the size of the existing market. Households with no car available and with a low number of vehicle miles traveled are already living a car-free lifestyle. People living in high density areas are also likely to be living car free. However, some of these households may do so because of poverty rather than choice. We will look at car availability, car use, density, and income.

**Car-free Households.** The National Household Transportation Survey (NHTS) for 2001 is the best source of national data; it is compressive, accessible, and allows users to create their own tables, including two-way and three-way tables. Starting with the simplest data, **8.1 percent of US households were auto-free**, or at least have no vehicle in the household. Closely related to zero vehicles in household is households where there are fewer cars than there are adults, indicating some grown-up doesn't have a car. An **additional 15.1 percent** of the adult population turns up one car or more short.

How many of them live in areas with a transit density? In the US population of 277,203,000 in 2001, **4.1 percent lived at densities above 25,000 persons** per square mile, which is 39 persons per gross acre. A gross acre in this case includes all land in census block groups, not just land for housing, but also streets, businesses, and anything else that happens to be there, sometimes seriously diluting the reported density. Net densities, which include only land residentially used, are usually much higher. Gross neighborhood densities are in-between; they adjust the gross area to exclude non-neighborhood uses that do not affect normal walking distances. Transit density starts at about 30 persons per gross neighborhood acre.

Compact densities of 10,000 to 25,000 persons per square mile can support transit, but to a lesser extent (10,000 per acre is 16 persons per gross acre). 8.5 percent of the population lived at a compact density.

Households without a car do not completely overlap with those living in dense or compact areas. A two-way table shows the relationship between auto availability and density. **Within the category of zero auto households, 24 percent live in transit density** and 18 percent live at a compact density. Zero auto households are a small percent of the national total, only 8 percent, and households with both zero autos and in dense neighborhoods are only 2.0 percent of total US households, a small percent, but still totaling 2.1 million households. Households with both zero auto and in compact neighborhoods total an additional 1.5 percent of the national households.

How many of them may be living there from choice, not from necessity of low income? The NHTS “create a table” feature in this case allows looking at persons, not households, which is a little more accurate. The table coming from the website is huge and requires considerable manipulation to find meaningful data. At a far corner of the matrix we find persons in high income households, which is over \$100,000 per year, with zero vehicles, living at densities over 39 persons per acre. There are 335,000 persons in this rarified category, fully 0.121 percent of the national population. **If we pull in all those with household incomes above \$30,000 per year, the percent goes up to 0.53 percent.** (See bolded numbers in table below.) At the compact density of 16 to 39 persons per acre, again for zero auto households with incomes above \$30,000, we find an additional 0.20 percent of the national population.

Not surprisingly, few people seem to have a car-free lifestyle, but it is interesting that there are any at all. The middle to affluent income, car-free, high density population numbers about one and half million people. The methodology leaves out many car-free, well-off persons living at lower densities where their specific circumstances support mobility comparable to car-driving suburbanites. Depending on their needs, people living close to campuses, grocery stores, restaurants, and/or multiplex theaters could have access comparable to suburbia.

### Car-free Persons by income level and higher population densities

Number of Persons (Thousands)	Population per sq mile - Block group			Percent	
	10 to 25k	over 25,000	All	10 to 25k	over 25,000
0 vehicles; HH income \$0 - \$9,999	899	945		0.32%	0.341%
0 vehicles; HH income \$10,000 - \$19,999	693	888		0.25%	0.320%
0 vehicles; HH income \$20,000 - \$29,999	496	514		0.18%	0.185%
0 vehicles; HH income \$30,000 - \$39,999	287	391		0.10%	0.141%
0 vehicles; HH income \$40,000 - \$49,999	178	304		0.06%	0.110%
0 vehicles; HH income \$50,000 - \$59,999	25	111		0.01%	0.040%
0 vehicles; HH income \$60,000 - \$69,999	13	110		0.00%	0.040%
0 vehicles; HH income \$70,000 - \$79,999	21	91		0.01%	0.033%
0 vehicles; HH income \$80,000 - \$99,999	1	123		0.00%	0.044%
0 vehicles; HH income > = \$100,000	16	<b>335</b>		0.01%	<b>0.121%</b>
<i>ST: 0 vehicles; HH income &gt; = \$30,000</i>	<i>541</i>	<i>1,465</i>		<i>0.195%</i>	<b><i>0.528%</i></b>
Total	2,629	3,812	277,203	0.95%	1.375%

2001 NHTS

NHTS Data Version 1/04

My source: Persons, HH vehicles, density, income.xls sheet2

**Low mileage drivers.** We need to focus now on driving, especially on the low mileage, affluent drivers in dense neighborhoods. At the low mileage end of the spectrum are the 27 percent of drivers who drive less than 5,000 miles per year. At the high end are the 5 percent of drivers who drive more than 40,000 miles per year. They look pretty car-dependent.

In terms of density, in areas over 39 persons per acre, drivers are averaging about 7,000 miles per year. As density goes down, vehicle miles traveled goes up. Driving increases steadily to the most rural density of fewer than 100 persons per square mile, where drivers average about 17,000 miles per year, 143 percent more than their urban compatriots.

As we move from a little driving to a lot of driving, the statistics show an odd bump along the way. Starting from the 27 percent who drive less than 5,000 miles a year, the next category is those who drive 5,000 to 10,000 miles per year, which drops down to 13 percent. The next category, 10,000 to 15,000 miles per year, jumps up to 24 percent, and the next higher category drops back down, to 14 percent. It is one of these statistical complications where the mode is very different from the median, which is different from the mean.

This bump at 10 to 15 thousand would only be a curiosity were it not for how it relates to density. An NHTS two-way table shows vehicle miles traveled (vmt) by density categories. There are eight density levels, each with its own line on the chart. Each line shows the percent of drivers at various levels of vmt. Seven of the density levels are very close to the national pattern: a high percent below 5,000 vmt, a drop down to percent of drivers at 5 to 10,000 vmt, a jump back up to the high point at 10 to 15,000 vmt, and a steady decline at higher vmts. The eighth density level, the transit density, is the one we are interested in,. Drivers living in this density have a much, much higher percent of driving less than 5,000 miles per year: 57 percent are in this low mileage category as compared to the others, which cluster around 25 percent. The next unusual thing is that the dense category does not have the bump the other seven, higher density categories have in the 10 to 15,000 vmt range. High density is clearly related to less driving.

The next question is, how many drivers may be driving less by choice, not from necessity of low income? The NHTS table is again huge and requires considerable manipulation. At a far corner of this matrix we find persons in high income households, driving less than 5,000 miles per year, living at densities over 39 persons per acre. There are 449,000 persons in this still rarified category, with 0.313 percent of the national population. **If we pull in all those with household incomes above \$30,000 per year, the percent goes up to 1.04 percent.** At the

compact density of 16 to 39 persons per acre, again for low mileage households with incomes above \$30,000, we find an additional 1.32 percent of the national population.

### Low mileage drivers by income level and higher population densities

Number of Drivers (Thousands)	Population per sq mile - Block group			Percent	
<b>Miles respondent drove last 12 months</b>					
<b>less than 5,000 miles</b>	10 to 25k	over 25,000	All		
HH income \$0 - \$9,999	296	213		0.207%	0.149%
HH income \$10,000 - \$19,999	548	267		0.382%	0.186%
HH income \$20,000 - \$29,999	598	267		0.417%	0.186%
HH income \$30,000 - \$39,999	482	321		0.336%	0.224%
HH income \$40,000 - \$49,999	229	219		0.160%	0.153%
HH income \$50,000 - \$59,999	257	126		0.179%	0.088%
HH income \$60,000 - \$69,999	188	101		0.131%	0.070%
HH income \$70,000 - \$79,999	109	125		0.076%	0.087%
HH income \$80,000 - \$99,999	250	150		0.174%	0.105%
HH income > = \$100,000	379	<b>449</b>		0.264%	<b>0.313%</b>
ST: HH income >= \$30,000	1,894	1,491		1.321%	1.040%
Total	3,336	2,238	143,329 *	2.328%	1.561%

\*Based on a two way table for persons by vmt and density, without unascertained values.

2001 NHTS

NHTS Data Version 1/04

My source: Persons, vmt by density, income.xls Sheet2

We can now combine persons in zero vehicle households with persons in the low mileage households to estimate the car-free population in the US. There is a caveat first, which is that some persons with no vehicles nevertheless report driving vehicles, and I have not adjusted for possible double counting of persons with no vehicles driving less than 5,000 miles per year. That said, the 0.53 percent of the no vehicle group combined with the 1.04 percent of the low mileage group totals 1.57 percent car-free. In population terms, the total is just shy of three million people. With more time, the differences between the vehicle data set and the vmt data set could be reconciled and a more accurate analysis could be made, but the adjustment is unlikely to change the above in any major way.

### The San Francisco Bay Area

What part of the Bay Area is the least car-dependent? Lacking NHTS data, I used 2000 census data from the MTC website, which reports vehicles available, commute mode, and travel analysis zone density.

The nine counties of the Bay Area have 160 cities and other Census Defined Places (CDPs). I ranked all of them for percent of households with zero vehicles and for percent drive alone commute. I selected all those with 10 percent or more zero vehicle or 58 percent or less drive alone commute. Thirteen places survived, 8 of which met both criteria, 2 of which had drive alone commutes below 58 percent but zero auto below 10 percent, and 3 of which had the reverse, that is, higher zero auto household but high drive alone commutes. These last three were lower income, single family neighborhoods with poor transit, so their large number of zero vehicle households was due to poverty, and their high drive alone to work was due to lack of density and of transit. The 13 areas had a household population of 643,000, of which 22 percent had no vehicle and 52.7 percent commuted without driving alone.

**Commute Mode and Zero Household Vehicles, Selected Bay Area Cities**

County	Place	Zero vehicle households	Total Households	% zero households	Drive alone commuters	Commuters	% drive alone commuters	Average commute minutes
SC	Stanford CDP	335	3,148	10.6%	1,438	5,711	25.2%	12.7
SF	San Francisco	94,178	329,700	28.6%	169,508	418,553	40.5%	30.7
ALA	Berkeley	7,649	44,955	17.0%	23,626	54,674	43.2%	27.8
ALA	Albany	529	7,011	7.5%	4,613	8,568	53.8%	29.2
ALA	Oakland	29,584	150,787	19.6%	94,333	170,503	55.3%	31.1
ALA	Emeryville	454	3,975	11.4%	2,359	4,155	56.8%	26.4
SM	Daly City	2,486	30,727	8.1%	28,654	49,640	57.7%	29.9
CC	El Cerrito	740	10,243	7.2%	6,884	11,867	58.0%	32.2
CC	San Pablo	1,571	9,057	17.3%	6,165	10,405	59.3%	33.4
CC	Richmond	4,476	34,705	12.9%	24,738	41,745	59.3%	34.3
SM	East Palo Alto	721	6,938	10.4%	7,053	11,014	64.0%	25.9
ALA	Ashland CDP	730	7,216	10.1%	5,906	8,874	66.6%	29.6
ALA	Cherryland CDP	473	4,608	10.3%	3,789	5,577	67.9%	31
	total	143,926	643,070	22.4%	379,066	801,286	47.3%	30.54

2000 Census, Bay Area places with 10 percent or more zero vehicle households or 58 percent or less Drive Alone Commute.

**Hayward Market Area**

ALA	Hayward	3,555	44,902	7.9%	42,622	61,696	69.1%	31.3
ALA	San Leandro	2,850	30,616	9.3%	25,973	36,928	70.3%	30.5
ALA	Union City	947	18,628	5.1%	22,243	30,457	73.0%	32.1
ALA	San Lorenzo CDP	482	7,532	6.4%	7,334	9,663	75.9%	29.1
ALA	Castro Valley CDP	1,071	21,653	4.9%	21,819	28,564	76.4%	30.4
	Hayward market area	8,905	123,331	7.2%	119,991	167,308	71.7%	30.99

Source, March 31, 2005: <ftp://198.31.87.7/pub/mtc/census2000/DP2-4/>, Compare1-BayPlace-19902000.xls

### Three Less Car-Dependent Bay Area Cities

	San Francisco	Oakland	Berkeley	Total
Households	329,700	150,787	44,955	525,442
HH with zero vehicles available	94,178	29,584	7,649	131,411
Percent with zero vehicles	28.6%	19.6%	17.0%	25.0%
total commuters	418,553	170,503	54,674	643,730
transit commuters	130,311	29,728	10,156	170,195
Percent by transit	31.1%	17.4%	18.6%	26.4%

source, March 31, 2005: 2000 census  
[http://www.mtc.ca.gov/maps\\_and\\_data/datamart/census/dp234/Census-Transportation-Related.htm](http://www.mtc.ca.gov/maps_and_data/datamart/census/dp234/Census-Transportation-Related.htm)

My source: HH Bay Area.xls Sheet 5

San Francisco, not surprisingly, was top performer for car-free households, and the Stanford CDP was tops for commuting, with 75 percent using modes other than driving alone. Stanford's success is not accidental; it is a result of economic analysis of parking, its role in generating traffic, restrictions on the amount of parking, high costs for parking, high densities supporting short walking distances and transit, support for bicycling, and frequent transit.

The Hayward market area ranks well below the top 13 places, but is not at the car-dependent end of the spectrum either. The Quarry Project in Hayward will have to attract people from the Hayward area and possibly the larger market, mostly in San Francisco, Oakland and Berkeley.

San Francisco, Oakland, and Berkeley are the heart of the car-free area in the Bay Area or, more accurately, they have more car-free households and high density neighborhoods than the rest of the region. They have 25 percent of their households with zero vehicle, and 26 percent of their workers use transit to get to work.

MTC has data for travel analysis zones, of which there are 1,454 in the 9 counties. These zones are similar to census tracts and larger than the block groups that were used to look at density in the national statistics. I calculated the 1454 zone population densities and ranked them with a cut off line at 39 per acre, same as the NHTS break point. The Bay Area had 328 high density zones with 1,443,000 population and an average density of 69.2 persons per acre. Of the 328 zone total, most were in the inner bay counties of San Francisco (179) and Alameda (64), which includes Oakland and Berkeley. There were 37 dense zones in San Mateo, 26 in Santa Clara, 18 in Contra Costa, 2 in Solano, and 2 in Marin. The census has data on vehicle

availability but not for the same zone system, and regional mileage data does not exist for households.

Without a consistent data set, it is hard to estimate a car-free population—no vehicle available or low mileage, high density, middle to affluent income—for the Bay Area. The national data indicate that 57.3 percent of those living at high density drive less than 5,000 miles a year. If applied to the Bay Area, the high density, low mileage population would be about 827,000. The NHTS data also show that two-thirds of low mileage persons at high density have household incomes above \$30,000 per year, which is the cut off line at the bottom of the middle class. If applied to the Bay Area, the low mileage, middle to affluent income population in dense neighborhoods would be about 551,000 people.

Why is this important? There is a tendency to think everyone has a car, drives a lot, and lives in suburbia, except for Manhattan and a few other smaller downtowns. The idea that there is not only a car-free population, but also that this population is big enough to create a market for car-free housing, needs more emphasis. It is also important that the kinds of statistics we need are not readily available, let alone discussed as to how good they are. These people in these areas need more recognition for achieving the benefits described above for the Quarry Project. We need to figure out how to make their urban system work better, and attract more people to it.