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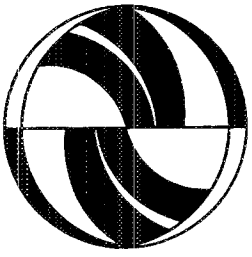https://escholarship.org/uc/item/89k664kz

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Projects in California

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Market Profiles of Rail-Based Housing Projects in California

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Market Profiles of Rail-Based Housing Projects in California

1. Introduction

Proponents of rail-based housing contend that besides the obvious transportation benefits of having more people residing near transit stops, a number of other second-level benefits would accrue as well: increases in affordable housing, more choices on where to live and how to travel, increased mobility for transportation-disadvantaged groups, and the creation of a village environment where people from all walks of life come into daily contact with each other, similar to America's streetcar cities at the turn of the century. For the most part, these second-level benefits could be expected to accrue to specific subpopulations: young families in search of affordable housing; people who are tired of traffic snarls and want to live near transit to ease their commute; the elderly and the poor who have limited access to autos; and perhaps even recent immigrants anxious to assimilate into American culture and looking for a multicultural neighborhood near transit in which to do so.

Exactly who lives in multi-family housing projects near rail transit? We suspect that these households are very similar to those living in apartments and higher-density housing elsewhere: single people; college students; young couples without children; persons once again living alone because of divorce or death of a spouse; empty nesters and retirees seeking smaller, simpler, and easier-to-maintain residences and perhaps wanting to cash in on their accumulated housing equity; and low-income renters and buyers. That is, station-area households are probably fairly small and in the lower income brackets. What likely distinguishes apartment-dwellers and condominium-owners near rail stations is that many purposefully chose to move there in order to be near transit and commute by rail. We would expect, then, that residents of transit-based housing tend to work in locations that are best served by rail — namely downtowns and other regional subcenters. Voith (1991) observed this kind of "residential sorting" on the basis of employment location and transportation preferences in greater Philadelphia. He found that census tracts near suburban Philadelphia commuter rail stations had higher shares — around 12 percentage points more — of worker-residents with jobs in the CBD, other things held constant.

Lastly, transit-based housing (and the prospect of a transit village blossoming around it) might also appeal to those wanting a more active, urbane environment but who choose not to live in dense settings where, say, crime is a problem or in pricey central-city neighborhoods. Artists, craftspersons, software programmers, sole-proprietors, "independent" professionals, those who wish to avoid the costs of owning and maintaining a car, and people trying to hold their expenses down and want simple but convenient accommodations — all might be attracted to apartments and condos near rail stations. Even companies maintaining condominiums for out-of-town guests might find rail-based housing in a pleasant neighborhood setting to their liking.

As far as we know, no market research has been conducted to date which confirms or alters these hypotheses on who tends to live in dense housing near rail stations in the U.S. This report aims to provide some insights on this question by profiling residents of 27 apartment and condominium projects near rail stations in California, focusing mainly on the BART system in the San Francisco Bay Area. The analysis is limited mainly to comparing the sociodemographic characteristics of station-area dwellers to those of the surrounding community. Differences in workplace locations are also probed to investigate the degree to which "sorting" takes place — people choosing to live near transit to lower their commuting costs. Such information hopefully will be useful to homebuilders and residential developers who want a clearer definition of the market niche of station-area dwellers. Community planners committed to creating transit villages and transit officials interested in co-developing station-area landholdings should also find these market profiles useful.

2. Demographic Trends, Multi-Family Markets, and Rail-Based Housing
Demographic Trends

California's and much of the nation's demographic makeup are clearly moving in the direction of population groups that seem to be good candidates for rail-based housing. Two important demographic trends of the 1980s were the stabilization of average household size (after declining for several decades) and the influx of immigrants from abroad, especially southeast Asia and Latin America. In greater Los Angeles, 30 percent of households in 1990 contained no children; in the inner suburbs of Los Angeles, two-thirds of households were childless (Speare, 1993). Between 1980 and 1990, the Bay Area saw a 6.2 percent increase in the share of households without children under the age of 18 years old. [1]

The huge increase in immigrant populations during the 1980s was felt mainly in the nation's largest cities, in some cases markedly changing the cultural and political character of the places affected. For the 10 largest U.S. metropolitan areas, immigrants accounted for 78 percent of total population growth between 1980 and 1990. Immigration added over 2 million to the population of the Los Angeles-Long Beach-Anaheim MSA and nearly 600,000 to the San Francisco-Oakland MSA during the 1980s (Speare, 1993). As noted, since many new arrivals to this country have limited financial resources, do not drive or own a car, and are most inclined to live in urban centers where service jobs are more plentiful, they are a natural market of potential transit station-area dwellers.

Correlated with the stabilization in household size is the relative growth in elderly households and young households. During the 1980s, Los Angeles's share of residents over 65 years of age grew from 8.6 percent to 9.7 percent. In the San Francisco Bay Area, the trend was more pronounced — with seniors increasing from 8.9 percent to 11.0 percent of the region's population. The graying of America portends a future where many more people will be depending on trains and buses to get around, and perhaps some will be seeking to live in places which have easy access to both. Older Americans also seem to be attracted to neighborhoods with a sense of community and attachment.

In addition to a growing cohort of seniors, the number of young adults (25 to 34 years old) has also grown noticeably. In the Bay Area, this group grew from 14.6 percent to 19.8 percent of the total population during the 1980s, while in greater Los Angeles it rose from 17.2 percent to 19.8 percent. These post-baby boomers tend to have fewer children, and many employed in professional fields are attracted to more upscale rental units. Given attractive housing near transit stations, many could be potential station-area residents.

Multi-Family Housing Markets

Changing demographics, lifestyles, and housing prices (in general, higher ones) have created a demand for a variety of housing choices, including multi-family housing. Multi-family housing consists of housing that is built for rent (apartments and townhouses) or for sale at market prices (condominiums), typically at densities in the 15 to 50 dwelling units per acre range. Over the years, multi-family housing has obtained a tarnished image. Many communities and neighborhood groups try to block multi-family construction because they fear such projects will drain tax coffers and lower the values of surrounding single-family residences. These fears are often unfounded. Because multi-family households usually contain fewer school children than do single-family homes, they impose less of an education burden on communities. Burchell et al. (1985) estimated, for instance, that in the western region of the U.S., single-family homes yield almost three times the number of school-age children per unit that garden apartment complexes produce and more than eight times that of high-rise apartments. Nationwide, 72 percent of multi-family households had no school-age children in 1985, compared to 61 percent of single-family households (U.S. Census Bureau, 1986).

At the same time, changing demographics and lifestyles have created a demand for smaller, multi-family housing alternatives. In regions like the San Francisco Bay Area and Southern California the cost of owning a detached, single-family home has soared out of reach of many prospective home-buyers. This is reflected in the distribution of housing types by household income categories, shown in Figure 1. The high cost of buying a first home has forced many young people to delay or abandon their efforts to purchase a home on a private lot. Faced with the trade-off of living in the exurbs and commuting several hours a day or getting by with less housing, the majority seem to be opting for the latter choice.

Affordable, multi-family housing is also suited to the needs of moderate wage-earners, like teachers, nurses, police, and administrative personnel, as well as lower-wage workers in restaurants, hospitals, retail shops, and service establishments (Urban Land Institute, 1991). Downs (1989) argues that such residents are essential to the lifeblood of a community since they provide the government, retail, and businesses services that are associated with a high quality of life and regional productivity.

3

Household Income (Thousands)

Percent of Households

Multifamily   Single-family
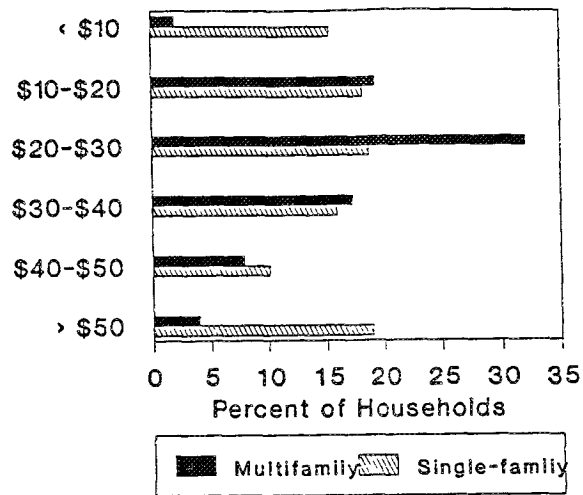
Figure 1. Household Income Category by Housing Type, All U.S. Households, 1985

Market Profiles of Transit-Based Housing

No previous work could be found that profiled the sociodemographic characteristics of relatively dense housing projects near rail stations for a collection of projects, as is presented in this paper. Market profiles have no doubt been drawn for specific projects that are near rail stations, though such information is rarely published and is often proprietary. One San Francisco Bay Area housing project near BART whose tenants were recently surveyed (and the results were made available to the public) is Del Norte Place. Near the El Cerrito del Norte station, the second stop north of Berkeley on the Richmond line, Del Norte Place is a 135-unit apartment complex with 19,000 square feet of ground-floor retail. Twenty-seven units have been set aside for low- and moderate-income households. The project was built on land owned by the El Cerrito Redevelopment Agency. When the agency sought proposals for the site, John Stewart, a San Francisco-based housing developer, put in an aggressive bid, actively seeking a site near a transit stop. In an interview with the *New York Times*, Stewart maintained that living near train stations will become more attractive with time as traffic congestion continues to worsen and the cost of driving rises (McCloud, 1992).

Del Norte Place has leased rapidly. It opened in mid-1992 and by mid-1993, 97 percent of its apartments were rented. Most tenants are singles or married couples without children who work in downtown San Francisco or Oakland, students at the nearby University of California at Berkeley, or empty-nesters. Only 17 percent of Del Norte Place's households include children; 56 percent of the units have a single occupant. Residents of Del Norte Place predominately fall into two groups: young adults and retirees. Forty-one percent of residents are over 62 years of age, while 21 percent are 26-35 years of age and 14 percent are in the 18-25 year age group (Stewart, 1993).

4

3. Research Approach: Sources and Methodology

Survey Data Source

      The principle source of data for studying the market profiles of those living in apartments and condominiums near California rail stations was a survey of 27 sites conducted by the National Transit Access Center in late 1992 and early 1993. The surveyed housing projects had at least 75 dwelling units and were within two-thirds of a mile of a station, with the majority lying within the more walkable distance of a quarter mile. In all, residential sites near stations of the following five California rail systems were surveyed (with the number of sites surveyed shown in parentheses): San Francisco Bay Area Rapid Transit District, or BART (11 sites); Peninsula CalTrain (4 sites); Santa Clara County Light Rail (4 sites); Sacramento Light Rail (4 sites); and San Diego Trolley (4 sites). Map 1 shows the location of the 11 surveyed residential sites that were near BART.
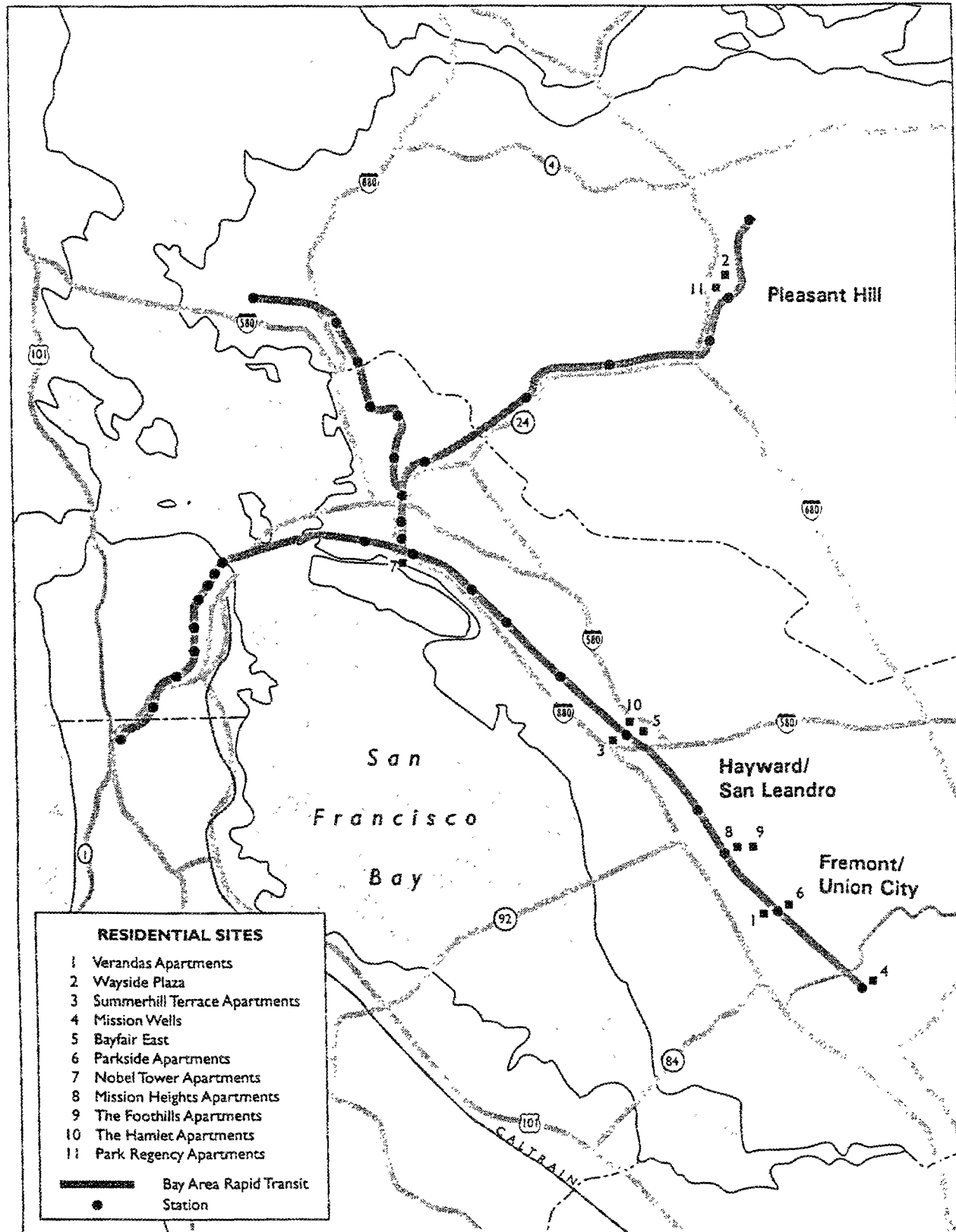
      Among the 27 surveyed projects, housing projects varied in terms of proximity to stations (361 to 3,525 feet) and size (76 to 892 units). By housing type, 21 of the sites contained rental units and the other six were condominiums.

      For each site, self-administered questionnaires were mailed to the tenants in all units of selected buildings. Surveys mainly elicited information on the trip-making characteristics of station-area residents; however, data were also collected on such household characteristics as family size, number of vehicles, and income as well as such person characteristics as age, gender, ethnicity, and occupation. Person-level data were collected, however, only for occupants 16 years of age and above. Thus, while the household-level statistics presented in this paper are for all occupants, the person-level summaries are only for adults and teenagers of driving age. In comparing the sociodemographic profiles of station-area residents with those of surrounding areas, comparisons are only drawn for the 16-and-above age cohort.

      The overall response rate for the survey was 18.4 percent, which, when netting out the unoccupied units, increased to around 22 percent. Data on a total of 885 station-area households were obtained. The interested reader is referred to Cervero (1993) for more background on the residential sites studied, survey instrument, and sampling approach.

Research Method

      Largely descriptive statistics are used in this study to profile station-area residents at the 27 surveyed sites. To provide a basis of comparison, the characteristics of households and individuals living near stations are contrasted with those of surrounding neighborhoods and communities, using 1990 census data. Comparisons are drawn at three levels: neighborhood (using census tracts); city; and county. For the neighborhood-level comparisons, statistics for households and individuals at the surveyed sites were netted from statistics for households in the surrounding census tract. This allowed characteristics of households in large housing complexes near rail stations to be contrasted to all other households in the "vicinity," with vicinity defined by the size of the census tract. Since most surveyed sites were in mature suburban

RESIDENTIAL SITES

1 Verandas Apartments
2 Wayside Plaza
3 Summerhill Terrace Apartments
4 Mission Wells
5 Bayfair East
6 Parkside Apartments
7 Nobel Tower Apartments
8 Mission Heights Apartments
9 The Foothills Apartments
10 The Hamlet Apartments
11 Park Regency Apartments

▬▬▬ Bay Area Rapid Transit
● Station

Map 1. Surveyed Residential Sites, BART System

settings with similar-size census tracts of several square miles, comparisons were generally consistent across sites. To some degree, this neighborhood-level analysis provides a reasonably good controlled context for studying the characteristics of those living in dense housing near stations versus the characteristics of those living in less-dense, and often single-family, housing in the same vicinity.

The other two levels of comparisons were meant to contrast characteristics of station-area households versus everyone else in the subregion (city) and region (county). These comparisons, then, seek to highlight what distinguishes rail-based households from the "typical" household in the surrounding city and county. With these comparisons, statistics on station-area households were not "netted out" of the citywide and countywide statistics, in large part because the surveyed households are a minuscule share of the city and county totals. Thus, what is being compared is the traits of one small sliver of a large circle in a Venn diagram with the traits of the entire circle.

In addition to these sociodemographic comparisons, the spatial and modal journey-to-work characteristics of surveyed apartment and condominium dwellers are compared to those of the surrounding census tract, cities, and counties, for the surveyed sites near the BART system only. This analysis seeks to probe what is thought to be the trait of station-area residents that distinguishes them most from other multi-family dwellers — a workplace destination that is in the central business district (CBD) or is well-served by BART. Those headed to such destinations, we expect, are more likely to be transit commuters.

One important caveat needs to be made about the comparisons presented. Data for station-area residents are from a survey while those for surrounding residents are from a census. Thus, comparisons are being made between roughly a 20 percent sample of one group and a near 100 percent (adjusted) sample of another. For the sake of comparison, it must be assumed that among the station-area households surveyed, the non-respondents and respondents are similar. Of course, it is difficult to know if they are — after all, we can only really determine this if we have a 100 percent response rate. In order to reduce potential bias, a number of tactics were used, including extensive pre-testing, mailbacks to initial non-respondents, and letters from property managers of surveyed buildings that urged tenants to participate in the survey (see Cervero, 1993, for further discussions on this). Still, the analyses that follow are valid only to the degree that survey respondents are fairly representative of the tenants in a project, something we are unable to establish but which we believe to hold true due to the extra efforts made to reduce survey bias.

4. Household and Sociodemographic Comparisons of Rail-Based and Areawide Residents
Household Characteristics

As expected, households living in apartments and condominiums near California's rail stations tended to be much smaller than the typical household in the surrounding county. In the case of the 11 surveyed BART sites, for instance, the average household had 1.66 members, compared to the average for Alameda and Contra Costa Counties combined of 2.52 (see Table 1). The largest differential was found

Table 1
Comparison of Household Characteristics
of Rail-Based Housing and Surrounding Region, by Rail System

	BART		CalTrain		SCCTA		SD Trolley		SRT	
	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region
Household Size										
Average	1.66	2.52	1.83	2.50	1.67	2.65	1.93	2.57	1.64	2.50
(Std. Dev.)	(0.81)	(1.33)	(0.85)	(1.33)	(0.71)	(1.37)	(0.78)	(1.34)	(0.74)	(1.32)
Percent w/One Occupant	48.6	25.4	41.2	25.6	45.7	22.3	29.0	23.4	50.7	25.6
Percent w/Two Occupants	41.7	32.9	39.0	34.1	42.3	32.3	54.3	34.4	35.8	33.7
Percent w/Three Occupants	5.9	17.7	15.4	17.0	10.9	18.3	11.6	17.4	12.2	17.6
Percent w/Four Occupants	2.8	14.9	4.4	14.0	1.1	15.9	5.1	14.5	1.4	14.2
Percent w/Five Occupants	0.7	6.7	0.0	6.6	0.0	7.8	0.0	7.3	0.0	6.4
Percent w/Six + Occupants	0.3	2.5	0.0	2.6	0.0	3.3	0.0	3.0	0.0	2.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of Vehicles Available										
Average	1.26	1.76	1.46	1.87	1.48	1.98	1.47	1.77	1.46	1.73
(Std. Dev.)	(0.68)	(1.06)	(0.78)	(1.04)	(0.66)	(1.07)	(0.66)	(1.03)	(0.74)	(1.00)
Percent w/Zero	8.7	10.0	4.7	6.1	2.9	5.3	3.0	7.9	4.2	8.4
Percent w/One	61.5	32.4	57.4	32.4	52.3	28.4	51.1	34.1	54.9	34.6
Percent w/Two	24.8	37.1	26.4	38.7	38.5	40.5	42.9	38.7	31.7	38.9
Percent w/Three	4.9	14.5	10.9	16.0	6.3	17.2	1.5	13.4	8.5	13.4
Percent w/Four	0.0	4.3	0.8	4.8	0.0	6.2	1.5	4.1	0.7	3.5
Percent w/Five +	0.0	1.7	0.0	2.1	0.0	2.5	0.0	1.7	0.0	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The "Surrounding Region" consists of the census data for the entire county or counties which encompass the housing project or projects. The project's data were not subtracted from the census data.
Comparisons were made between the following aggregations of projects (denoted by the transit system) and counties: BART-Alameda/Contra Costa; CalTrain-San Mateo; SCCTA-Santa Clara; SD Trolley-San Diego; SRT-Sacramento.
Percentages may not add up to 100.0% due to rounding.

in Santa Clara County, where the county averaged about one more person per household than did the four rail-based projects that were surveyed (three of which were condominiums). In comparing standard deviations to averages, it appears that there was not a lot of variation in average household sizes either among surveyed projects or within counties; for each of the five rail systems studied, the coefficients of variation for household size were consistently lower for the rail-based projects than the counties at large. [2]

In the case of BART and Sacramento Regional Transit (SRT), around half of the surveyed housing units had a single occupant, and for all five systems, over 80 percent of all units had no more than two members. For all paired comparisons, rail-based projects had larger shares of 1-2 person households and surrounding counties had larger shares of 3+ person households.

These same patterns held when relationships were studied at a finer-grain level — rail-based housing versus the surrounding city (instead of county). Table 2 compares household size between groups of rail-based housing projects in the same city and the corresponding citywide averages. [3] Average household sizes for cities were between 15 and 94 percent larger than in rail-based housing, with the largest differential found between Union City and its two rail-based projects (Verandas Apartments and Parkside Apartments). Combining the data across all city pairs, Figure 2 amplifies what was stated before: rail-based projects tend to be home almost exclusively to 1-2 person households. [4]

Tables 1 and 2 also show that, as expected, with smaller households, there also tend to be fewer cars and trucks available to occupants of rail-based housing. High-density housing near the BART system

Table 2

Comparison of Household Characteristics of Rail-Based Housing and Surrounding City, Bay Area

	Union City		Hayward		San Leandro		Walnut Creek		Oakland	
	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City
Household Size										
Average	1.70	3.30	2.10	2.71	1.44	2.31	1.47	2.11	1.31	2.47
(Std. Dev.)	(0.98)	(1.54)	(0.85)	(1.45)	(0.68)	(1.29)	(0.67)	(1.17)	(0.46)	(1.49)
Percent w/One Occupant	50.0	12.5	22.0	22.2	63.0	30.9	60.2	35.6	68.8	33.1
Percent w/Two Occupants	40.0	24.3	56.0	31.8	33.3	36.1	35.0	37.9	31.3	28.5
Percent w/Three Occupants	6.0	18.6	12.0	17.8	0.0	14.3	3.9	12.2	0.0	15.3
Percent w/Four Occupants	0.0	21.0	10.0	14.8	3.7	11.0	0.0	9.5	0.0	11.0
Percent w/Five Occupants	2.0	12.1	0.0	7.8	0.0	5.0	1.0	3.5	0.0	5.9
Percent w/Six + Occupants	2.0	11.5	0.0	5.7	0.0	2.6	0.0	1.3	0.0	6.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of Vehicles Available										
Average	1.20	2.13	1.41	1.77	1.22	1.70	1.24	1.65	0.40	1.28
(Std. Dev.)	(0.57)	(1.09)	(0.70)	(1.03)	(0.68)	(1.03)	(0.65)	(0.94)	(0.50)	(1.03)
Zero	6.0	3.8	8.2	7.9	7.4	9.8	5.8	7.1	60.0	23.3
One	70.0	24.6	46.9	34.6	70.4	35.8	69.9	40.3	40.0	40.5
Two	22.0	40.6	40.8	37.7	14.8	35.3	18.4	37.1	0.0	25.1
Three	2.0	19.9	4.1	13.7	7.4	14.2	5.8	11.8	0.0	8.2
Four	0.0	7.7	0.0	4.5	0.0	3.6	0.0	2.9	0.0	2.1
Five +	0.0	3.4	0.0	1.6	0.0	1.3	0.0	0.8	0.0	0.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

	Fremont		San Mateo		Burlingame		Palo Alto		San Jose	
	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City
Household Size										
Average	1.84	2.82	2.05	2.35	1.41	2.13	1.50	2.22	1.67	2.98
(Std. Dev.)	(0.77)	(1.36)	(0.91)	(1.33)	(0.56)	(1.21)	(0.50)	(1.22)	(0.71)	(1.54)
Percent w/One Occupant	34.1	16.8	52.3	30.9	62.1	37.2	50.0	33.5	45.7	18.3
Percent w/Two Occupants	52.3	31.9	36.4	34.5	34.5	34.6	50.0	35.2	42.3	28.1
Percent w/Three Occupants	9.1	20.2	11.4	15.1	3.4	13.4	0.0	14.6	10.9	18.3
Percent w/Four Occupants	4.5	18.6	0.0	11.3	0.0	9.4	0.0	11.3	1.1	17.0
Percent w/Five Occupants	0.0	8.4	0.0	4.8	0.0	3.7	0.0	3.8	0.0	9.3
Percent w/Six + Occupants	0.0	4.1	0.0	3.4	0.0	1.7	0.0	1.6	0.0	9.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of Vehicles Available										
Average	1.52	2.08	1.55	1.72	1.36	1.64	1.21	1.81	1.48	2.01
(Std. Dev.)	(0.66)	(0.99)	(0.83)	(0.99)	(0.72)	(0.98)	(0.52)	(1.02)	(0.66)	(1.09)
Zero	2.4	3.2	6.1	7.2	3.6	7.9	0.0	6.0	2.9	5.9
One	50.0	23.6	47.6	37.3	67.9	42.0	84.2	35.2	52.3	26.5
Two	40.5	45.5	32.9	37.9	17.9	34.3	10.5	39.0	38.5	40.5
Three	7.1	19.5	12.2	12.8	10.7	11.2	5.3	13.7	6.3	17.8
Four	0.0	6.0	1.2	3.4	0.0	3.4	0.0	4.0	0.0	6.6
Five +	0.0	2.2	0.0	1.4	0.0	1.1	0.0	2.0	0.0	2.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The "Surrounding City" comprises the city which encompasses the project or projects.
The population for the housing project is not subtracted from the city's population.
Comparisons were made between the following cities and projects: Union City (Verandas Apts., Parkside Apts.); South Hayward (The Foothills Apts., Mission Heights Apts.); San Leandro (Summerhill Terrace Apts., Bayfair East, The Hamlet Apts.); Walnut Creek (Wayside Plaza, Park Regency); Oakland (Nobel Tower Apts.); Fremont (Mission Wells); San Mateo (Hillsdale Garden Apts., Grosvenor Park Condos.); Burlingame (Northpark Apts.); Palo Alto (Palo Alto Condos.); San Jose (Stonegate Circle Condos., Willow Glen Creek Condos., Bella Vista Apts., Park Almaden).
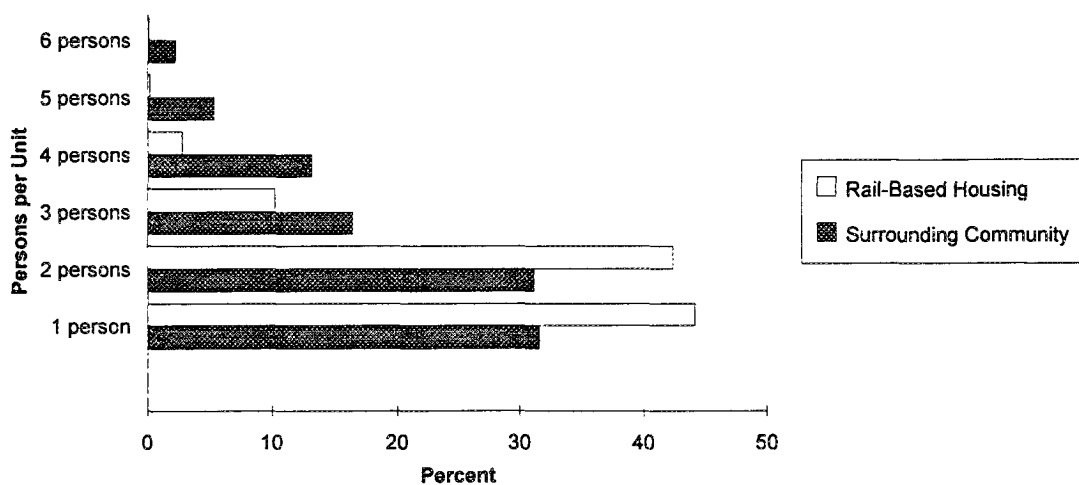Percentages may not add up to 100.0% due to rounding.

**Figure 2. Comparison of Persons Per Household,
Rail-Based Housing and Surrounding Community**

seems to average the fewest motor vehicles per household; BART also had the largest differential in vehicle availability between residents of rail-based housing and the surrounding county. Oakland's surveyed rail-based project, Nobel Tower Apartments (which lies a quarter mile from the Lake Merritt station), was the least auto-dependent, with 60 percent of the respondents owning no cars or trucks. Combining all pairs of data, Figure 3 shows a strong peak in single-car households for rail-based residents, while the surrounding community is evenly split between one- and two-car households. The average vehicles per households for rail-based housing is 1.40, as compared to 1.67 for the surrounding community.

As noted, vehicle ownership per household levels are lower for rail-based projects, as expected given that they also average fewer occupants. We might expect vehicle availability levels to be proportionally even lower (against matched cities and counties) than household sizes since the availability of rail transit should, in theory, reduce the need for owning a car. That is, vehicles per capita should be lower for rail-based housing. However, Figure 4 reveals that rail-based households average more vehicles per capita (0.81) than the surrounding community (0.70). This discrepancy may be attributable to the relatively high incomes of rail-based households (shown later in Tables 5, 6, and 9), which often correlate with higher vehicle ownership levels.

Demographic Characteristics

Tables 3 and 4 compare various sociodemographic characteristics of surveyed transit-based housing projects and surrounding counties and cities, respectively, for persons 17 years of age and over. [5] In both tables, statistics for the "control areas" — i.e., counties and cities — have been netted of individuals under 17 years of age to ensure comparability with surveyed projects.
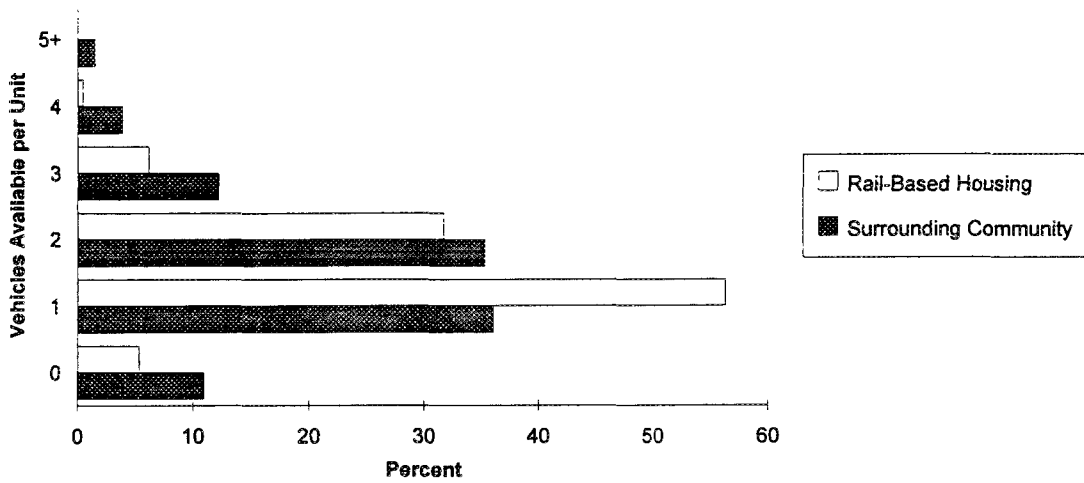
Figure 3. Comparison of Residential Units with Vehicles Available, Rail-Based Housing and Surrounding Community
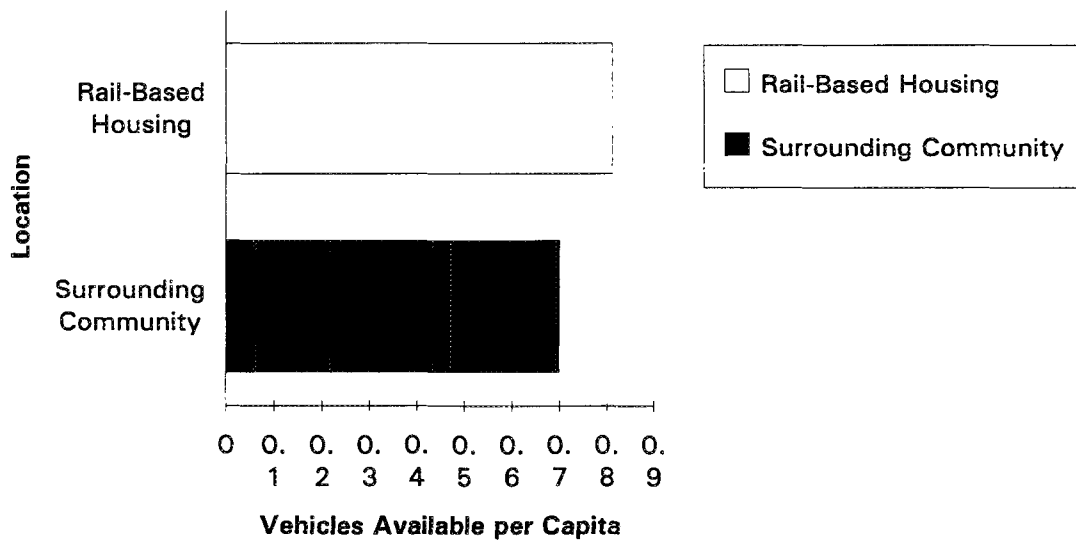

Figure 4. Comparison of Vehicles Available per Capita, Rail-Based Housing and Surrounding Community

Table 3
Comparison of Demographic Characteristics
of Rail-Based Housing and Surrounding Regions, by Rail System

	BART		CalTrain		SCCTA		SD Trolley		SRT	
	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region
Age (17+ years)										
Average	36.3	42.4	48.4	43.7	33.3	40.8	43.1	41.1	30.0	42.1
(Std. Dev.)	(14.7)	(17.1)	(18.8)	(17.4)	(10.5)	(16.5)	(19.3)	(17.7)	(11.8)	(17.3)
Percent 17-24 years	16.0	14.5	4.3	13.0	11.2	15.8	13.7	18.8	44.1	15.1
Percent 25-34 years	48.2	24.7	27.9	24.1	59.0	27.8	34.8	26.3	32.7	26.1
Percent 35-49 years	17.9	30.6	25.0	29.6	23.1	29.2	15.0	26.4	14.2	28.5
Percent 50-64 years	11.1	16.2	16.3	17.8	4.1	16.1	16.7	14.3	6.6	16.2
Percent 65+ years	6.9	13.9	26.4	15.6	2.6	11.1	19.8	14.2	2.4	14.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Percent Female	56.8	51.0	55.2	50.6	50.6	49.3	54.8	49.1	61.2	51.2
Ethnicity (percent)										
African-American	10.8	14.3	2.1	5.2	1.2	3.5	2.8	6.0	3.0	9.1
Asian-American	19.6	12.5	1.0	16.3	10.0	17.0	3.8	7.5	3.9	9.0
Hispanic	4.8	12.8	8.9	17.4	3.6	20.5	3.8	20.0	3.9	11.4
White	64.0	59.7	85.9	60.6	83.1	58.4	89.2	65.6	88.4	69.4
Other	0.8	0.7	2.1	0.5	2.0	0.6	0.5	0.8	0.9	1.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The "Surrounding Region" consists of the census data for the entire county or counties which encompass the housing project or projects. The project's data were not subtracted from the census data.
Comparisons were made between the following aggregations of projects (denoted by the transit system) and counties: BART-Alameda/Contra Costa; CalTrain-San Mateo; SCCTA-Santa Clara; SD Trolley-San Diego; SRT-Sacramento.
Percentages may not add up to 100.0% due to rounding.

(1) *Age.* In general, within the adult population, those residing in surveyed rail-based projects are younger than those in the surrounding cities and counties. This was especially the case for housing near SCCTA, SRT, and BART rail stations. Table 3 shows that for housing surveyed near all five rail systems, there were much higher shares of adults in the 25- to 34-year age group than in the control areas. These are people in the early to mid-stages of their life cycle, many of whom are saving to buy a home and thus seem attracted to apartments and condominiums near rail stops. Not all surveyed projects were populated predominantly by young adults, however. The Palo Alto Condominiums and Grosvenor Park Condominiums in San Mateo had significant shares of older residents, which gave higher-density, rail-based housing near the CalTrain commuter line a higher-density and older tenant age profile (Table 4). The surveyed housing project with the highest share of senior residents was the Noble Tower Apartments near the Lake Merritt BART station in Oakland.

Figure 5 summarizes the age distributions for rail-based housing projects versus surrounding cities, summed over all cities in the study. [1] The more youthful demographic profile of rail-based housing is underscored — it attracts proportionally large shares of adults in the 25-34 year age bracket.

(2) *Gender.* Tables 3 and 4 suggest that rail-based housing also have proportionally large numbers of female residents. For all five rail systems (Table 3) and for nine of the ten city pairs (Table 4), there were higher shares of women ages 17 and above living in the surveyed housing projects than in the surrounding area. One possibility is that rail-based housing attracts single-mother households and single

Table 4
Comparison of Demographic Characteristics
of Rail-Based Housing and Surrounding City, Bay Area

| | Union City | | Hayward | | San Leandro | | Walnut Creek | | Oakland | |
	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City
Age (17+ years)										
Average	30.9	40.2	33.9	41.7	36.6	47.0	37.1	49.2	72.6	42.8
(Std. Dev.)	(8.3)	(15.9)	(13.2)	(17.3)	(13.7)	(18.8)	(14.7)	(19.4)	(8.0)	(17.9)
Percent 17-24 years	15.9	16.8	21.8	15.7	16.7	11.1	13.6	9.5	0.0	14.8
Percent 25-34 years	59.4	24.9	47.4	27.1	38.9	22.1	47.1	18.2	0.0	25.2
Percent 35-49 years	18.8	34.0	14.1	27.2	25.0	24.9	20.7	27.0	0.0	29.3
Percent 50-64 years	5.8	14.8	14.1	16.4	13.9	18.6	13.6	18.3	5.6	14.8
Percent 65+ years	0.0	9.5	2.6	13.6	5.6	23.2	5.0	26.9	94.4	15.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Percent Female	50.7	50.5	59.3	50.9	58.8	52.1	59.3	53.7	66.7	52.3
Ethnicity (percent)										
African-American	9.5	8.3	21.1	9.4	19.4	5.7	1.7	0.8	22.2	43.2
Asian-American	33.3	31.6	21.1	14.9	9.7	13.5	11.8	6.6	55.6	14.5
Hispanic	6.3	24.9	1.3	23.4	6.5	14.5	4.2	4.6	0.0	13.2
White	50.8	34.5	55.3	51.3	64.5	65.6	80.7	87.8	22.2	28.5
Other	0.0	0.7	1.3	1.0	0.0	0.7	1.7	0.2	0.0	0.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

| | Fremont | | San Mateo | | Burlingame | | Palo Alto | | San Jose | |
	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City
Age (17+ years)										
Average	32.8	40.1	48.0	45.2	35.3	46.7	68.2	45.6	33.3	39.8
(Std. Dev.)	(9.2)	(15.3)	(17.3)	(18.4)	(12.8)	(19.1)	(16.1)	(17.7)	(10.5)	(16.0)
Percent 17-24 years	18.2	14.1	6.6	11.8	0.0	10.6	0.0	9.7	11.2	16.8
Percent 25-34 years	57.6	29.2	21.2	24.2	65.9	23.7	6.7	22.9	59.0	29.0
Percent 35-49 years	16.7	32.3	29.2	27.6	22.0	25.8	10.0	31.1	23.1	29.6
Percent 50-64 years	7.6	15.8	21.2	16.8	7.3	17.3	6.7	17.6	4.1	15.1
Percent 65+ years	0.0	8.6	21.9	19.6	4.9	22.7	76.7	18.7	2.6	9.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Percent Female	51.4	50.1	56.8	51.0	51.2	52.9	53.3	51.2	50.6	49.3
Ethnicity (percent)										
African-American	9.2	3.7	2.3	3.3	2.9	0.6	0.0	2.9	1.2	4.5
Asian-American	13.8	18.8	0.0	13.0	5.7	7.8	0.0	10.2	10.0	19.0
Hispanic	9.2	12.9	10.1	15.3	11.4	11.1	0.0	5.2	3.6	26.1
White	67.7	63.9	85.3	68.0	77.1	80.2	100.0	81.4	83.1	49.8
Other	0.0	0.7	2.3	0.4	2.9	0.4	0.0	0.3	2.0	0.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The "Surrounding City" comprises the census data for the city which encompasses the project or projects. The population for the housing project is not subtracted from the city's population.
Comparisons were made between the following cities and projects: Union City (Verandas Apts., Parkside Apts.); South Hayward (The Foothills Apts., Mission Heights Apts.); San Leandro (Summerhill Terrace Apts., Bayfair East, The Hamlet Apts.); Walnut Creek (Wayside Plaza, Park Regency); Oakland (Nobel Tower Apts.); Fremont (Mission Wells); San Mateo (Hillsdale Garden Apts., Grosvenor Park Condos.); Burlingame (Northpark Apts.); Palo Alto (Palo Alto Condos.); San Jose (Stonegate Circle Condos., Willow Glen Creek Condos., Bella Vista Apts., Park Almaden). Percentages may not add up to 100.0% due to rounding.

women, although this can only be inferred since the surveys did not directly inquire about type of household. It might also be noted that differences in female shares between surveyed housing and surrounding areas are not huge (perhaps with the exception of SRT), and could very well reflect sampling bias — i.e., larger shares of female respondents.
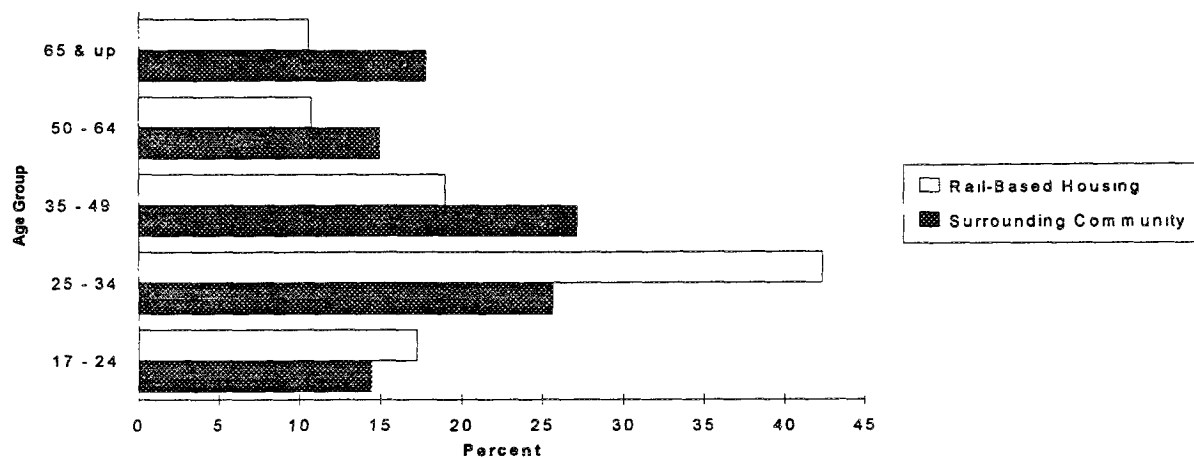
**Figure 5. Comparison of Age Distributions (Persons 17+ years),
Rail-Based Housing and Surrounding Community**

(3) *Ethnicity.* For all systems, Figure 6 illustrates that whites are represented proportionally more in rail-based housing than they are in the surrounding census tracts. Whites were the dominant ethnic group in all of the surveyed rail-based projects, with the exception of Oakland's Nobel Tower Apartments. The majority of adults responding to the survey in Noble Tower were Asian American. Asian Americans also constituted over 20 percent of rail-based households in Union City and Hayward. African Americans made up relatively large shares of residents in rail-based projects in Hayward and San Leandro, in addition to Oakland. Relative to the surrounding area, few Hispanics appear to live in the surveyed rail-based projects; the surrounding cities had far greater shares of Hispanics than did rail-based projects, especially in the cases of Union City, Hayward, and San Jose (Table 4).

While we suspect that whites make up the largest single ethnic group living in rail-based housing, their dominance is likely overstated by Tables 3 and 4. This is mainly because the survey response rate was probably much lower for other ethnic groups, particularly Hispanics. Since the mail-back questionnaires were printed only in English, those with limited English reading and writing skills, or for whom English is a second language, would have been more inclined to ignore the survey.

Employment Characteristics

Surveys also elicited information on the occupations and incomes of those 17 and over who are employed. Compared to surrounding areas, Tables 5 and 6 suggest that rail-based housing is attractive to large shares of managerial/professional and clerical/accounting workers. In contrast, relatively few workers in sales, services, and other occupations (including manufacturing, labor, and crafts) resided in rail-based housing. The two notable exceptions were the Noble Tower Apartments in Oakland and Palo Alto Condominiums, both of which had large shares of older residents and pensioners and, in the case of Noble Towers, large numbers of non-whites.
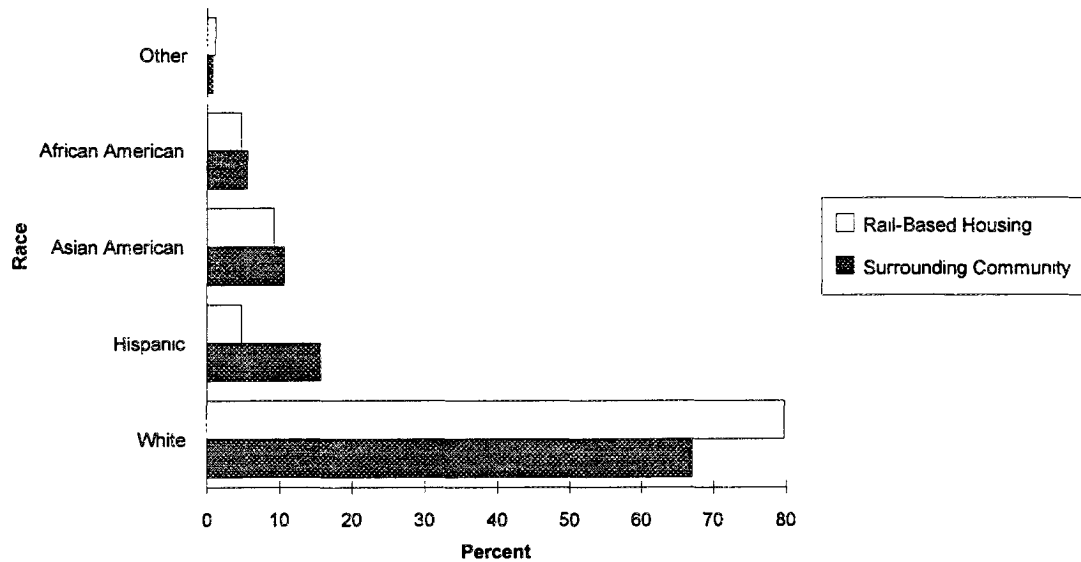
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**Figure 6. Comparison of Ethnicity (Persons 17 + years),
Rail-Based Housing and Surrounding Community**

Table 5
Comparison of Employment Characteristics
of Rail-Based Housing and Surrounding Region, by Rail System

	BART		CalTrain		SCCTA		SD Trolley		SRT	
	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region
Occupations — Percent										
Manager/Professional	48.7	37.7	39.5	35.6	64.6	41.1	38.9	34.5	33.9	33.3
Clerical/Accounting	22.4	17.6	21.0	18.7	17.5	15.9	25.9	15.9	19.3	20.1
Sales/Services	10.9	22.5	10.8	24.5	6.9	20.3	9.9	25.7	19.8	24.3
Other	18.0	22.2	28.7	21.2	11.0	22.8	25.3	23.9	27.1	22.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Annual Household Salary — Percent										
$0-$15,000	7.0	16.3	5.2	11.3	1.8	11.1	3.4	17.9	12.3	20.3
$15,000-$25,000	8.2	12.9	13.9	10.6	1.8	10.2	19.0	16.4	34.9	17.0
$25,000-$30,000	7.4	6.7	11.3	6.4	1.2	5.7	17.2	7.9	14.4	8.4
$30,000-$40,000	19.1	13.1	13.9	13.2	9.5	12.6	16.4	14.7	17.8	14.9
$40,000-$50,000	16.0	12.1	13.0	12.5	17.2	12.3	18.1	12.1	9.6	12.3
$50,000-$60,000	15.6	10.1	12.2	10.5	15.4	10.9	6.9	9.0	4.8	9.3
$60,000 + over	26.6	28.7	30.4	35.4	53.3	37.1	19.0	22.0	6.2	17.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The "Surrounding Region" consists of the census data for the entire county or counties which encompass the housing project or projects. The project's data were not subtracted from the census data.
Comparisons were made between the following aggregations of projects (denoted by the transit system) and counties: BART-Alameda/Contra Costa; CalTrain-San Mateo; SCCTA-Santa Clara; SD Trolley-San Diego; SRT-Sacramento.
Percentages may not add up to 100.0% due to rounding.

Figure 7 underscores the dominance of managerial, professional, clerical, and accounting occupations among tenants of California's rail-based projects. These two occupation categories account for over 68 percent of respondents from rail-based housing, while the surrounding community has only 54.1 percent of residents employed in these occupations. Sales and services occupations only accounted for 11.4

Table 6

Comparison of Employment Characteristics
of Rail-Based Housing and Surrounding City, Bay Area

| | Union City | | Hayward | | San Leandro | | Walnut Creek | | Oakland | |
	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City
Occupations — Percent										
Manager/Professional	57.6	26.6	38.2	26.3	42.4	29.0	54.4	49.5	20.0	36.2
Clerical/Accounting	18.2	20.9	23.7	20.6	18.2	21.3	23.2	16.0	0.0	17.6
Sales/Services	9.1	19.5	3.9	21.7	6.1	22.4	11.2	23.0	40.0	24.2
Other	15.2	33.0	34.2	31.3	33.3	27.3	11.2	11.4	40.0	22.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Annual Household Salary — Percent										
$0-$15,000	2.0	9.9	6.3	16.0	4.0	16.5	3.5	9.9	85.7	28.6
$15,000-$25,000	12.2	9.0	12.5	16.0	16.0	16.1	3.5	11.9	14.3	17.5
$25,000-$30,000	4.1	5.9	14.6	7.5	12.0	8.2	7.1	7.5	0.0	7.9
$30,000-$40,000	24.5	14.0	10.4	16.3	28.0	16.0	24.7	13.3	0.0	12.9
$40,000-$50,000	20.4	15.7	14.6	14.3	12.0	13.2	17.6	12.8	0.0	9.3
$50,000-$60,000	14.3	13.0	20.8	10.1	20.0	10.4	12.9	9.8	0.0	6.7
$60,000 + over	22.4	32.5	20.8	19.8	8.0	19.7	30.6	34.9	0.0	17.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

| | Fremont | | San Mateo | | Burlingame | | Palo Alto | | San Jose | |
	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City	Rail-Based Housing	Surrounding City
Occupations — Percent										
Manager/Professional	49.2	39.0	36.8	35.3	46.2	38.0	41.7	66.6	64.6	34.4
Clerical/Accounting	23.8	17.6	23.6	17.8	20.5	19.0	0.0	10.2	17.5	16.9
Sales/Services	15.9	19.9	12.3	25.4	10.3	26.8	0.0	15.1	6.9	21.8
Other	11.1	23.5	27.4	21.6	23.1	16.2	58.3	8.1	11.0	26.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Annual Household Salary — Percent										
$0-$15,000	9.5	7.8	7.8	11.6	0.0	10.8	0.0	10.7	1.8	11.9
$15,000-$25,000	2.4	8.4	14.3	11.5	13.8	12.5	11.1	8.9	1.8	10.9
$25,000-$30,000	2.4	5.3	10.4	7.2	13.8	7.0	11.1	4.5	1.2	5.9
$30,000-$40,000	9.5	12.6	13.0	15.4	17.2	15.7	11.1	11.5	9.5	13.0
$40,000-$50,000	14.3	14.1	10.4	13.2	20.7	12.9	11.1	9.5	17.2	12.8
$50,000-$60,000	16.7	12.8	10.4	10.7	13.8	9.9	22.2	8.9	15.4	11.6
$60,000 + over	45.2	39.0	33.8	30.5	20.7	31.1	33.3	46.0	53.3	34.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The "Surrounding City" comprises the city which encompasses the project or projects.
The population for the housing project is not subtracted from the city's population.
Comparisons were made between the following cities and projects: Union City (Verandas Apts., Parkside Apts.); South Hayward (The Foothills Apts., Mission Heights Apts.); San Leandro (Summerhill Terrace Apts., Bayfair East, The Hamlet Apts.); Walnut Creek (Wayside Plaza, Park Regency); Oakland (Nobel Tower Apts.); Fremont (Mission Wells); San Mateo (Hillsdale Garden Apts., Grosvenor Park Condos.); Burlingame (Northpark Apts.); Palo Alto (Palo Alto Condos.); San Jose (Stonegate Circle Condos., Willow Glen Creek Condos., Bella Vista Apts., Park Almaden).
Percentages may not add up to 100.0% due to rounding.

percent of those surveyed, while the surrounding census tract had 23.9 percent in these professions. The dominance of managerial, professional, clerical, and accounting occupations in rail-based housing were somewhat surprising and could be attributable to three factors. One, many of these occupations are found in downtowns, which universally are the workplace destination best served by rail. This could be evidence that many rail-based residents consciously seek out station-area locations because rail best serves their commute trips. Second, many professional, managerial, clerical, and accounting occupations tend to
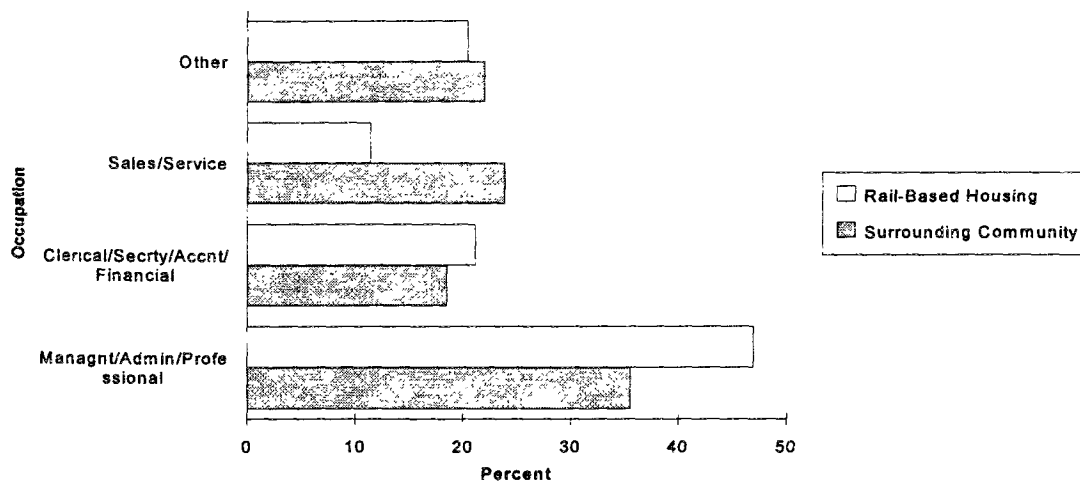
**Figure 7. Comparison of Occupations,
Rail-Based Housing and Surrounding Community**

be dominated by whites, which as already mentioned represented the majority of surveyed households. This large share of professionals, then, could partly reflect a high non-response rate among non-professionals. Third, responses might represent the skewed impressions by some of the kind of jobs they hold. Some people might be inclined to classify themselves as managers or professionals, even though their work might require low to moderate skill levels.

Because of the high share of respondents who were (or self-classified themselves as being) in professional fields, the annual incomes of rail-based households tended to be relatively high. Compared to the surrounding area, higher-income households were found living near rail stations of BART and the Santa Clara County light rail system in particular. Only in the case of Sacramento Regional Transit were rail-based housing projects inhabited mainly by comparatively low-income households. In general, the breakdowns of rail-based households by income matched those of the surrounding areas in the cases of CalTrain and the San Diego Trolley. [6]

Figure 8 summarizes the annual income profiles of rail-based housing versus surrounding communities for all 27 surveyed sites. Among all respondents for the five systems under study, the largest share of households were those earning in excess of $60,000. 27.9 percent of respondents were in this category, as compared to 20.6 percent for the surrounding communities. The largest differential between the two study groups was at the $0-$15,000 income level. This income group made up 19.7 percent of the surrounding census tracts, while only 6.1 percent of those in rail-based housing fell into this group.

5. Household and Sociodemographic Contrasts of Rail-Based and Neighborhood Residents

This analysis complements the previous one; however, stronger geographic controls have been introduced since households within the same general vicinity are compared. Since surveyed respondents live in
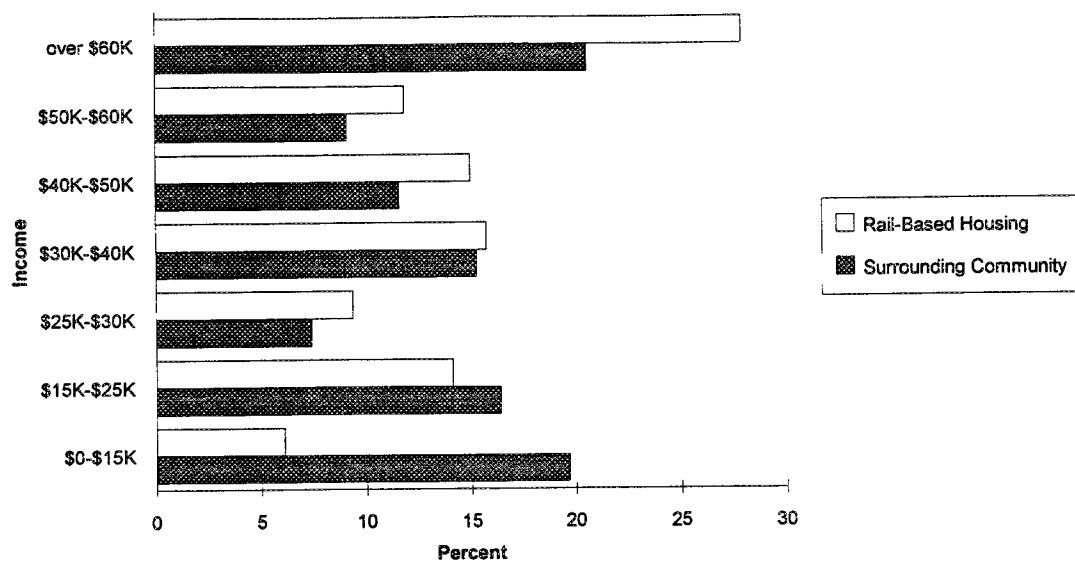
Figure 8. Comparison of Household Income, Rail-Based Housing and Surrounding Community

the highest-density housing in each vicinity, more than anything, the comparisons presented contrast household, sociodemographic, and employment characteristics for high-density housing near rail stations versus low-density (predominantly single-family) housing farther away but still in the same general vicinity.

Household Characteristics

Even within the same immediate vicinity, Table 7 shows that California's rail-based households contain relatively few people. Across all rail systems, more dense, rail-based housing consistently has larger shares of 1-2 person households than other nearby housing. The biggest difference in large households is seen in the case of Santa Clara County — among surveyed rail-based projects there, only 1.1 percent of households have more than three occupants, compared to over a third of all other households within the same census tracts as the rail-based projects. Only 50 percent of units surveyed along the Santa Clara light rail line were one-person households, while over 54 percent of San Diego's units were two-person households.

Rail-based projects also tend to have fewer vehicles per household, the only exception being denser housing close to CalTrain stations. Across all rail systems, no more than 11 percent of rail-based households have more than two motor vehicles, with BART and San Diego Trolley having the lowest share of 3+ vehicle households. For all systems, the majority of households had only one vehicle. This fact could prove to be important to developers when trying to negotiate with banks and cities over lowering parking requirements for their rail-based housing projects. In terms of vehicles per capita, BART and SD Trolley

Table 7
Comparison of Household Characteristics
of Station-Area Projects versus Surrounding Neighborhoods, by Rail System

	BART		CalTrain		SCCTA		SD Trolley		SRT	
	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region
Household Size										
Average	1.66	2.39	1.83	1.96	1.67	2.94	1.93	2.39	1.64	2.49
(Std. Dev.)	(0.81)	(1.37)	(0.85)	(1.25)	(0.71)	(1.50)	(0.78)	(1.27)	(0.74)	(1.32)
Percent w/One Occupant	48.6	32.7	41.2	47.9	45.7	18.5	29.0	28.4	50.7	25.4
Percent w/Two Occupants	41.7	29.2	39.0	29.4	42.3	28.1	54.3	34.0	35.8	34.5
Percent w/Three Occupants	5.9	16.8	15.4	9.7	10.9	18.9	11.6	17.2	12.2	17.5
Percent w/Four Occupants	2.8	12.8	4.4	7.3	1.1	17.6	5.1	13.2	1.4	14.0
Percent w/Five Occupants	0.7	4.7	0.0	3.1	0.0	8.9	0.0	5.3	0.0	5.5
Percent w/Six + Occupants	0.3	3.8	0.0	2.6	0.0	7.9	0.0	1.9	0.0	3.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of Vehicles Available										
Average	1.26	1.61	1.46	1.44	1.48	1.92	1.47	1.75	1.46	1.79
(Std. Dev.)	(0.68)	(1.11)	(0.78)	(1.08)	(0.66)	(1.16)	(0.66)	(1.06)	(0.74)	(1.20)
Zero	8.7	13.1	4.7	15.5	2.9	7.5	3.0	8.0	4.2	10.6
One	61.5	36.1	57.4	42.6	52.3	27.7	51.1	35.7	54.9	29.7
Two	24.8	34.1	26.4	30.5	38.5	40.1	42.9	36.6	31.7	38.7
Three	4.9	12.1	10.9	6.5	6.3	16.9	1.5	13.8	8.5	13.9
Four	0.0	3.3	0.8	3.3	0.0	5.5	1.5	4.4	0.7	5.1
Five +	0.0	1.4	0.0	1.6	0.0	2.2	0.0	1.4	0.0	2.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The "Surrounding Census Tract" consists of the census tract which encompass the housing project, with the estimated number of household occupants or estimated number of vehicles per household for rail-based housing projects subtracted from the corresponding census tract.
Percentages may not add up to 100.0% due to rounding.

had the lowest ratios for rail-based residents, both averaging 0.76 vehicles/adult. The largest ratios were for SRT and SCCTA, both at 0.89 vehicles/person. The largest differential was for SCCTA, with respondents averaging 0.89 vehicles/adult in comparison to only 0.64 for the surrounding communities. For all systems, rail-based housing had higher ratios of vehicles per person. This again can be partially attributed to the higher incomes of rail-based housing respondents, in comparison to the surrounding communities.

Sociodemographic Characteristics

Table 8 confirms what was found previously: California's rail-based projects tend to have large shares of young, white households with female members. Only in the case of the CalTrain commuter line did relatively dense housing projects near stations average older residents than those in the immediately surrounding lower-density housing. The majority of residents living in apartments and condominiums near stations of the other four rail systems were under 34 years of age. Rail-based projects also consistently had larger shares of female adults than did single-family homes and other kinds of nearby housing.

Only in the case of dense housing near BART were there larger shares of African Americans and Asian Americans than in other housing in the immediate vicinity. Except for BART, more than eight out of ten households in rail-based projects were white. All rail-based projects appear to be underrepresented by Hispanics, especially those near Sacramento light-rail stations, although this again is likely attributable, at least in part, to higher survey non-response rates among Hispanic households.

Table 8
Comparison of Demographic Characteristics
of Station-Area Projects versus Surrounding Neighborhoods, by Rail System

	BART		CalTrain		SCCTA		SD Trolley		SRT	
	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region
Age (17+ years)										
Average	36.3	42.05	48.4	46.47	33.3	41.04	43.1	44.21	30.0	41.8
(Std. Dev.)	(14.7)	(17.7)	(18.8)	(20.0)	(10.5)	(17.0)	(19.3)	(19.1)	(11.8)	(18.0)
Percent 17-24 years	16.0	14.5	4.3	10.5	11.2	15.3	13.7	14.7	44.1	16.9
Percent 25-34 years	48.2	26.6	27.9	27.4	59.0	26.0	34.8	24.5	32.7	22.7
Percent 35-49 years	17.9	28.5	25.0	25.3	23.1	30.1	15.0	24.4	14.2	25.9
Percent 50-64 years	11.1	14.1	16.3	11.8	4.1	14.7	16.7	15.9	6.6	18.9
Percent 65+ years	6.9	16.2	26.4	25.0	2.6	13.8	19.8	20.6	2.4	15.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Percent Female	56.8	49.3	55.2	52.6	50.6	50.1	54.8	53.3	61.2	48.6
Ethnicity (percent)										
African-American	10.8	9.9	2.1	2.1	1.2	3.2	2.8	2.8	3.0	5.3
Asian-American	19.6	15.6	1.0	8.0	10.0	15.7	3.8	1.8	3.9	6.8
Hispanic	4.8	17.3	8.9	12.0	3.6	24.2	3.8	10.8	3.9	11.3
White	64.0	56.3	85.9	77.7	83.1	56.3	89.2	83.7	88.4	75.1
Other	0.8	0.9	2.1	0.2	2.0	0.6	0.5	0.8	0.9	1.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The "Surrounding Census Tract" consists of the census tract which encompasses the housing project, with the estimated population for the housing project subtracted from the census tract population.
The population for the housing projects was estimated by multiplying the number of units in each project by that projects average household size.
Percentages may not add up to 100.0% due to rounding.

Employment Characteristics

Table 9 reaffirms the tendency of rail-based projects to house white-collar workers. This is especially so for the condominiums and apartments near Santa Clara's light-rail line, many of which were marketed to young professionals working in downtown San Jose and the Silicon Valley on the northern end of the line. Rail-based projects have relatively few sales and service industry workers compared to other housing in the immediate vicinity. This could reflect the tendency of these workers to be more auto-dependent (e.g., business salespeople) and to work outside of downtown (e.g., retail sales in suburban shopping malls).

Table 9 reinforces the previous finding that rail-based households tend to have higher income profiles than other nearby housing. Over 55 percent of surveyed households in denser housing near BART, CalTrain, and Santa Clara County rail stations had annual incomes above $40,000, whereas in none of these cases did more than half of other nearby households earn as much. Only in the case of Sacramento did rail-based projects tend to attract relatively low-income households.

6. Comparisons of Spatial and Modal Patterns of Commuting Among Rail-Based and Surrounding Residents

Perhaps one factor that most distinguishes residents of housing near rail stations is their tendency to work downtown and in other locations well served by transit. Is living near rail-transit a self-selecting process whereby residents seek out locales with superior accessibility to major employment centers in the

Table 9

Comparison of Employment Characteristics
of Station-Area Projects versus Surrounding Neighborhoods, by Rail System

	BART		CalTrain		SCCTA		SD Trolley		SRT	
	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region	Rail-Based Housing	Surrounding Region
Occupations — Percent										
Manager/Professional	48.7	32.1	39.5	45.7	64.6	33.0	38.9	35.5	33.9	37.3
Clerical/Accounting	22.4	19.4	21.0	15.6	17.5	18.2	25.9	17.7	19.3	20.6
Sales/Services	10.9	23.3	10.8	23.0	6.9	21.9	9.9	27.0	19.8	25.3
Other	18.0	25.2	28.7	15.8	11.0	26.9	25.3	19.9	27.1	16.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Annual Household Salary — Percent										
$0-$15,000	7.0	19.1	5.2	18.0	1.8	14.6	3.4	19.3	12.3	29.0
$15,000-$25,000	8.2	18.3	13.9	13.9	1.8	14.8	19.0	19.7	34.9	11.5
$25,000-$30,000	7.4	8.2	11.3	5.0	1.2	7.4	17.2	7.4	14.4	8.0
$30,000-$40,000	19.1	15.2	13.9	15.5	9.5	17.4	16.4	16.3	17.8	11.4
$40,000-$50,000	16.0	12.0	13.0	12.3	17.2	11.6	18.1	11.0	9.6	10.3
$50,000-$60,000	15.6	8.0	12.2	8.9	15.4	10.7	6.9	9.8	4.8	9.8
$60,000 +	26.6	19.2	30.4	26.5	53.3	23.5	19.0	16.5	6.2	19.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The "Surrounding Census Tract" consists of the census tract which encompasses the housing project, with the estimated population for the housing project subtracted from the census tract population.
The population for the housing projects was estimated by multiplying the number of units in each project by that projects average household size.
Percentages may not add up to 100.0% due to rounding.

region? Do more persons who live in rail-based projects work in San Francisco and Oakland, places to which BART offers frequent service, than in surrounding communities?

Voith (1991) has examined residential location choice in greater Philadelphia as a function of employment accessibility. This "residential sorting" suggests that people will naturally locate in areas which have a comparative accessibility advantage to places of employment. In the Philadelphia metropolitan area, Voith estimated that census tracts with commuter rail service nearby had 12 percent more of their residents working in downtown Philadelphia than did surrounding census tracts. Like BART, the Philadelphia system primarily delivers suburban commuters to the CBD.

Methodology

Residential sorting was examined for three sets of housing projects along the BART system. As shown in Map 1, the projects are clustered around the Bay Fair/South Hayward area, the Fremont/Union City area, and the Pleasant Hill BART station. Three sources of data were used in exploring whether residential sorting was a factor in influencing the decision to reside near BART. To identify the Journey-To-Work (J-T-W) characteristics of those living near BART, travel diary data compiled by NTRAC were utilized. These data recorded the city and zip code of trip origins and destinations (Cervero, 1993). Tables 10 and 11 label J-T-W trips, sorted by employment destination, as "Rail-based Housing." [7]

1990 U.S. census data were used to define the commuting patterns of all residents in a subregion served by BART, as opposed to just the residents of rail-based housing. This provided a control, or comparison, group. The origins and destinations of 1990 J-T-W trips were sorted by superdistricts, defined by the San Francisco Bay Area Metropolitan Transportation Commission (MTC). In general, superdis-

Table 10

Comparison of Workplace Locations: Rail-Based Housing versus Surrounding Cities

Destination	Fremont/Union City		Hayward/San Leandro		Pleasant Hill	
	Rail-Based Housing	Surrounding Area[1]	Rail-Based Housing	Surrounding Area[2]	Rail-Based Housing	Surrounding Area[3]
San Francisco	14.3	4.8	17.9	7.5	37.9	11.3
Oakland	8.3	4.5	25.3	17.4	12.1	5.9
Albany/Berkeley/ Emeryville	3.0	0.9	3.2	3.0	4.8	2.9
San Jose	6.8	2.8	1.1	0.6	2.4	0.1
Pleasant Hill/ Walnut Creek	0.8	1.3	2.1	1.7	15.3	60.6
Remainder of Bay Area	66.9	85.7	50.5	69.8	27.4	19.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

Notes: [1]MTC Super District 16.
[2]MTC Super District 17.
[3]MTC Super District 21.

Table 11

Comparison of Workplace Locations: Rail-Based Housing versus Surrounding Census Tracts

Destination	Fremont/Union City		Hayward/San Leandro		Pleasant Hill	
	Rail-Based Housing	Surrounding Area[1]	Rail-Based Housing	Surrounding Area[1]	Rail-Based Housing	Surrounding Area[1]
San Francisco	14.3	3.7	17.9	4.2	37.9	5.9
Oakland	8.3	2.8	25.3	8.9	12.1	4.1
Albany/Berkeley/ Emeryville	3.0	0.2	3.2	1.3	4.8	1.4
San Jose	6.8	9.1	1.1	1.4	2.4	0.8
Pleasant Hill/ Walnut Creek	0.8	0.3	2.1	0.1	15.3	11.0
Remainder	66.9	83.9	50.5	84.1	27.4	76.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

Note: [1]Source: Bay Area Travel Survey (BATS) Data

Percentages may not add up to 100.0% due to rounding.

tricts correspond to sub-regions that are 5 to 10 miles in radius, and even larger for the periphery of the Bay Area. Because superdistricts closely match the geographic breakdowns for destination data from the surveys of rail-based housing, they were best suited for comparing commute patterns.

A third data source for studying the incidence of residential sorting was the 1990 Bay Area Travel Study (BATS). J-T-W destinations using BATS data were broken down by census tracts, providing a more

refined geography for defining destination than superdistricts. Large Bay Area employment centers were designated by aggregating contiguous census tracts that had at least 4,000 employees per square mile.

The BATS work destinations were identified as concentrations of employment. For example, San Francisco's primary employment center is the financial district (an area well served by BART). With the BATS data, the San Francisco destination was defined as the cluster of census tracts encompassing the downtown core. [8] On the residential end, the J-T-W destinations for census tracts that encompass the surveyed BART projects were examined. [9]

Findings

Table 10 compares the workplace locations of residents of the surveyed rail-based housing projects with those of residents of surrounding areas. Residential sorting by employment destination is evident for all three transit-based housing submarkets. For instance, 22.6 percent of work trips by surveyed residents of rail-based housing in Fremont and Union City are to San Francisco or Oakland, destinations well served by BART. In comparison, only 9.3 percent of all residents in the Fremont/Union City area (MTC Super District 16) commute to these two cities. Likewise, 43.2 percent of work trips by residents living near Hayward and San Leandro BART stations are to San Francisco or Oakland, compared to 24.9 percent of all residents of Hayward/San Leandro (MTC Super District 17). Residential sorting appears to be most prevalent among residents of the Pleasant Hill station area. Half of all work trips by surveyed residents living near the Pleasant Hill stations are to San Francisco or Oakland. In contrast, only 17.2 percent of commutes by areawide residents (MTC superdistrict 21) are to these two cities.

Some degree of residential sorting is also evident for those commuting to smaller urban centers (e.g., Albany/Berkeley/Emeryville), although the pattern is not as strong. Several interesting relationships stand out. One, more residents of rail-based housing in Fremont and Union City work in downtown San Jose (an area *not* served by BART) than do residents of the surrounding superdistrict. Second, relatively few residents of rail-based housing in Pleasant Hill work nearby — instead, significant numbers work in San Francisco and Oakland, clearly choosing to reside near BART to expedite their commute. Table 11 compares the same survey data for residents of rail-based housing versus data from the Bay Area Travel Study (BATS) data. BATS data have been broken down by census tract, allowing a direct comparison between the origins of commutes recorded by the BATS data and by the NTRAC survey of residents of rail-based housing. The destination end is more problematic. Because the survey of station-area residents merely asked for a destination city, it uses a larger geographic unit in defining destination than the BATS data. Accordingly, it is expected that smaller shares of residents from surrounding areas (as recorded by BATS) would be to BART-served destinations.

Table 11 shows that for all three clusters, rail-based housing has a higher percentage of commuters with San Francisco or Oakland destinations when compared to residents of the surrounding census tract. In the case of the Fremont/Union City and Hayward/San Leandro station areas, three times the

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share of residents of rail-based housing worked in San Francisco and Oakland as residents of the entire surrounding census tract. In the case of Pleasant Hill, there was a five-fold differential. Collectively, these findings strongly suggest that many people working in San Francisco or Oakland are indeed sorting into rail-based housing near BART. The case is particularly strong for the Pleasant Hill BART station area.

7. Conclusion

As was expected, California's rail-based projects appear to appeal most to young households without children or very many cars. Unexpected, however, were the large shares of households with professional workers making relatively good salaries and the dominance of white households. This latter finding could reflect some degree of survey bias. More likely, however, is the tendency of many white-collar workers with jobs downtown to consciously seek out condominiums and apartments near rail stops so they can easily rail commute. For most rail-based projects in the East Bay suburbs, the share of residents who work in San Francisco was between two and three times as high as the share in surrounding superdistricts. It appears that the incidence of residential sorting is relatively high among residents of rail-based housing in the Bay Area. The classical model of residential location, wherein households trade-off housing and commuting costs, also seems to be validated by these finding. That is, many people choosing to locate near California's rail stations seem willing to trade-off less housing (in the form of comparatively dense apartments and condominiums) for a lower cost and easier commute.

Market profiles are valuable to those in the business of building housing projects. This research suggests that those interested in building apartments and condominiums near California's rail stations should concentrate mainly on satisfying the housing preferences of young, childless households as well as other niche markets, such as seniors. Builders should also recognize, however, that a number of downtown workers earning professional wages seem attracted to rail-based housing. Projects with more amenities and which cater to the tastes and preferences of young professionals drawing relatively high salaries would likely appeal to many seeking out residences close to rail. One example of this is the Park Regency Apartment development near the Pleasant Hill BART station. This high-amenity complex, complete with a pool, spa/sauna, and recreational building, is an upmarket address for multi-family living in the Walnut Creek area. Eighty percent of respondents from this complex were in the 17- to 34-year-old range, and over 50 percent earned more than $40,000 annually.

A number of public policy initiatives would likely encourage even larger numbers of Californian households to seek out rail station locations. In recognition of the relatively low number of automobiles per rail-based household, zoning standards could be relaxed to allow fewer parking stalls per unit in complexes near rail stations. One option would be to provide just one parking space per unit, and give tenants the option of paying a surcharge for a second parking stall at a central location. Lower parking standards would translate into lower rents. Another fairly novel policy would be to have banks grant

those living in rail-based condominiums an "efficient-location" loan (Holtzclaw, 1994). Under such a program, if transit-based housing is believed to lower transportation costs, then these savings would be subtracted from principal, interest, taxes, and insurance when calculating mortgage qualification. Holtzclaw (1994) estimates the automobile cost savings from living in a transit-oriented, pedestrian-friendly environment can be substantial: a family in San Francisco's Nob Hill neighborhood spends an average of $6,000 a year less on automobile expenses than a family of similar size and income living in San Ramon, a newer East Bay suburb. Another way to lower the cost of rail-based housing would be to grant developers of such projects a local tax abatement or credit against impact fees since tenants of such projects tend to use transit more often, thus placing less of a burden on local road infrastructure (Cervero, 1993).

As pointed out in this research, just lowering costs is not necessarily the most effective way of luring more people to rail station areas. Many prospective tenants likely want to live in a complex with attractive amenities, even if it costs more. However, cutting costs does not have to mean cheaper quality housing. The objective would seem to be to introduce policies that help lower costs of transit-based housing, in recognition of the social benefits it provides, so that more people can find good deals for whatever class of housing they choose. Overall, any move to expand market choices while also reward-ing developers and tenants of rail-based housing, if only marginally, would be a positive step in attracting more Californians to residences near transit.

NOTES

[1]Source: U.S. Census Bureau, Summary Tape File 3-A.

[2]Coefficient of variation is the normalized standard deviation — i.e., standard deviation divided by the mean. The coefficients of variation for household size for rail-based projects were in the 0.40-0.47 range for all five systems, compared to the coefficients for counties, which were all in the 0.50-0.59 range.

[3]The comparisons for Oakland and Palo Alto are somewhat problematic because only one rail-based project was surveyed in each community.

[4]For all figures shown, comparisons are drawn for the five rail systems studied — BART, Santa Clara County light rail, CalTrain, San Diego Trolley, and Sacramento Regional Transit.

[5]In the original surveys, data on sociodemographic characteristics of households were compiled only for individuals above 17 years of age. See Cervero (1993) for further details.

[6]San Diego County's large share of very low-income households, in the under $15,000 annual income group, stems mainly from its large enlisted military population.

[7]Because destinations were coded at the sub-regional level (i.e. Albany/Berkeley/Emeryville) we were unable to identify specific destinations within cities. For example, many respondents recorded San Francisco as their work destination on the survey, as opposed to a more specific location, such as the financial district. Because locational data were aggregated, comparison data, such as the MTC superdistricts, also had to be aggregated (e.g., the four superdistricts for the city of San Francisco were combined).

[8]The census tracts used in identifying the San Francisco CBD are: 101-125, 128-135, 151-155, 157-160, 164-166, 168.98, 169, 177-178, 179.01, 180, 202.98, 202.98, 203, 205, 208-211, 214, 226-229, 253, 607, and 609.

[9]For example, BATS data for the census tracts that encompass the three projects located near the Fremont/Union City area, (Mission Wells, census tract 4419.01; Verandas tract, 4403.09; and Parkside tract, 4403.08) were aggregated and compared to the NTRAC travel diary data for the three projects. A direct comparison between the BATS data and the NTRAC survey data is problematic due to differences in the definition of "destination," and thus should be viewed as a coarser gauge of residential sorting.

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