

SECTION 4

STRATIFICATION OF THE STUDY AREA AND STATISTICAL SAMPLE

4.1 OVERVIEW

Because of the larger number of census tracts and households in the Bay area, statistical sampling was required to implement both hedonic and survey methods; the same census tract sample was used for both. In order to be able to extrapolate from the sample to the Bay area as a whole, stratified sampling was used. Strata were defined in terms of socioeconomic characteristics, air quality characteristics, and market location. Procedures for defining the strata and sampling are described below.

4.2 ANALYSES OF CITY AND TRACT TYPES

4.2.1 City Typology

The methodology for defining "types" (based on factor and cluster analysis) was used at the city level mainly to test the procedures to see that reasonable results were produced.

A preliminary factor analysis was performed on 22 city level variables for the 73 cities in the Bay Area. The list of variables used in the analysis is shown in Table 11; these variables have been used in previous property value studies. There is correlation between these variables; factor analysis groups these variables into factors which are maximally uncorrelated. Three factors accounted for 67.7% of the variance for the 22 variables. By considering the factor pattern matrix, (which defines the variables associated with each factor), an interpretation can be given to the factors; "socioeconomic status" of occupants (**SES**), "**life**" (age and family size), and "**cityness**". Table 12 gives the factor pattern matrix in terms of these factors.

In addition to three factors, a growth rate variable was also used to classify cities. Most socioeconomic data used for the factor analysis was from the 1970 census; some areas have changed over the past 10 years. The growth rate is an indicator of how accurately an area is represented by the 1970 census data; for example a fast growing area may be less well-represented by 1970 census data than a slow growing city. The growth rate variable is computed as the percent change in city population between 1970 and 1978. The growth rate variable was not significantly correlated with any of the other factors.

Table 11

LIST OF VARIABLES USED
IN FACTOR ANALYSIS: CITY CLUSTERING

<u>Name</u>	<u>Definition</u>
POP78	1978 city population
DENS	Population density 1975 (POP 75/Land)
EMPOP	Employment in city (1975)/POP1975
EMRSTR	% of person work trips originating and ending within the area
HSGRDP	% of persons over 25 graduated from high school
CTAX	City tax rate per \$100 assessed value
FIRE	1979 rating of fire protection quality (low rating is good)
CRIMRA	Crime rate, 1978
NONWH	% nonwhite, 1979 pop.
MEDINC	Median family income, 1979
POVP	% families below poverty level, 1969
AGE65	% 65 and over, 1969
UNITLP	% single units, 1969
OWNOCC	% owner occupied units
MEDAGE	Median age
CHILD	% families w/children 19 and younger
MEDSCH	Median years school completed
BLUEP	% employed in blue collar jobs
MEDOCC	Median number of occupants in owner occupied units
NEWHSP	% new housing units 1960-75
SCORES	School scores
PROFP	Local serving employment 1975/ total employment 1975

Table 12

FACTOR DEFINITION FOR CITY CLUSTERING

	<u>SES</u>	<u>Life</u>	<u>Cityness</u>
POP78	-.23361	-.10521	.78800*
DENS	-.22100	-.44705	.57161
EMPOP	-.31407	-.29485	-.05049
EMRSTR	-.18306	.06332	.70605*
HSGRDP	.95902*	-.02481	.03900
CTAX	-.40348	-.34669	.61039*
I? IRE	-.08414	.11963	- .71886 *
CRIMRA	-.721.31*	-.29729	.18534
NONWH	-.86170*	-.06188	.05641
MED INC	.82629	-.02255	-.12795
POVP	-.82709*	-.28119	.03326
AGE65	.06022	-.63610	.14835
UNITLP	.41228	.56363	-.32169
OWNOCC	.50462	.58439	-.14063
MEDAGE	.46527	-.76828*	-.04126
CHILD	-.00674	.94449	-.03346
MED S CH	.88101:	-.15546	-.03073
BLUEP	-.86917*	.32446	-.04320
MEDOCC	.10699	.94946*	.00294
NEWSHP	.05118	.79436*	-.01911
SCORES	.87116*	-.04951	- .15994
PROFP	.47265	-.09696	-.03388

*denotes correlated variables within a factor which define the factors.

Cluster analysis (as described in Appendix B) was used to define city types based on the above three factors and the growth rate variable. The number of "clusters" (city types) was determined by considering the reduction in squared error as related to the number of clusters. It was found that six clusters gave a maximum reduction in error per cluster. Figure 8 describes the characteristics of the six resulting city clusters.

The clusters of cities break down basically into urban (high on "cityness") and suburban (moderate or low on "cityness") types. The urban type is characterized by lower growth and an older population with a moderate socioeconomic status. The suburban types are differentiated according to socioeconomic status and all types (low, moderate, high) occur. The highest socioeconomic status type is associated with an older age and a low growth rate. The highest growth rate types (cluster 3 and 4) is associated with a younger population.

Table 13 shows the assignment of cities according to the six types. The clustering basically conforms to subjective notions of city types. The urban type includes Berkeley, Oakland, and San Francisco. West Bay cities are all in either cluster one or cluster six. The East Bay includes cities from one, two, and six.

4.2.2 Census Tract Typology

According to the 1970 Census, the six counties of the Bay Area are divided into 946 tracts. For each of these tracts, detailed demographic and socioeconomic data is available. The Bay Area includes a variety of tracts, from large, low density, rural tracts and small, high density tracts common to San Francisco.

Initially, certain of these tracts were eliminated from our sample, excluded were tracts in which no house sales were recorded in 1978, tracts in unincorporated areas, unusual tracts (e.g., dominated by institutional facilities such as prisons, state hospitals, universities, seminaries, etc.) and tracts with missing data. After the initial elimination process, the remaining 784 tracts were used in the factor and cluster analyses.

Tract types were defined using procedures similar to the method for cities. Again, factor analysis was used as a first step to group correlated variables. Table 14 shows the variables used in the factor analysis. Table 15 shows the factor pattern matrix. From this matrix, the first factor (designated by "life") is associated with age of residents and family size. The second factor (SES) characterizes the socioeconomic status of tract residents (educational level, income, occupation, ethnicity, etc.). Factor three ("owner") pertains to the housing type and ownership characteristics of the neighborhood (owner vs. renter-occupied housing, percent single unit structures and percent of housing with recent turnover). The fourth factor indicates the degree of development within a tract (percent vacant land, residential land acreage and the amount of land allocated to roads). These four factors explain 75.5 percent of the variation of the original 21 variables.

Figure 8

CITY CLUSTER CHARACTERISTICS BY FACTOR

Cluster Number	S E S			Life		Cit yness			Growth		
	Low	Moderate	High	Young	Old	Low	Moderate	High	Low	Moderate	High
1			X		X		X		X		
2	X			X		X				X	
3		X		X			X				X
4		X		X		X					X
5		X			X			X	X		
6		X		X			X			X	

Table 13

CLUSTER MEMBERSHIP TABLE

<u>Cluster 1</u>	<u>Cluster 2</u>	<u>Cluster 3</u>	<u>Cluster 4</u>	<u>Cluster 5</u>	<u>Cluster 6</u>
High Socioeconomic Moderate Life Cycle Suburban <u>Moderate Growth</u>	Low Socioeconomic Moderate Life Cycle Suburban-Rural <u>Moderate Growth</u>	Moderate Socioeconomic Young Life Cycle Suburban <u>High Growth</u>	Moderate Socioeconomic Young Life Cycle Suburban-Rural <u>High Growth</u>	Moderate Socioeconomic Old Life Cycle Urban <u>Low Growth</u>	Moderate Socioeconomic Moderate Life Cycle Suburban <u>Moderate Growth</u>
Albany Atherton Belmont Belvedere Burlingame Corte Madera Cupertino El Cerrito Fairfax Hillsborough Lafayette Larkspur Los Altos Los Altos Hills Los Gatos Menlo Park Millbrae Mill Valley Monte Sereno Moraga Palo Alto Piedmont Portola Valley Rosau San Anselmo San Carlos San Mateo San Rafael Saratoga Sausalito Tiburon Walnut Creek Woodside	Brentwood Brisbane Emeryville Gillroy Pittsburg Richmond San Pablo	Clayton Foster City Half Moon Bay Morgan Hill Pleasanton Union City	Hercules	Berkeley Oakland San Francisco	Alameda Antioch Campbell Concord Daly City Fremont Hayward Livermore Martinez Milpitas Mountain View Newark Novato Pacifica Pinole Pleasant Hill Redwood City San Bruno San Jose San Leandro South San Francisco Sunnyvale

Table 14

LIST OF VARIABLES USED IN FACTOR
ANALYSIS: TRACT CLUSTERING

<u>Name</u>	<u>Definition</u>
PCT65	% of population 65 years or older
MEDAGET	Median age of tract residents
CHILDT	% of families with children 0-19
MEDS CHT	Median years of school completed
HSGRDPT	% of persons over 25 graduated from high school
PCTPOV	% of all families with income below poverty level
MEDINCT	Median family income
BLUECOL	% of employed in blue collar occupations
MEDOCCT	Median persons per unit
UNIT1PT	% single unit structures
NEWSPT	% owner occupied housing units built between 1960 and 1970
VACANTP	Z of land area not developed
RESIDP	Z of land area occupied by residential housing units
ROAD?	Z of land area occupied by streets and highways
NONRESP	Z of land area occupied by manufacturing or other commercial interests
RENTP	% of year-round housing units renter occupied
OWNOCCT	Z owner occupied housing units
NEWS68P	% of housing units moved into from 1968-70
DENST	Housing units per hectare
SOLDPT	Z of housing units sold in 1978
NONWHP	% Spanish and Black population in 1970

Table 15
 FACTOR DEFINITION FOR TRACT CLUSTERING

	<u>Life</u>	<u>SES</u>	<u>Owner</u>	<u>Land</u>
PcT65	-0. 71822*	0. 04216	-0.10325	0.18188
MEDAGET	-0. 87788*	0.26507	0.08856	0.05469
CHILDT	0.82317*	-0.11898	0.39187	-0.10387
MEDSCHT	0.00851	0.87889	0.02233	0.02817
HSGRDPT	0.06723	0.95526*	0.06225	0.01045
PCTPOV	-0.06927	-0.78943*	-0.27499	0 . 0 0 7 1 5
MEDINCT	0.05578	0.79250*	0.40975	-0.06960
BLUECOL	0.31612	-0.80168*	0.14577	-0.05616
MEDOCCT	0.80722*	0.17575	0.35513	-0.09786
UNIT1PT	0.31950	0.18774	0.87342*	-0.14057
NEWHSPT	0.63156	0.36027	-0.17881	-0.32031
VACANTP	0.21543	0.14355	0.17503	-0.92033*
RESIDP	-0.11809	0.16508	0.09104	0.89639*
ROADP	-0.28009	-0.13060	-0.19818	0.86989*
NONRESP	-0.11553	-0.49077	-0.40070	0.13616
RENTP	-0.26535	-0.31588	-0.86330*	0.13317
OWNOCCT	0.26397	0.32741	0.86289*	-0.09541
NEWHS68P	0.31154	0.01786	-0.83971	-0.12950
DENST	-0.38583	-0.05687	-0.47099	0.34723
SOLDPT	0.24819	0.13410	0.18874	-0.32310
NONWHP	0.06316	-0.8297?	-0.05202	0.08206

*denotes correlated variables within a factor which defines a factor.

Factor scores for the 784 tracts were used to cluster tracts. Since use of more than 10-12 clusters did not substantially reduce the standard error associated with the clusters, an appropriate number of clusters was determined to be eleven.

A description of the resulting 11 clusters can be derived from considering **whether** the clusters are associated with high, medium or low values for factor 'scores. Figure 9 shows the description of census tract types according to factor scores.

Tracts associated with clusters one through ten are not concentrated in any one city but are scattered throughout. San Francisco and Oakland tracts are included in types one through ten. Cluster ten included areas of much lower density than others. Cluster eleven included areas of much higher density; most of cluster 11 is from San Francisco tracts. Clusters seven, eight, and nine were areas with very low owner occupancy. The remaining tract types (types one through six) were of similar owner occupancy and land use types but varying socioeconomic and life cycle types.

Because of the large number of census tracts, it is not possible subjectively to assess the validity of tract classification as in the case of cities. There is some correlation between tract and city cluster types. Generally, tracts in low socioeconomic cities are in the low socioeconomic tract type. The high socioeconomic status tract cluster included tracts from both city type six (moderate socioeconomic city) and city cluster one (high socioeconomic city). No tracts in low socioeconomic type cities fall into the high socioeconomic tract type.

4.3 OTHER MARKET AREA CLASSIFICATIONS

Viewing a housing market as a "closed system," we have defined a housing market area as an area in which a large percentage of people (at least 80%) both reside and work. Due to the influence of several employment centers (San Francisco, San Jose, Oakland, and "Silicon Valley") and the existence of geographical factors (e.g. San Francisco Bay), it was hypothesized that several submarkets may exist in the Bay Area.

Data obtained from the Metropolitan Transportation Commission (MTC) on percents of work trips from one region (440 zone) to another was used to group 440 zones into three **submarkets**. In each of these submarket areas, more than 80 percent of work trips generated in the area also terminate within the area. The first submarket area stretches from **Marin** southward to San **Mateo**. This market area includes all of **Marin** and San Francisco Counties and San **Mateo** County north of Redwood City. San Francisco clearly dominates this region as the primary employment and cultural center. Within this market area, 91.1 percent of all work trips begin and terminate within the area.

The second market area extends southward from Redwood City including **Portola** Valley, Menlo Park, Atherton, Redwood City, Woodside and San **Carlos** from San **Mateo** County and also includes all of Santa Clara County. This

Figure 9
TRACT CLUSTER CHARACTERISTICS

Cluster Number	Life Cycle		Socioeconomic Status			Single Unit/Owner Occupancy		Developed Land		
	Young	Old	Low	Moderate	High	Low	High	Low	Moderate	High
1	X		X				X		X	
2	X			X			X		X	
3	X				X		X		X	
4		X	X				X		X	
5		X		X			X		X	
6		X			X		X		X	
7		X	X			X			X	
8		X		X		X			X	
9		X	X			X			X	
10	X				X		X	X		
11		X	X			X				X

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area is dominated by high technology companies centered in the area known as the "Silicon Valley". In this **submarket** area, 90.2 percent of all work trips generated in the region terminate within the area.

The final market area includes all of Contra Costa and Alameda Counties. Oakland is the major job center in this area but the employment pattern is **somewhat** dispersed. In addition to the major employment center of Oakland, a belt of manufacturing exists along the East Bay stretching from Richmond to **Fremont**. Of the work trips engendered in this area, 82.5 percent of the work trips are completed within the market area.

Preliminary work with these three market areas showed no great differentiation in housing prices between the north and south parts of the **West Bay**. Thus, in the final analysis, only two **submarket** areas (East and West Bay) were utilized.

4.4 STRATIFICATION OF CENSUS TRACTS AND HOUSEHOLD SAMPLE DESIGN

The procedures used to select the household sample are based on a stratified sample design. The same tracts were used for the survey and hedonic analysis at the household level. Since the survey budget limited the number of tracts which could be surveyed, tracts were sampled only from socioeconomic types one through six. Thus, our study is based on only those tracts which may be thought of as having "normal" neighborhood density and owner occupancy. Very high and very low density areas and areas with a high proportion of rentals are excluded from the household survey sample and household hedonic analysis. However, all tracts are included in the tract level hedonic analysis.

Because of the correlation between city and tract socioeconomic characteristics, cities were differentiated only by the urban/suburban distinction. Using air quality, tract, bayside, and urban/suburban characterizations, there are 42 distinct types of tracts (see figure 10).

To choose tracts for the "sample pool" data set, tracts were sorted according to tract type, air pollution type, **bayside** and urban/suburban type. From the stratification of tracts by types, random selection of one tract from each type was made; the sample tracts were selected with probability proportional to population size. This resulted in a selection of 42 tracts, each one representative of one type.

All household sales in the selected 42 tracts were used in the household level hedonic analysis. The same tracts (with three exceptions) were used for the survey. (One tract was dropped from the survey and substitutions were made for two tracts because of surveying problems.) Figures 11 and 12 show some characteristics of the selected tracts by type.

Table 16 shows air quality measures for cities represented in the sample tracts. Recall that air quality classification was based on health and visibility characteristics, not the measures shown in Table 16. The PS12 measure increases going from area A to E. However, the **OZONE levels** are not quite consistent with the air quality categories; **air quality** area

Figure 10*

Stratification of Tracts by Type

West Bay, Suburban

TTYPE	AQTYPE					TOTAL
FREQUENCY	A	B	C	D	E	
1	0	0	0	2	6	a
2	0	6	0	2	32	40
3	0	2	0	5	9	1b
4	0	0	0	0	2	2
s	0	10	1	10	7	28
b	0	1b	4	27	5	60
TOTAL	0	34	5	46	61	154

West Bay, Urban

TTYPE	AQTYPE					TOTAL
FREQUENCY	A	B	C	D	E	
1	0	1	0	0	0	t
2	0	0	0	0	0	0
3	1	0	0	0	0	0
4	0	2	0	0	0	2
5	0	27	0	0	0	27
6	0	10	0	0	0	10
TOTAL	0	40	0	0	0	40

East Bay, Urban

TTYPE	AQTYPE					TOTAL
FREQUENCY	A	B	C	D	E	
1	0	6	0	0	0	b
2	0	1	0	0	0	1
3	0	0	0	0	0	0
4	0	6	0	0	0	6
5	0	7	0	0	0	7
6	0	11	0	0	0	11
TOTAL	0	31	0	0	0	31

East Bay, Suburban

TTYPE	AQTYPE					TOTAL
FREQUENCY	A	B	C	D	E	
1	0	4	1	2	0	7
2	0	5	6	23	0	34
3	0	0	2	1	0	3
4	0	1	0	0	0	1
5	0	16	2	5	0	23
6	0	6	1	1	0	8
TOTAL	0	32	12	32	0	76

*"TTYPE" denotes tract type and "AQTYPE" denotes air quality type

Figure 11
1970 CENSUS DATA FOR SELECTED TRACTS

WEST BAY - SUBURBAN

	A	B	C	D	E
Young Age Low Income	Tract: City: Med. Age: Med. Income:			6111.00 Menlo Park 19.6 \$7,651	5033.01 San Jose 15.9 \$9,766
Young Age Moderate Income	Tract: City: Med. Age: Med. Income:	6036.00 San Bruno 25.6 \$13,958		5110.00 Palo Alto 26.5 \$13,795	5027.02 San Jose 26.1 \$11,438
Young Age High Income	Tract: City: Med. Age: Med. Income:	6037.01 San Bruno 22.3 \$15,005		5081.01 Cupertino 25.5 \$14,938	5029.02 San Jose 21.4 \$14,961
Old Age Low Income	Tract: City: Med. Age: Med. Income:				5001.00 San Jose 28.7 \$9,101
Old Age Moderate Income	Tract: City: Med. Age: Med. Income:	6066.00 San Mateo 42.5 \$12,049	1170.00 San Anselmo 31.9 \$11, s37	6110.00 Redwood City 28.9 \$12,125	5068.01 Los Gatos 32.4 \$12,794
Old Age High Income	Tract: 1191.00 City: Larkspur Med. Age: 35.1 Med. Income \$17,299	6038.00 San Bruno 27.7 \$15,152	1150.00 San Anselmo 32.3 \$15,915	5112.00 Palo Alto 34.4 \$18,407	>062.02 San Jose 27.1 \$15,045

Figure 11 (continued)
1970 CENSUS DATA FOR SELECTED TRACTS

WEST - URBAN

E

D

C

B

A

Young Age Low Income	Tract: City: Med. Age: Med. Income:				
Young Age Moderate Income	Tract: City: Med. Age: Med. Income:				
Young Age High Income	Tract: City: Med. Age: Med. Income:				
Old Age Low Income	Tract: City: Med. Age: Med. Income:	260.00 San Francisco 33.2 \$9,989			
Old Age Moderate Income	Tract: City: Med. Age: Med. Income:	257.00 San Francisco 37.6 \$11,197			
Old Age High Income	Tract: City: Med. Age: Med. Income:	107.00 San Francisco 37.9 \$15,716			

Figure 11 (continued)
 1970 CENSUS DATA FOR SELECTED TRACTS

EAST BAY - SUBURBAN

	A	B	C	D	E
Young Age Low Income	Tract: City: Med. Age: Med. income:	3810.00 ^a 3680.00 ^b Richmond San Pablo 24.7 26.3 \$9,889 \$8,690	3110.00 Pittsburg 24.1 \$8,822	4363.00 Hayward 26.5 \$8,946	
Young Age Moderate Income	Tract: City: Med. Age: Med. Income:	31320.00 ^a 3672.00 ^b Richmond San Pablo 13.7 21.2 \$10,805 \$10,874	3072.00 Antioch 23.1 \$11,552	4424.00 Fremont 20.2 \$12,278	
Young Age High Income	Tract: City: Med. Age: Med. Income:		3383.00 Walnut Creek 24.5 \$19,435	4421.00 Fremont 24.9 \$14,577	
Old Age Low Income	Tract: City: Med. Age: Med. Income:	4205.00 Albany 32.3 \$9,925			
Old Age Moderate Income	Tract: City: Med. Age: Med. Income:	3810.00 El Cerrito 32.7 \$12,815	3310.00 Concord 31.6 \$12,000	4356.00 Hayward 29.2 \$10,048	
Old Age High Income	Tract: City: Med. Age: Med. Income:	3851.00 El Cerrito 37.3 \$19,362	3382.00 Walnut Creek 28.7 \$16,217	4426.00 Fremont 30.9 \$14,754	

a used in property value analysis

b used in survey analysis

Figure 11 (continued)
 1970 CENSUS DATA FOR SELECTED TRACTS

EAST BAY - URBAN

	A	B	C	D	E
Young Age Low Income	Tract: City: Med. Age: Med. Income:	4093.00 Oakland 23.2 \$7,637			
Young Age Moderate Income	Tract: City: Med. Age: Med. Income:	4078.00 Oakland 23.4 \$11,861			
Young Age High Income	Tract: City: Med. Age: Med. Income:				
Old Age Low Income	Tract: City: Med. Age: Med. Income:	4087.00 Oakland 29.4 \$8,642			
Old Age Moderate Income	Tract: City: Med. Age: Med. Income:	4067.00 Oakland 43.5 \$12,127			
Old Age High Income	Tract: City: Med. Age: Med. Income:	4212.00 Berkeley 35.4 \$18,246			

Figure 12

AVERAGE PROPERTY VALUE FOR
SAMPLE TRACTS
WESTBAY - SUBURBAN

	A	B	c	D	E
Young Age Low Income	Tract: City: Living Area: Property Value:			6117.60 Menlo Park 998 \$36,000	5033.01 San Jose 1183 \$49,574
Young Age Moderate Income	Tract: city: Living Area: Property Value:	6036 San Bruno 1457 \$80,800		5110 Palo Alto 1223 \$84,746	5027.02 San Joaa 1535 \$82.851
Young Age High Income	Tract: city: Living Area: Property Value:	6037 San Bruno 1390 \$83,200		5081.01 Cupertino 1692 \$101,824	5029.02 San Jose 1715 \$88,532
Old Age Low Income	Tract: City: Living Area: Property Value:				5001.00 San Jose 1189 \$51,525
Old Age Moderate Income	Tract: City: Living Area: Property Value:	6066.00 San Mateo 1440 \$96,508	1170.00 San Anselmo 1642 \$110,400	6110.00 Redwood City 1189 \$77,256	5068.01 Los Gatos 1612 \$93,252
Old Age High Income	Tract: 1191.00 City: Larkspur Living Area: 1985 Property Value: \$149,500	6038.00 San Bruno 1492 \$108,000	1150.00 San Anselmo 1606 \$104,200	5112.00 Palo Alto 1742 \$132,824	5062.02 San Jose 1617 \$89,648

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Figure 12 (continued)
 AVERAGE PROPERTY VALUE FOR
 SAMPLE TRACTS
 JEST BAY - URBAN

	A	B	c	D	E
Young Age Low Income	Tract: city: Living Area: Property Value:				
Young Age Moderate Income	Tract: city: Living Area: Property Value:				
Young Age High Income	Tract: city: Living Area: Property Value:				
Old Age Low Income	Tract: city: Living Area: Property Value:	260.00 San Francisco 1209 \$63,732			
Old Age Moderate Income	Tract: city: Living Area: Property Value:	257.00 San Francisco 1274 \$72,392			
Old Age High Income	Tract: city: Living Area: Property Value:	307.00 San Francisco 1438 \$91,316			

Figure 12 (continued)
 AVERAGE PROPERTY VALUE FOR
 SAMPLE TRACTS
 EAST BAY - SUBURBAN

	A	B	c	D	E
Young Age Low Income	Tract: city: Living Area: Property Value:	3810.00 ^a 3680 ^b Richmond San Pablo 104M 932 \$35,952 \$35,645	3110.00 Pittsburg 1044 \$34,741	4363.00 Wayward 1039 \$45,746	
Young Age Moderate Income	Tract: city: Living Area: Property Value:	3820.00 ^a 3672 ^b Richmond San Pablo 1167 982 \$42,287 \$40,771	3072 Antioch 1228 \$51,124	4424 Fremont 1191 \$58,591	
Young Age High Income	Tract: city: Living Area: Property Value:		3383.00 Walnut Creek 1955 \$108,855	4427 Fremont 1471 \$73,176	
Old Age Low Income	Tract: city: Living Area: Property Value:	4205 Albany 991 \$51,635			
Old Age Moderate Income	Tract: city: Living Area: Property Value:	3870 El Cerrito 1150 \$66,514	3310.00 Concord 1293 \$64,087	4356 Wayward 1121 \$58,605	
Old Age High Income	Tract: city: Living Area: Property Value:	3851.00 El Cerrito 1957 \$119,429	3382.00 Walnut Creek 1483 \$81,602	4426.00 Fremont 1455 \$72,679	

a used in property value analysis
 b used in survey analysis

Figure 12 (concluded)
 AVERAGE PROPERTY VALUE FOR
 SAMPLE TRACTS
 EAST BAY - URBAN

	A	B	c	D	E
Young Age Low Income	Tract: city: Living Area: Property Value:	4093.00 Oakland 1097 \$30,535			
Young Age Moderate Income	Tract: city: Living Area: Property Value:	4078.00 Oakland 1287 \$49,516			
Young Age High Income	Tract: city: Living Area: Property Value:				
Old Age Low Income	Tract: city: Living Area: Property Value:	4081.00 Oakland 1200 \$35,622			
Old Age Moderate Income	Tract: City: Living Area: Property Value:	4067.00 Oakland 1264 \$69,512			
Old Age High Income	Tract: city: Living Area: Property Value:	4212.00 Oakland 2000 \$117,364			

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Table 16

AIR QUALITY DATA FOR CITIES IN SAMPLE

	OZEX	OZMAX	OZONE	PS12	TSP	PCTVIS
<u>West Bay</u>						
Area A Suburban						
Larkspur	7.5	3.6	27.0	4.5	37.0	9.7
Area B Suburban						
San Bruno	2.5	3.0	7.5	9.6	36.5	24.0
San Mateo	2.5	3.0	7.5	9.6"	36.5	24.0
Area B Urban						
San Francisco	2.0	2.3	4.6	6.6	41.5	24.0
Area C Suburban						
San Anselmo	7.5	3.6	27.0	11.3	37.0	9.7
Area D Suburban						
Cupertino	24.5	5.4	132.3	16.2	45.0	34.4
Menlo Park	4.5	3.0	13.5	14.4	51.5	34.4
Palo Alto	4.5	3.0	13.5	14.4	51.5	34.4
Redwood City	4.5	3.0	13.5	3.4.4	51.5	24.0
Area E Suburban						
Los Gatos	43.5	7.2	313.2	18.7	45.0	34.4
San Jose	33.0	6.0	198.0	35.0	63.0	34.4
<u>East Bay</u>						
Area A Suburban						
Albany	6.5	3.2	20.8	8.0	51.5	21.2
El Cerrito	6.5	3.2	20.8	8.0	51.5	21.2
Richmond	6.5	3.2	20.8	8.0	51.5	21.2
San Pablo	6.5	3.2	20.8	8.0	51.5	21.2
Area B Urban						
Oakland	2.5	2.2	5.5	5.1	41.5	21.2
Berkeley	6.5	3.2	20.8	8.0	51.5	21.2
Area C Suburban						
Antioch	20.0	6.0	120.0	16.5	57.5	9.7
Concord	27.5	5.8	159.5	16.7	47.0	9.7
Pittsburg	20.0	6.0	120.0	16.5	57.5	9.7
Walnut Creek	27.5	5.8	159.5	16.7	47.0	9.7
Area D Suburban						
Fremont	20.0	4.4	88.0	19.0	60.0	21.2
Mayward	11.0	4.4	48.4	17.7	60.0	21.2

B, West Bay suburban, is better than air quality area A in terms of OZONE. Also air quality area D in the East Bay is better than air quality area C in terms of OZONE; area D has air quality problems other than ozone (notably CO and TSP) reflected in **PSI2**.

Table 17 shows Bay area population broken down according to the major air quality and, **geographic** categories used in this study; the predominant air quality type is type B. These population estimates were used in the benefit extrapolations reported in Sections 6 and 7.

4.5 SIMPLE PROPERTY VALUE COMPARISONS

The Los Angeles study tested the differences in property values between the matched pairs of census tracts. Within a matched pair, all socioeconomic variables except air pollution were similar; any property value difference could then be attributed to air pollution.

Here, we used stratified sampling because it gives a better basis for projection of benefits for the whole Bay Area. Our stratified sample does not contain matches for every possible tract-air quality type. Where matches are possible, Table 18 shows the property value per square foot differential (going from air quality area A to B, A to C, etc.) for selected paired tracts of the same types; (average property values per square foot are derived from Figure 12). The greatest differential is from A to E (\$20 per square foot difference). **In** most cases, a decline **in** property values as air quality declines is indicated. Exceptions are due to the nature of the areas (e.g., Palo Alto is considered to be one of the most desirable areas of the Peninsula in spite of its lower air quality ratings; similarly for Los Gates).

Using statistical methods **such** as cluster analysis, tracts may not be matched exactly; characteristics associated with city and neighborhood type and other location characteristics may cause a greater property value effect than air quality. Rather than using tract pairs which "matched" on all characteristics except air quality, the next chapter presents another statistical technique which separates air quality effects on property values from effects of other location, neighborhood, and city-type characteristics.

Table 17

NUMBER OF HOUSEHOLDS BY AREA^a

	A	B	c	D	E	All
West Bay						
Suburban	20,696	154,482	52,034	225,421	301,655	
Urban		286,119				
East Bay						
Suburban	11,371	148,092	138,648	156,596		
Urban		172,793				
Total	32,067	761,486	190,687	382,017	301,655	1,667,912

^aHousing data (1978) for all the cities in 6 County Bay areas were obtained from a survey performed by the U.S. Postal Service with cooperation of the Federal Home Loan Bank of San Francisco. **This** data was published by the **Real Estate Council of Northern California** in Northern California Real Estate Report August 1979, Volume 31/Number 2.

Table 18

PROPERTY VALUE DIFFERENTIALS (\$ PER SQUARE FOOT)
(West Bay)

From \ To	A(1191)	B(6066)	B(6038)	C(1170)	D(6110)	E(5068.01)
A(1191)	●	x	3	10	1.5	20
B(6066)	x	●	x	0	2	9
B(6038)	3	x	●	7	x	17
C(1170)	x	0	x	●	2	11
D(6110)	x	2	x	0	●	7
E(5068.01)	20	9	17	11	7	●

x no socioeconomic match in the sample