**Title**
Transit, Density, and Residential Satisfaction



**Author**
Shaw, John Gordon

**Publication Date**
1994

# Transit, Density, and Residential Satisfaction

by

John Gordon Shaw

B.A. (Emory University) 1977
M.S. (Pennsylvania State University) 1981

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

City and Regional Planning

in the

GRADUATE DIVISION

of the

UNIVERSITY of CALIFORNIA at BERKELEY

Committee in charge:

Professor Robert Cervero, Chair
Professor Elizabeth Deakin
Professor Clare Cooper Marcus

1994

APPROVAL PAGE

The dissertation of John Gordon Shaw is approved:

_____

Chair Date

_____

Date

_____

Date

University of California at Berkeley

1994

Transit, Density, and Residential Satisfaction



John Gordon Shaw

## ABSTRACT

TRANSIT, DENSITY, AND RESIDENTIAL SATISFACTION

by

John Gordon Shaw

Doctor of Philosophy in City and Regional Planning

University of California at Berkeley

Professor Robert Cervero, Chair

Planners and others have proposed developing high-density residential nodes around transit stations to reduce auto dependence and encourage transit use. Such nodes, the argument goes, would provide more patrons for the transit system, more shoppers for nearby stores, and more of a community for the residents. However, such high-density housing runs counter to the assumed American preference for low-density, detached homes. This study investigates the relationship between residential density and housing satisfaction. It also examines the extent to which other factors, such as proximity of the residential development to transit and respondent background variables, influence this relationship.

Data were collected through the presentation of computer-simulated slides to respondents in two urban areas in California. Slides of residential developments of various densities were overlaid on slides of four different settings, two settings next to transit stations and two next to freeway interchanges. Respondents indicated levels of satisfaction with each slide, selected slides they most and least liked, identified housing and neighborhood attributes and other factors associated with their selections, and provided information on their travel behavior and socioeconomic and demographic variables.

High-density housing was strongly disliked by a large majority of respondents. However, this reaction was affected by various design features. Housing near transit was generally preferred to housing near freeways. Familiarity with and proximity to sites used in the study did not influence

satisfaction ratings. Certain respondent variables did influence the satisfaction-density relationship, including age, income, and presence or absence of children.

These results suggest that the desire for single-family detached housing is still quite strong, although not absolute. The concluding section discusses some reasons for this, including cultural norms that confer status and social position on owners of a single-family house with a yard and federal policies that support purchases of single-family detached housing, particularly in suburban areas. Planners and others concerned with increasing residential densities around transit stations should recognize these factors in their planning efforts. Recommendations stemming from this work include utilizing what has been learned about reducing perceived densities while maintaining relatively high objective densities, and identifying and designing high-density living for selected submarkets, such as younger residents, lower-income residents, and households without children.

**ACKNOWLEDGEMENTS**

I would first like to thank my dissertation chair, Professor Robert Cervero, for his help and guidance throughout this process; he provided valuable and timely assistance at both the conceptual and technical levels. My research topic and approach also were refined through discussions with my other committee members, Professors Elizabeth Deakin and Clare Cooper Marcus. As my outside field advisor, Professor Kenneth Craik supported and informed my research at a very early stage, as did Professors William Garrison and Peter Hall as members of my inside field committee.

Thanks go also to other colleagues at U.C. Berkeley: Professors Peter Bosselmann, David Dowall, and John Landis, for answering specific questions at just the right time; fellow PhD students Susan Handy and Ruth Steiner, for more general discussions that helped shape my thinking and provided me different perspectives; Kevin Gilson of the Environment Simulation Laboratory, for insight into the world of computer-aided photosimulations; and Carlos Martinez, for his work in developing the simulated slides. Professor Judith Innes, Barbara Hadenfeldt, and other staff members at the Institute of Urban and Regional Development graciously provided office access for the telephone survey. Professor Melvin Webber and the University of California Transportation Center generously provided financial support for this project. Kaye Bock assisted this project in large ways and small, and smoothed the process considerably.

I am grateful to all the survey participants who took the time to view a repetitive series of slides, and contributed considerably to the outcome of this study.

My parents have always provided love and support for all my undertakings, including this

one. They have been my role models in more ways than I can count. Finally, my wife, Marlene, has been with me every step of the way; she has provided both tangible and intangible assistance. Without her love and encouragement, this dissertation would not be what it is, nor would I.

## TABLE OF CONTENTS

## LIST OF FIGURES AND TABLES

Figures



Tables

## CHAPTER 1 - INTRODUCTION AND STATEMENT OF PROBLEM

An outstanding characteristic of modern American life is its extreme dependence on the automobile. Comments on America's love of automobility have passed from astute observation to common knowledge, and are on their way to the status of well-worn cliche. But this does not tell the whole story, as Americans are increasingly reliant on their cars for almost every aspect of their travel, whether they love, loath, or simply tolerate them.

The past half-century has seen steady growth in auto use and a corresponding decline in transit patronage. By 1990, 88% of American commuters traveled to work in a car (either by themselves or sharing a ride), a 27% increase from 1960 levels. Only 5% used transit to get to work, a 59% drop over the previous 30 years. Even in the largest urban areas of over one million people, commuters are far more reliant on autos; 84% used cars in 1990, while only 9% took transit (Federal Highway Administration, 1993).

As the auto has become ever more ubiquitous in American cities, its shortcomings have been noted from a variety of perspectives. Environmentalists point to the contribution of the internal combustion engine to dangerous levels of air pollutants in many cities. Economists note the drain on regional economies caused by the inefficiencies inherent in traffic congestion.[1] Planners and policymakers worry about reliance on an energy source (oil) which is imported from other countries in large quantities, decreasing national energy independence. And everyone who experiences regular, extended traffic congestion complains about the associated stress and unpleasantness.

---

[1] Estimates of this sort vary widely, and are notoriously difficult to calculate with any precision. The U.S. Department of Transportation reports that the cost of congestion, including delay and fuel consumption, exceeds $39 billion in the fifty largest U.S. urban areas (Bureau of Transportation Statistics, 1994), while the World Resources Institute estimates the full cost of driving in America not paid by motorists is in the hundreds of billions of dollars annually (MacKenzie et al. (1992)).

In light of these problematic aspects of continuing auto dependence, an increasing number of planners, policymakers, architects, designers, and developers are examining the potential for alternative land use patterns in urban areas to decrease reliance on automobiles. A common starting point has been to support or develop increased densities around existing or planned transit stations (such as the Bay Area Rapid Transit system (BART) or CalTrain on the San Francisco Peninsula). Another approach is to develop new communities (e.g., "pedestrian pockets") which would be designed around an existing or planned rail extension. In each case, the higher residential densities would increase the potential ridership of transit lines, and would also provide the customer base necessary to support local commercial establishments within walking distance of many of the residents. In both of these ways, higher residential densities would contribute to decreased automobile dependence, while maintaining or increasing accessibility to jobs, services, and other urban functions.

## BACKGROUND

Newly designed communities suitable for rail transit have been given considerable attention in recent years (Delsohn (1989); Knack (1991)). Few if any such developments are actually in place, but plans have been proposed for several sites on the West Coast, including Laguna West near Sacramento (Urban Mass Transportation Administration, 1991). In the County of Sacramento, Transit-Oriented Developments were explicitly identified as an objective in the County's Draft General Plan Land Use Element (1990). The objective, supported by a number of specific policies, stated: "Locate higher residential densities and non-residential intensities that are designed to accommodate non-automobile

modes of travel within walking distance of transit stops and along key transit corridors" (p. 96).

Transit and land use planners in many cities which currently have light or heavy rail lines have urged development of high-density residential and commercial/office buildings near transit station sites. In the San Francisco Bay Area, such development has occurred in fits and starts around BART stations since the system opened in 1972. Local opposition to zoning variances, periods of economic sluggishness, and the multiplicity of jurisdictions through which BART passes have all restricted opportunities for such development, although recent development around the Pleasant Hill and El Cerrito del Norte stations suggests that such restrictions may be easing. A 1991 study released by the Transit/ Residential Access Center (TRAC) of the University of California's Institute of Urban and Regional Development identified sixteen major projects under construction or recently completed in the Bay Area near BART, CalTrain, or the Guadalupe light rail system in Santa Clara County. Each development exceeded 30 units in size and 15 units/acre in density, and each had been built to capitalize on access to rail transit stations (Bernick and Carroll (1991)).

Transportation and land use planners have generally supported the idea that increased residential and/or employment densities around the stations would reduce traffic congestion and increase transit ridership. A sensitivity test of the 1991 Regional Transportation Plan for the San Francisco Bay Area examined the effects of building denser residential development around various Bay Area transit stations in the year 2010 (Association of Bay Area Governments (1990); Metropolitan Transportation Commission (1991)). Although improvements to traffic conditions were fairly modest, this collaborative effort between the two agencies indicates the willingness of land use and transportation

planners and policymakers to explore land use options for mitigating transportation problems.

Pushkarev and Zupan (1977) examined existing residential and employment densities in the New York City metropolitan area in terms of the level of transit service each subcenter (e.g., Newark, Hartford, and midtown Manhattan) was able to support. They arranged transit systems in a rough hierarchy, depending on the densities required for each system to operate successfully - that is, within the generally accepted levels of operating subsidies provided to transit systems at that time. Taxicabs and dial-a-bus services operated successfully at the lowest densities, followed by local fixed-route bus service, express buses, light rail, heavy rail ("standard rapid transit"), and commuter rail. Although any specific application of these technologies to a particular place and time would produce variations in the theoretical minimum densities required, the examples cited by Pushkarev and Zupan of transit services in the various New York subcenters tend to support their overall conclusions. A particular type of transit would work well in a city that met or exceeded the theoretical minimum density (expressed in residences per acre and million square feet or nonresidential floor space in the downtown area), but would usually struggle in a city that did not meet this minimum.

These findings, based on empirical analyses of existing systems, provide a benchmark against which minimum residential densities can be measured for their suitability for various types of transit service. For instance, in a later work, the authors noted North American cities that might be appropriate sites for rapid and light rail systems, based on residential density patterns and the size of their central business districts (Pushkarev, Zupan, and Cumella (1982)).

Such studies are useful for determining what types of transit systems might not work

in a given setting. However, by presenting precise minimum densities that are associated with various types of transit service, their results are prone to misinterpretation by those who assume that a given type of transit can be successful simply if residential land is zoned to those densities. Such assumptions rely on oversimplified views of the links between residential density and transit use. If actual residential densities are lower than anticipated, the expectations for transit service would need to be scaled down appropriately. Additionally, these relationships, even in a general sense, might not apply to cities and regions with multiple business centers, such as Los Angeles.

## STATEMENT OF PROBLEM

As greater collaboration between land use and transportation planners produces more transit-based high-density residential developments, research is needed on the attractiveness and desirability of these developments to potential residents. Empirical studies of the relationship between residential densities and transit systems (for instance, the Pushkarev and Zupan studies cited above) are based on existing densities in residential neighborhoods, densities which may not be achievable simply by rezoning an area near a transit station for denser development. Many factors, working singly or in combination, may keep any particular development from reaching its design density; these include the housing market in the immediate area, the strength of the local economy, and the attractiveness and appropriateness of the residential development itself.

In addition, the role of planners in the development of transit-based high-density housing should not be simply to calculate the maximum feasible densities surrounding a given transit station (or the resulting load factors on the transit system). Ideally, planning a transit-based high-density residential development would utilize the considerable

knowledge base that has been developed by housing and community researchers (among them sociologists, urban designers, landscape architects, and psychologists, as well as planners), focusing on what makes a house or neighborhood desirable and attractive as a place to live. In this way, planning research findings could serve not only the immediate development needs, but also broader societal needs of increasing the stock of desirable housing. Developing housing around existing or planned transit stations involves working with special needs (particularly the need to increase residential densities over those of typical detached single-family homes), but also offers special opportunities - most notably the opportunity to provide residents with a less car-centered living environment.

Given a choice of residential locations within a metropolitan area, will people choose to live at densities supportive of various types of rail transit service? The TRAC study mentioned above offers a tentative answer in the affirmative, but the large amount of rental housing in the projects under study (85% of total units) raises doubts about the extent of choice actually available to the projects' residents, or the appeal of such housing to current and prospective homeowners. This question would seem to be key to anticipating the success of various transit systems, particularly capital-intensive systems, such as light and heavy rail lines, that often are sold on their ability to focus development around transit stations. In addition, answering this question would be likely to determine the potential success of the new transit-oriented developments mentioned above, such as the "pedestrian pocket" proposals.

This dissertation will address the question of the viability of transit-based high-density residences by focusing on significant attributes of high-density living, respondents' attitudes towards those attributes, and their attitudes towards high-density living in general. It will also examine submarkets of respondents according to their reactions to high-density

living and explore factors that distinguish among groups of people on this dimension.

This study uses market research techniques to provide greater insight into attributes of density that influence residential consumers. The results have implications for our understanding of how residential areas around transit stations might be developed, and have applicability to both transit and community development planning. The study is intended for two primary audiences:

1) planners involved with formulating policies and programs for the design of transit-based communities, and

2) urban researchers and others with interest in applying new methods and technologies to urban problems.

The study will draw largely on the residential satisfaction literature that has been developed by sociologists, social psychologists, housing researchers, and others. Key findings of this literature are summarized below; a more detailed literature review is presented in Chapter 2.

## HYPOTHESES

Hypotheses for this study are largely drawn from residential satisfaction research, and link findings from this body of knowledge to applications for potential residential developments around transit stations. A summary of important results from the residential satisfaction literature will provide some background for understanding the genesis of specific hypotheses. Chapter 2 provides a detailed review of specific studies in this field.

Housing satisfaction studies over the past 30 years have found a generally consistent set of variables that account for much of the satisfaction residents gain from their housing. These include home ownership, the location of the dwelling, the quality of the dwelling, the

social characteristics of the neighborhood, the density of the neighborhood, the presence of private outdoor space, and the age, gender, and parental status of the residents. A variable of obvious importance to this study that has not been widely researched is the presence or absence of transit facilities. In general, residents usually report moderate to high levels of satisfaction for both their dwelling unit and their immediate neighborhood. This is true independent of the type of dwelling unit. Those persons who are most satisfied are generally those who own their own dwelling, who live next to neighbors with whom they feel compatible, and who live in a detached, single-family home. If children are present, both suburban environments and private outdoor space may be highly valued. Although some studies have found that men may be more satisfied with lower-density living than women, more recent research suggests such differences may be due to employment and marital status, rather than gender. Two other variables that are likely to affect individuals' ratings of their residential satisfaction are age and income, with increasing levels of satisfaction correlated both with increasing age and increasing income.

The findings outlined above and described in more detail in Chapter 2 provide the foundations for the following hypotheses. The first hypothesis indicates the expected findings of the basic relationship between satisfaction and density:

**Hypothesis 1:** On average, people are more satisfied with low-density dwellings than with high-density dwellings.

The preference for low-density housing hypothesized above and identified in previous research is assumed to have a spatial dimension: preferences for such housing increase as the location of such housing is closer to one's own community or residence. This leads to two separate hypotheses:

**Hypothesis 2:** People will be more dissatisfied with high-density housing on a site

with which they are familiar than on a site with which they are unfamiliar.

**Hypothesis 3:** People living near a site at which high-density housing might be built will be more dissatisfied with such development than people living further from the site, even if all residents are within a mile of the site.

The fourth hypothesis addresses a possible influence on the relationship between residential densities and satisfaction levels, that of residential location near a transit station or near a freeway interchange. As this distinction has not been the subject of previous research, no a priori relationship was assumed:

**Hypothesis 4:** Satisfaction levels with varying residential densities will be the same at transit-based sites as at freeway-based sites.

As noted previously, past studies have identified various background characteristics of respondents that might influence their satisfaction with different residential densities. Campbell, Converse, and Rodgers (1976) found that, on average, satisfaction with housing and neighborhood increases with age, although they did not differentiate among dwellings of different densities. Baldassare (1979) speculated that higher incomes allow residents to purchase building amenities, such as doormen and greater interior space, that insulate them to some extent from the perceived externalities of high-density living. The presence of children has often been assumed to account, at least in part, for people's dislike of high-density residences (see Michelson (1977)). Controlling for gender in satisfaction studies has produced varied results, with the most recent and carefully-controlled study suggesting that gender does not play an independent role in people's satisfaction with various residences (Spain (1988)). These findings lead to the following hypotheses:

**Hypothesis 5:** Older residents will be more satisfied with housing in general than will younger residents. (It is not hypothesized that older residents will be more satisfied

with any particular level of density.)

**Hypothesis 6:** Persons with higher incomes will be more satisfied with high-density housing than persons with lower incomes.

**Hypothesis 7:** Persons without children will be more satisfied with high-density housing than persons with children.

**Hypothesis 8:** Gender will have no effect on satisfaction with various densities.

It should be noted that this study is not directly inquiring as to whether particular transit-based high-density residential developments will be successful. The success or failure of any particular transit-based high-density residential development is the product of many factors, including market forces, the economic climate, features of particular locations, and the attitudes of and actions taken by local planning boards, residents of the existing neighborhood (for infill developments), and lending/financial institutions, as well as the attitudes of current and prospective residents.

## REMAINING CHAPTERS

As mentioned earlier, Chapter 2 includes a review of relevant literature. The literature review will focus primarily on past findings of residential satisfaction, particularly as they relate to features that are likely to be present in transit-based high-density housing. A comparison is also drawn between residential satisfaction research and another source of housing preference information, hedonic pricing studies.

Chapter 3 describes the study methodology in detail. The study is constructed around visual photosimulations of residences of various densities. These residences are placed in varying settings near transit stations or freeway interchanges. Slides of each

dwelling-by-setting combination are rated by respondents. The collection of socioeconomic and demographic information from respondents permits market segmentation of attitudes towards density and its components. The method of computer-aided photosimulation, the selection of study areas and survey participants, and the process of questionnaire development and distribution are discussed in this chapter.

Chapter 4 presents statistical analyses of the results of the surveys, examining the satisfaction ratings provided by the respondents and their preferences for various slides in light of the settings of those slides, the residences of the respondents, and socioeconomic and demographic variables. Chapter 5 discusses conclusions of and recommendations from the research, with an examination of the strengths and weaknesses of the photosimulation method and policy recommendations targeted towards planners and others interested in residential development around transit stations.

## CHAPTER 2 - LITERATURE REVIEW

This chapter reviews past research efforts that have studied valuations of housing attributes as a means of determining satisfaction with housing. The two general methods that have been used are residential satisfaction studies (largely from sociology) and hedonic studies of housing prices (from economics). The key findings from these approaches are described below, and general strengths and weaknesses of each method are discussed.

## RESIDENTIAL SATISFACTION

Residential satisfaction research provides the strongest basis for an investigation into attitudes towards transit-based high-density residences. No in-depth studies have focused specifically on this set of characteristics, although density has been an occasional topic of investigation. To some extent, this reflects the relative newness of much of the transit-based residential work.

Foote et al. (1960) provide an overview of early research in residential satisfaction, and identify several themes that have continued to be a focus of research:

* home ownership is an extremely strong social value. "(I)t seems safe to say that owning a home, even more than suburban living per se, is a basic part of the American dream of the good life. The fact that economists regard it as a questionable course of action on the part of the marginal buyer is more or less beside the point. Homeownership is not a purely rational utilitarian choice. It is overcrusted with sentiment, symbolic value, and considerations of status and prestige" (p. 190).

* residents are generally satisfied with both the location and the quality of their dwellings;

* the social characteristics of the neighborhood are a potentially significant source of

dissatisfaction with the residential location;

* men are generally more satisfied with "suburban" living than are women, and adults in their 20s-40s are more satisfied with the suburbs than teenagers and adults over 50;

* suburban developments are valued highly for amenities for young children, especially safety, room to play, and good schools.

For the research proposed in this study, however, this summary lacks two key elements: residents' reactions to higher-density dwellings per se, and attitudes towards different transportation modes. These elements are introduced in research by Lansing, Mueller, and Barth (1964) and Lansing, Marans, and Zehner (1970). The latter authors studied several planned communities (including Reston, Columbia, and Radburn) in the United States, matching them with studies of "less-planned" communities. A total of ten communities were studied; personal interviews were held with a cross-section of residents, including residents of single-family houses and townhouses, but not apartments. Probability sampling gave each occupied dwelling an equal chance of being selected. Respondents in Columbia and Radburn were deliberately oversampled, to allow for greater comparisons among residents of highly planned environments in locations peripheral to metropolitan areas. The sampling framework aimed for 200 respondents from each of these communities, and 100 from each of the other communities in the study. A total of 1,253 interviews were obtained, with the selection of interviewees among the adults in the household determined randomly in advance.

This effort to determine the extent to which the planned nature of the community affects the attitudes and behaviors of the residents is intriguing, although the study was hampered by the relative newness of Reston and Columbia (most residents had moved to these communities within the previous two years). Residents expressed greatest satisfaction

with low neighborhood densities (under 2.5 dwelling units/acre), although only the highest density (above 12.5 d.u./acre) substantially decreased residents' satisfaction. Townhouses (predominating in higher density areas) showed similar levels of satisfaction to single-family houses, except at extremes of density. The authors note that "the preference for low density seems to arise out of needs for privacy, quiet, and outdoor space, needs which are met in varying degrees by different site arrangements" (p. 122).

The study also examined transportation behavior. Of the newer suburbs, both planned and less-planned, only Reston showed a substantial number of transit commuters, due to its commuter bus service to Washington, D.C. Radburn and its "matched" community in the New York suburban ring both had substantial commute usage of transit, with bus, rapid transit, and commuter railroads all used. Although Columbia apparently had more bus service than a typical suburban or exurban community, only 5% of respondents said that they used the bus at least once a week, although 39% stated that having a bus stop near their home was "very important". As transportation facilities were not an integral part of the development of any of the planned communities studied here (including those in the central city areas of Detroit and Washington, D.C.), this research can only act as a general guide to the question of the attractiveness of transit-based high-density residential developments.

A nationwide survey of metropolitan area residents (Campbell, Converse, and Rodgers (1976)) provided a richly-detailed examination of residents' satisfaction with their environments. Data for this study were collected through personal interviews conducted by the Survey Research Center at the University of Michigan with 2,164 adults living in households, excluding households on military reservations and various nondwelling unit quarters (such as hospitals, prisons, and rooming houses). Respondents were selected

through a multistage probability sampling procedure of households in the 48 contiguous states. The overall response rate was about 80 percent. The results of the survey were compared to data from the 1970 Census. The primary difference in socioeconomic and demographic characteristics between the sample and the census is gender; males were underrepresented in the survey sample "for various reasons that affect census counts as well as sample surveys" (p. 512). Because of this, the analyses of the survey results were weighted, with males given weights of 1.25 relative to those of females.

The research framework of this study focused on attributes of various life domains, including housing, neighborhood, and community. The model included both individual perceptions of objective attributes and standards against which residents are judged to relate attributes to expressed levels of satisfaction. "Thus the model... makes a critical distinction between objective indicators (the reality) and subjective indicators (perceptions, assessments, and satisfactions) of the quality of the residential environment. This distinction is based on the assumption that characteristics of the individual intervene so as to influence the subjective indicators. Specifically, the manner in which an objective environmental attribute is perceived and assessed by individuals is modified by their present situation, their attitudes, and their past experiences" (p. 264-265). Unfortunately, the study provided little information about residential density at either a community or neighborhood level. Type of residence was used as an independent variable, with significant correlations on ratings of satisfaction. However, this relationship largely disappeared when factors such as type of tenure (owner/renter) and unit size were taken into account. Nevertheless, the study provides a cogent framework for understanding any relationship between satisfaction and environmental attributes (see also Marans and Rodgers (1975) and Marans (1979)).

Both the Quality of Life data base and another national survey conducted in the

early 1970s are utilized by Baldassare (1979) in his study of residential crowding. From the Quality of Life survey, he selected only residents of Standard Metropolitan Statistical Areas (SMSAs). Baldassare also used data from the Continuous National Survey conducted by the National Opinion Research Center at the University of Chicago. The total sample size from this survey was 7,954, although the number of responses to any particular item varied widely (from 610 to 7,954). The surveying was done in 12 cycles over a 14-month period, with each question included in either some or all of the surveying cycles. The sample was based on a selection of households and individuals within households using NORC's multistage, stratified probability sampling of adults in the 48 contiguous states. Again, only the subset of respondents living in SMSAs were selected.

Following Hawley (1972), Baldassare notes the potential benefits of high-density neighborhoods: a higher opportunity for diversity and stimulation, more conveniences, and a qualitative improvement in transportation and communication (see also Fischer (1976)). But high-density neighborhoods can also produce conflicts over scarce resources and increased congestion. Baldassare observes that some individuals choose to live in high-density neighborhoods, and speculates that "people with greater economic resources may be able to manipulate high density settings to drastically reduce their costs and increase their benefits (e.g., using doormen and soundproofing to reduce interference)" (p. 161).

Baldassare identified moderate negative correlations between neighborhood density and overall neighborhood satisfaction (controlling for age, education, home ownership, years in the neighborhood, and census tract median income). However, this did not translate into an increased desire to move. A possible explanation for this somewhat counterintuitive finding is provided by Michelson (1977) who reports on one of the few longitudinal studies of residential satisfaction. Personal interviews were conducted with

761 families in the Toronto metropolitan area. Respondents were roughly evenly divided between high-rise apartment dwellers and residents of single-family houses; within each of these groups, about three-quarters of the respondents lived in suburban areas and about one-quarter lived downtown. The respondents were drawn from a population of families identified by realtors and others as households about to move into new housing. Slightly under 1,000 families were approached, and 77% agreed to participate in the study. All high-rise apartment residents were renters, and all residents of single-family housing were homeowners. Neither young singles nor families in or approaching retirement were included in the study, as Michelson's intent was to assess the attractions and the effects of high-rise apartments for families. Three follow-up surveys were conducted after the initial survey, with the last survey conducted four years after the first. Personal interviews were used for the second and third surveys; the last was conducted by mail and, when necessary, telephone. Attrition rates over the course of the study were fairly small, with 81 percent of the initial families also participating in the final survey.

One of Michelson's primary findings is that apartment dwellers expressed less satisfaction than residents of single-family houses. Specifically, 64% of apartment dwellers agreed with the statement that "a detached home is the most desirable goal for families like mine," compared to 86% of single-family house residents. The statement that "children can be brought up just as well in high-rise apartments as in any other type of housing," was agreed with by only 33% of apartment residents and 8% of single-family house dwellers. Although clear distinctions exist between the patterns of responses from residents of each of the two types of housing, it is notable that approximately two-thirds of the apartment dwellers were critical of important aspects of their lifestyle. These dissatisfactions, however, do not make the apartment residents any more likely to move than residents of

single-family houses. "Apartment dwellers do not consider moving because of their difficulties, because most of them had never intended to stay in the first place. Their plans call for subsequent movement, toward lower rise housing and suburban locations, and are supported by a strong belief in conventional attitudes about family housing and location" (p. 303). Thus, satisfaction with current housing must be placed in the context of a family's life cycle, and their expectations as to the permanence of their present living conditions.

All the studies described above found at least moderate levels of satisfaction with the residential environment. This general satisfaction is found among residents of single-family houses, townhouses, mobile homes (Shelton, Gruber and Godwin (1983); Gruber, Shelton and Godwin (1985)), and even high-rise apartment buildings (Michelson (1977); Fuerst (1985)). However, as Michelson (1977) found, most respondents aspire to a single-family detached house. Eighty-one percent of his sample of current renters preferred home-ownership to renting, as did 95 percent of current owners. Earlier research by Michelson (1968), based on interviews with 748 metropolitan-area residents conducted by the Survey Research Center, also concluded that ownership of a single-family detached residence is valued highly by the American public.

A statewide mailout/mailback survey of 2,800 Washington state residents by Dillman, Tremblay, and Dillman (1979) also found a strong desire for single-family detached housing. The survey achieved an admirable response rate of 69 percent, and the authors found the sample to be "reasonably representative of the state as a whole". When asked what type of housing they most prefer, 76 percent of the sample selected single-family detached housing.[2] This strong preference exists regardless of the size of the county

[2] Other choices and the percent that chose them are: buying mobile home and lot (8%), renting apartment (5%), renting single-family house, buying townhouse, buying mobile home on rented space, and renting duplex (each with 3%).

or city in which the respondent lived. Respondents living in rural counties (with no city larger than 10,000 population) favored owning a single-family house to the same extent as respondents living in King County, where Seattle is located (78 percent and 79 percent, respectively). Residents of towns under 2,500 population chose owning a single-family house 79 percent of the time; Seattle residents did so 75 percent of the time, and residents of cities in between these population extremes chose single-family housing ownership between 78 and 81 percent of the time. These findings suggests, although they do not prove, that the desire to own a single-family house may be separate from another desire that encompasses a number of valued attributes: that of suburban living. Studies of residential satisfaction that enquire as to satisfaction with current living conditions may have difficulty in separating qualities of single-family living from qualities of suburban living, since many residents of single-family units live in the suburbs. The Dillman, Tremblay, and Dillman study examines preferences, rather than existing living conditions, and does so with a large statewide sample that permits analysis by size of residential community.

The findings described above undoubtedly reflect the strong North American value placed on ownership of a private dwelling, as mentioned above by Foote et al. (1960). However, they also are a reflection of objective features of a single-family house. One of the most salient of these may be private outside space, particularly for families with children (Dillman and Dillman (1987)). Sanoff and Sawhney (1972) report on the results of a survey administered to 145 respondents in a city of 20,000 in North Carolina. Respondents were drawn from areas of town with large concentrations of low-income households; the sample was split fairly evenly between owners and renters. From a list of 17 housing attributes, presence of "back yard" and "front yard" were considered "very important" by 62 percent and 60 percent of respondents, respectively. These were the fourth- and fifth-most valued

attributes, exceeded only by "comfortable temperature in the house," "size of rooms," and "outside appearance of house," and more desired than such attributes as "privacy for each member of the house," "not being bothered by street noises," and "inside children's play area". The absolute percentages achieved by each attribute may be misleading, as respondents were not constrained in their rating of attributes as "very important". The high rankings of the outdoor space attributes, however, suggest that respondents viewed them as relatively important ones.

The ability of a detached and owned, as opposed to rented or condominium-owned, residence to be altered at the owner's wishes has also been found to be a factor in respondents' preferences for homeownership. Silverman (1987) interviewed 80 residents divided evenly among four neighborhoods in the San Francisco Bay Area. Two neighborhoods were in San Francisco and two were in the suburbs; one in each contained single-family detached housing, and one low-rise apartment buildings. Respondents were asked whether they would prefer to live in a house or an apartment. "Virtually all chose a house (often altering the choice to that of a home) rather than an apartment precisely because they would have the greatest control over the use of its space. Control first involved the ability to use the space as desired without the intervention of an outside party. For this reason, apartments and condominiums were not considered true homes.... Control also meant the absence of interference by neighbors" (p. 4-5).

Several studies have supported the findings of Foote et al. (1960) that men are generally more satisfied with lower-density living than are women. Popenoe (1977) conducted a primarily qualitative study comparing residents of the Swedish community of Vallingby and persons living in Levittown near Philadelphia. He did not study residential satisfaction per se, but he noted that his comparisons indicated that the low-density living

patterns typified by Levittown were generally more stressful for its residents than the higher-density developments of Vallingby, particularly for working women. "The low rise, high-density residential environment [of Vallingby] offers many advantages to the woman who works, who has many activities outside the home, and who wishes to minimize housekeeping activities. The working women of Vallingby have a far more enviable situation than do those of Levittown because of the larger job market available, public transportation, day care and other services for families with children, and ease of home maintenance" (p. 227).

Shlay and DiGregorio (1985) reported on interviews with 177 residents of the Syracuse, New York, metropolitan area. Households were randomly selected roughly evenly from four census tracts: high-income suburban, middle-income suburban, low-income central city, and middle-income central city. The factorial survey technique was used: each respondent evaluated 20 neighborhood "vignettes," consisting of descriptions of key attributes (such as distance to work, racial composition, and average neighborhood income) at various levels, and provided a "neighborhood desirability rating" for each vignette. Through this technique, the relative importance of neighborhood attributes was determined for both subsets of the sample and for the sample as a whole. In addition, the level or amount of one attribute within a vignette is not dependent on the level or amount of any other attribute; thus, the attractiveness of any given attribute can be assessed independently of other factors, unlike many analyses of real-world evaluations.

Based on their results, the authors recommend that women would be more satisfied in residential settings with higher densities, levels of public service, and public transportation, but "retain(ing) much of their residential ambience" (p. 66). However, their reported findings indicate that although women may prefer some features commonly

associated with high densities, such as increased public transportation, women do not differ from men in their ratings of "densely populated" and "sparsely populated" environments, with all respondents about as satisfied with one type of environment as the other. (As noted below, this may be due to poor specification of the density variable.)

A weakness of the Shlay and DiGregorio study is the lack of attention to marital status as an important intervening variable affecting men's reactions to various neighborhood attributes. Spain (1988) examined this factor explicitly. Using data from the 1983 Annual Housing Survey, she selected households from within SMSAs, achieving a total sample size of 25,961. The dependent variable is the response to a question asking persons to rate their overall satisfaction with their neighborhood. Using ordinary least squares regression, Spain determined that gender was not a predictor of neighborhood satisfaction when other household and neighborhood characteristics were controlled for. Marital status remained significant, with single-person households, whether male or female, expressing lower levels of satisfaction than married households.[3] These findings, coupled with demographic trends in the United States towards increased workforce participation by women and shrinking household size, suggest that future residential satisfaction research should be placed in a context of household activity patterns, perhaps similar to those explored by activity-based transportation researchers (see Jones, ed. (1990)).

These series of findings support Galster's (1987) critique of residential satisfaction studies, that such studies should be disaggregated by household type. In addition, he identifies non-linearities between residential settings and their associated levels of

[3] As single-person households may be younger than persons in married households, additional research is needed to determine if this finding is an artifact of age. Increasing age is generally associated with increasing satisfaction (Campbell, Converse, and Rodgers (1976)).

satisfaction. These stem from the possibility of an upper bound of satisfaction being reached on various attributes (such as number of rooms within a house), and the diminishing marginal utility of increases in the levels of these attributes. These operate together to produce a curvilinear function describing the relationship between satisfaction and various features of the residential environment. However, the shape of these functions is likely to vary substantially across different households, which have their own sets of aspirations or perceived needs, and which respond uniquely to gaps in such aspirations or needs and reality.

This disaggregation of households suggests differences in "life-styles," a topic explored on a parallel path by Kitamura (1988) in his examination of life-style factors and travel demand. He identifies two major components of life-style: activity and time-use patterns, and values and behavioral orientation. Both components are useful in conceptualizing individual variations of residential satisfaction: values motivate individuals (or households) to achieve certain types of residential settings, and the settings in turn constrain or assist particular activity and time-use patterns. This overview of residential satisfaction assessments suggests several themes that are of importance in evaluating the potential for transit-based high-density residential developments:

* Most residents have a strong preference for ownership of a detached, single- family house;

* Certain segments of residents may be less inclined to favor single-family houses, particularly in suburban locations; these include the elderly, households without children, and housewives working in the home. In addition, single householders of either gender are less likely to favor low-density living;

* Regardless of their current living conditions, most residents report general

satisfaction with their home and neighborhood. Statements of dissatisfaction, in and of themselves, are not indications that an individual or household is planning or expecting to move;

* Income is apt to be a significant intervening variable affecting attitudes towards various residential locations.

Roots of the Preference for Single-Family Detached Housing

As noted above, many researchers have found empirical support for the belief that single-family detached housing is desired above all other dwelling types by the large majority of Americans. Why are residents so averse to high-density living? How has the single-family house, particularly the detached house with a yard, come to have such a powerful hold on the American image of the good life? These questions extend well beyond the boundaries of this study, but a brief exploration of this complex issue can help our understanding of the forces shaping housing choice, and the constraints planners face in building successful transit-based high-density housing developments.

A good starting point is to consider the intangible as well as the tangible benefits that accrue to one owning a detached single-family house. As anthropologist Constance Perin (1977) notes, these include the status and social position that come from owning one's own home, particularly if it is a detached house with a yard. "In American society the form of tenure - whether a household owns or rents its place of residence - is read as a primary social sign, used in categorizing and evaluating people, in much the same way that race, income, occupation, and education are" (p. 32). Essentially, the single-family detached house is a sign that one has "made it," that its owners are successes on both their own terms, and on society's. "(T)he American ideal of homeownership is equally the ideal of perfected

citizenship.... President Hoover's Conference on Home Building and Home Ownership in 1931, where many of today's selective incentives began, termed homeownership a 'birthright' and an 'epochal event' in a family's life. The awful alternative was to be 'condemned,' according to one realtor at the same conference, 'to die in a rented house'" (Perin, p. 72).

The corollary to the belief of homeownership as 'perfected citizenship' is that any other type of housing is undesirable, unwanted - perhaps even un-American. A developer interviewed by Perin recounted the extreme opposition he faced from neighbors of a proposed development of quadruplex condominiums. "(I)nitially we got some very negative reaction from homeowners surrounding it that we were going to downgrade their neighborhood[, by] the mere fact of building quadruplexes, something other than a single-family house" (p. 96). Although the neighbors were somewhat reassured by the knowledge that the buildings would be occupied by property owners, rather than renters, "there was the issue raised on the emotional plane, this stuff is <u>like</u> an apartment and it looks <u>like</u> an apartment, and therefore it's bad" (p. 138).

Perin also notes that many people equate different types of residence with different periods in a person's life cycle; housing that might be appropriate at one point would not be appropriate at other times. "In distinguishing between the characteristics of renters and of owners, they see the correct sequence of the life cycle as being an intrinsic feature of these differences - first a renter, then an owner" (p. 32). Perin's qualitative findings are supported by the survey results of Michelson (1977). In his study he found that apartment dwellers are just as satisfied with their living arrangements as owners of single-family housing, although they dislike a number of objective features of their housing. He attributes this to their belief that their rental status is temporary, and that they will soon become homeowners (or, more

specifically, owners of single-family houses) themselves. Their expectations for moving up the "ladder of life" allow them to bear their current dissatisfactions with equanimity.

These cultural norms are not passive societal preferences about the appropriate shape of the "American Dream". Public policy has been strongly influenced by such norms, most notably by the policies of the Federal Housing Administration (FHA). Through its long-term mortgage loan insurance program, the FHA has played a major role in reshaping American cities. As one urban historian notes, "No agency of the United States government has had a more pervasive and powerful impact on the American people over the past half-century than the Federal Housing Administration" (Jackson, p. 203). Historically, FHA has been considerably more supportive of single-family housing programs than multi-family projects. "In 1939 FHA asked each of its fifty regional offices to send in plans for six 'typical American houses'. The photographs and dimensions were then used for a National Archive exhibit. Virtually all of the entries were bungalows or colonials on ample lots with driveways and garages" (Jackson, p. 208).

Perin echoes these statements:

> Realizing the American Dream by arriving at the ownership of the single-family detached house... has been possible only through artifact.... (T)he historical trend to widespread homeownership has come about not through some natural workings of the market, but only by means of an artificial set of incentives designed originally to stimulate the economy by increasing housing production. The taxpayer-incentives are still being used that way. One economist studying their effects on tenure choice concludes 'that the structure of income taxes in the U.S. has worked powerfully to distort housing tenure choice by U.S. households.' Another insists on terming these incentives federal housing 'subsidies' to middle-income families, the largest such program, and one having 'indefensible distributional consequences' (p.77).

The federal government also supports single-family residential living through the

mortgage interest and property tax deduction provisions of the Internal Revenue Code. "The size of this subsidy to homeownership is staggering and exceeds by four or five times all the direct expenditures Congress grants to housing. In 1981 deductions for property taxes and for interest payments on mortgages added up to a federal subsidy of $35 billion, and by 1984 the total had risen to $53 billion per year.... Simply put, the Internal Revenue Code finances the continued growth of suburbia" (Jackson, p. 294). Government subsidies of various forms have distorted the market for housing in America in the same manner, and with at least as much influence, as the impact of transportation subsidies on mode choice and travel behavior.

The federal programs noted above have been powerful forces shaping Americans' desire for single-family, suburban style housing. But this is only part of the story. The desire for a detached house and a yard has been part of the "American Dream" for over a century, well before the direct involvement of the federal government. This desire has been widespread among all segments of the population and helped account for the popularity and rapid acceptance of programs such as those implemented by the FHA. The federal government was merely helping people do what they had wanted to do all along, and what those with the wherewithal had already done: move from high-density to low-density living.

## A Critique of Residential Density and Transit Specifications

Despite the large numbers of residential satisfaction studies that have been conducted and the wide range of variables that have been considered as possible causal factors, most residential satisfaction studies have not included valid measures of residential density in their model specifications. Many studies have not attempted to include such a

measure, although some include characteristics that are clearly correlated with density. In their study of what neighborhood and housing attributes would be included in respondents' "ideal" dwelling, Sanoff and Sawhney (1972) obtained responses about privacy from neighbors, ability to park in front of home, presence of front or back yard, and proximity to friends, shopping, and church; all of these are likely to be correlated with various levels of density. Campbell, Converse, and Rodgers (1976) measured size of community and evaluation of "convenience" of neighborhood, which also are likely to be correlated with residential density.

Other studies have explicitly included density measures, but have not adequately specified such measures. Housing type of respondent has been used as a surrogate for residential density (Michelson (1977); Doling (1976)), as has size of community (Campbell, Converse, and Rodgers (1976); Dillman, Tremblay, and Dillman (1979)) and general location in a metropolitan area (Uyeki (1985)). Density has also been subjectively presented to respondents as neighborhoods that are "densely populated" or "sparsely populated" (Shlay and DiGregorio (1985)). Some of these researchers have noted the inadequacy of their specifications, but have been constrained by resources to use only easily available information, or simply have not focused on density as an important variable.

Baldassare (1979) represented neighborhood density as persons per residential acre. Similarly, Galster and Hesser (1981) defined density as households per residential acre, identical to Baldassare's specification if a factor for persons/household is applied. These definitions of density as a continuous variable not identical to (although certainly correlated with) dwelling type or community size produce a much more flexible independent variable. This conceptualization is also much more closely related to density measurements used by planners and urban designers (Alexander and Reed (1988)).

Flachsbart (1979) drew on interviews with 319 residents of the Los Angeles metropolitan area, from 17 different neighborhoods. Respondents were randomly selected through stratified cluster sampling, with residents grouped by income, race/ethnicity, and life-cycle stage. Flachsbart investigated relationships between factors that might influence perceived density (such as width of street, frequency of intersections, block length, and slope) and residents' satisfaction, as well as the accuracy of their perceptions of their residential density. The satisfaction rating was significantly correlated with wider streets and hillier slopes, as well as with greater diversity in street shapes (i.e., departures from a grid pattern) and in block shapes and sizes. However, topography was significantly positively correlated with street shape and block length, and significantly negatively correlated with an objective measurement of density (average dwelling units/acre). The multicollinearity of several of the independent variables obscured the identification of any underlying causal structure.

The Flachsbart study is one of very few empirical efforts at defining the relationship between perceived density and an objective measure of density in outdoor settings. Perceived density has generally been studied by environment-behavior researchers such as Rapoport (1976), who distinguish the reactions people have towards particular densities from objective measures of those densities. Considerable research has been done linking internal housing characteristics and perceived density (see, for example, Saegert (1976) and Aiello and Baum (1979)). Far fewer studies have examined the relationship between perceptions of external densities and environmental characteristics. This dissertation provides some evidence of these linkages.

As noted above, proximity to transit has rarely been considered as a potential determinant of residential satisfaction. Lansing, Marans and Zehner (1970) included transit

service as a factor in their study of planned residential communities, but the only service available was a bus line that was used very infrequently. The most significant inclusion of transit in a major study of residential satisfaction was by Campbell, Converse, and Rodgers (1976). They used multiple classification analysis to assess the total explanatory power of nine community attributes, including public transportation quality, to predict overall community satisfaction. The ratings of the community attributes were found to explain 19 percent of the variance in responses to the community satisfaction question. The relative importance of quality of public transportation among the nine community attributes was low, as measured by beta coefficients; it was tied for seventh with quality of garbage collection.[4]

Although this finding suggests that residential satisfaction, at least with the community, is not particularly dependent on public transportation, it has several weaknesses. The physical proximity of the residence to public transportation is not made explicit in the survey; respondents were asked, "is any form of local public transportation available to you here," leaving the definition of "available" open to interpretation by each respondent. In addition, the forms of available public transportation could vary widely, and likely included everything from dial-a-ride services to rapid transit or commuter rail. Most importantly, the availability of public transportation was not included as a community attribute. Those respondents indicating it was available were asked to rate its quality; this measure was the item used in the comparison of community attributes to overall satisfaction. Only 41 percent of respondents indicated public transportation was available to

[4] The quality of the individual community attributes was measured on a five-point scale, from "very good" to "not good at all," while the rating of overall community satisfaction was done on a seven-point scale, from "completely satisfied" to "completely dissatisfied".

them, and thus provided indications of its quality. This suggests that lack of availability was viewed as unimportant, or at least not a determinant of satisfaction with community. This seems unlikely, as lack of public transportation may impose significant mobility constraints, particularly for adults with limited or no access to an automobile.

The Quality of Life study described above is virtually unique in its recognition, albeit limited, that public transportation may play a role in residential satisfaction. This neglect of a potentially important feature of the urban landscape may be symptomatic of the declining role of transit in America over the past quarter-century, or it may reflect a general neglect by residential satisfaction researchers of the various dimensions of accessibility; where accessibility is included as a variable, it is generally defined simply as travel distance, with no consideration of travel time, mode, or other potential components of a valid accessibility measure.

## HEDONIC STUDIES OF HOUSING PRICE

Hedonic analysis refers to economists' efforts to understand the relative importance of various attributes of a particular commodity, and to associate those attributes to the market price of the commodity. This technique has been widely applied to the analysis of housing markets. As described by Follain and Malpezzi (1980), the process partitions the value of a commodity into components which can be individually measured; prices are then estimated for each component using multiple regression analysis. "These prices can then be used to compute a standardized measure of housing quality. The measure, for any housing unit, is simply a weighted average of the components embodied in the unit, where the weights are the estimated prices of the components" (p. ix). Williams (1991) traces the development of hedonic pricing theory from goods-attribute theory (Lancaster (1966)) and

residential location theory (Wingo (1961); Alonso (1964)). Kain and Quigley (1970) were among the first researchers to focus on individual dwellings and give serious attention to the proper measure of the quality of residential services. Quigley and Rubinfeld (1987) note that "the use of hedonic methods to evaluate the attributes of housing has become widespread, especially after the publication of Rosen (1974)," who provided a synthesis of earlier material (p. 2).

McLeod (1984) and Williams (1991) observed that the bulk of empirical work (on housing as well as other topics, such as air quality) has focused solely on the individual value estimates of attributes (the hedonic price function). "Very few studies have utilised the marginal valuations of characteristics implied by the estimated hedonic price function to develop estimates of willingness to pay for changes in the level of provision" (McLeod, p. 389). Thus, much of the focus of this work has been on the identification and weighting (through multiple regression) of key attributes of housing and neighborhoods. This has provided the housing researcher with a rich database of identified variables, along with some indication of their relative importance with respect to marginal housing prices.

Hedonic price techniques (especially the first stage of relative attribute pricing or weighting) have much in common with measures of residential satisfaction. Both attempt to ascertain the value of housing (although value is not generally defined the same in the two different approaches), usually through determining the impacts of housing components or attributes on the overall housing valuation.

Hedonic analysis equates the "value" of a particular dwelling unit with its cost, and the contribution of any feature of that unit (number of bedrooms, location next to a park, etc.) in terms of the amount of the monetary value such a feature adds or subtracts from the cost of the dwelling unit. In residential satisfaction studies, "value" is usually represented

by expressed levels of satisfaction with housing, neighborhood, community, or some combination of all three. (Occasionally, willingness to move is used as an expression of dissatisfaction, and thus (lack of) value, but such willingness is not generally correlated with measures of satisfaction (Michelson (1977); Lam (1985)).) To economists using hedonic analysis methods, "satisfaction" is implicitly revealed by consumers' willingness to pay for their housing choices.

Of the two techniques, the hedonic method has greater face validity; dollar amounts are generally accepted as at least a rough indication of an object's (or attribute's) value, which may not be true of satisfaction ratings. Certainly, such ratings represent a less common indicator of value. This also reflects the likely greater reliability of hedonic measures: a measure of value represented the sale price of a $200,000 house with a certain set of attributes is apt to be more stable than a satisfaction score obtained from a resident of such a house. Even hedonic analysis results, however, depend on circumstances; the components of a $200,000 house can be very different depending on the locational and temporal setting of the valuation. Just as the validity and reliability of residential satisfaction surveys must be viewed within a particular context, so too must the validity and reliability of hedonic measures.

As with residential satisfaction studies, dwelling type is often a surrogate for residential density in hedonic price studies (Kain and Quigley (1970); Quigley (1981, 1984)). Follain and Malpezzi (1980) do calculate a measure of internal density (persons per room), but do not measure external density. Williams (1991) included "residential density" as a housing attribute, but simply estimated "above average, average, and below average" house sizes from an exterior vantage point. Lot size was measured in square meters. From this description of the density variables, it is difficult to determine how a general breakdown

of houses into large, medium, and small size units, even if it is somehow linked to lot size - a link which is not explicitly made - says anything about residential density, whether housing density (e.g., persons per room) or neighborhood density (e.g., dwelling units per block or per acre).

Housing density occasionally has been studied through hedonic analysis; Follain and Malpezzi (1980) include a "crowding" variable in their model, defined as persons per room. However, no hedonic model appears to have explicitly included a neighborhood density variable, such as dwelling units per acre. Although it may be argued that hedonic studies have determined the impacts on housing price of variables which might serve as surrogates for neighborhood density, such as dwelling type, building size, and lot size, these variables can exhibit such a variety of specifications (see Alexander and Reed (1988)) that they effectively say very little about the impacts of actual neighborhood densities.

Several hedonic price studies have examined the impacts of accessibility to rail transit stations on housing prices. Diamond (1980) examined sales of 414 new Chicago-area houses. Several amenity variables were added to each observation, including distance to the CBD along major roadways and distance to the nearest commuter rail station. (See Table 2-1 for a complete list of variables included in this and the following hedonic models.) Both of these variables were significantly associated with housing price. Diamond notes that accessibility to commuter rail stations is an important amenity to many residents. "However, there is a clear division between those for whom it matters (commuters to the CBD) and those for whom it is irrelevant. It seems that the former group dominates the formation of land prices since there is a relatively strong effect on them. But those who have no use for the rail lines can avoid paying those prices by moving further away from the stations. The two groups may nullify each other in the general pattern, with

the result of a negligible correlation with income and, relatedly, relatively large variance on the estimate of the income elasticity" for the rail station accessibility variable (p. 11). Such interpretation of the results clearly suggests the need for a market segmentation into CBD-workers and other residents, with separate model estimates. In general, the residents did not live near the rail stations; the mean distance to a rail station was 3.0 miles, with a standard deviation of 1.3 miles.

Dewees (1976) describes a hedonic analysis more relevant to this research effort. He examined the impacts on housing sale prices of construction of a subway line in Toronto. Residential property sales along the Bloor-Danforth subway corridor were examined, up to one mile from Bloor Street. Data were gathered from sales of single-family houses and structures with up to four dwelling units; 690 observations were collected from 1961 (before subway service was initiated), and 1,174 observations came from 1971 (following the start of subway service). The subway replaced a streetcar line; unfortunately, the report does not indicate if headways changed along with the change in mode, although the subway did operate at speeds about double those of the streetcars (22 MPH vs. 10-12 MPH).

Housing prices were significantly related to accessibility to the transit system both before and after construction of the subway system. Dewees tested several specifications of the transportation variable in the regression model, including walking distance, travel time, and travel cost (see Table 2-1). In general, travel time proved to be a better measure of access than distance or travel cost, and access to the transit facility was more important than access to the CBD. Additionally, using a threshold cut-off distance of 1/3 mile, the author demonstrated that construction of the subway had no impact on housing prices beyond this point. Within 1/3 mile of the subway station, rent slopes increased almost 50% in constant

dollars, suggesting a definite impact of increased transit service on area property values.

Al-Mosaind, Dueker, and Strathman (1993) report results from a hedonic price model of residential neighborhoods near light rail transit stations in Portland. Like Dewees, they found a positive relationship between station proximity and housing cost. Housing within 500 meters (approximately 1/3 mile) of a station cost $4,300 more than equivalent housing between 500 and 1,000 meters from a station. Within 500 meters, the authors found a slight tendency for housing sale prices to decline as distance from the station increased; however, this tendency was not statistically significant. Only single-family houses were studied, and no density measures were included (see Table 2-1).

The primary weakness of hedonic analysis for the purpose of the current study is its inability to ascertain the value of new housing characteristics, or new combinations of existing characteristics. As relatively few transit-based high-density units have yet been constructed (and many of those currently in place are rental units (Bernick and Carroll (1991)), a method that relies on sales of existing dwelling units for its data set will not be able to provide an adequate data base. Hedonic techniques seem most appropriate where minor changes are being made or proposed to existing systems, services, or structures, and preferences can be fairly clearly identified. Where qualitatively new situations are being considered - such as neotraditional developments and residential densification around existing rail lines - residential satisfaction surveys are more appropriate.

To some extent, the dichotomy between hedonic analysis and residential satisfaction studies parallels that of revealed preference and stated preference survey techniques. The former relies on directly observed (or reported) behaviors to draw conclusions about the desirability or undesirability of certain actions under specific conditions. Revealed preference models suffer from some of the same shortcomings as hedonic pricing models:

variables of potentially limited range and a lack of some choice alternatives (Louviere et al. (1981)).

Stated preference surveys can manipulate the dependent variables based on a controlled experimental design procedure (Louviere (1986); Rossi and Anderson (1982)). However, some researchers note the possibility that such surveys can be prone to response bias (Kroes, Sheldon, and Gore (1990); Hensher, Brotchie, and Gunn (1989)). These concerns have also been raised regarding attitudinal surveys and statements of intended behavior. Recent techniques to evaluate public goods, such as the contingent valuation method (Cummings, Brookshire, and Schulze (1986); Mitchell and Carson (1989)), may reduce such threats to validity, by clearly defining the good to be evaluated and creating a meaningful market for valuing the good. Additionally, the cognitive psychological study of survey design and responses (see Tanur, 1992) provides insight into ways of strengthening research instruments, as well as the limits of such instruments. Strengths and weaknesses of the research methods for this study are explored in greater depth in the following section.

## A COMPARISON OF RESIDENTIAL SATISFACTION AND HEDONIC PRICING METHODOLOGIES

Despite their differences, residential satisfaction and hedonic methods often have been used to answer questions that are basically identical: what are the important attributes of housing, and what do they contribute to the overall value of housing? As indicated above, these procedures use divergent means (generally those of stated preference vs. revealed preference, respectively) and are based on different conceptions of "value". However, they share several methodological strengths and weaknesses:

1) Both lend themselves to disaggregate data analysis. As both methods are based on

actions or statements by individuals or households, the data have been collected at a disaggregate level and thus provide analysts with a flexible data base to test a wide variety of behavioral hypotheses, and (with a large enough sample) to control for a variety of socioeconomic or demographic variables. However, neither method has been widely used in this manner, and analysis has often neglected potentially useful submarket divisions (see MacLennan (1977); Galster (1987)). Residential satisfaction techniques would seem to be more capable of exploring such divisions, as information about a large number of household or individual characteristics can be collected in the process of interviewing. Hedonic models, on the other hand, are usually (though not always - see Kain and Quigley (1970)) limited to information available from records of home sales. Additional information may be available from other sources (e.g., Dewees (1976)), but often only at an aggregate level. Efforts to provide proxy measurements of socioeconomic characteristics of individual households, for example by assigning median census tract values for income, age, and family size (McLeod, 1984), say more about neighborhood characteristics than individual household characteristics, and may produce spurious results.

2) Both produce models that could take account of non-linearities, but infrequently do so (see MacLennan (1979); McLeod (1984); Galster (1987)). In general, hedonic analysis more often develops non-linear specifications for the relationships between the housing valuations and the housing attributes (generally semi-log and log-linear models). Both methods, however, frequently assume simple linear relationships.

3) As noted above, neither method has regularly used an adequate standard representation for neighborhood density. Such a representation should relate a unit of population to a unit of area; depending on the needs of the researchers, the numerator might be persons or households, and the denominator square footage, acres, or blocks of a standard size. In

addition, neighborhood density measurements should specify the extent to which non-residential land uses found in proximity to residences are being included; such land uses include streets, shops, and various business and commercial services (Alexander and Reed (1988)). Such specifications would enable both estimates of housing value and the presence or absence of specific housing attributes to be linked to more detailed representations of the residential environment (see Flachsbart (1979)). Such linkages would enable planners, policymakers, urban designers, and others to more easily incorporate findings from housing valuation studies into their designs, policies, and plans.

## CONCLUSIONS

Results from the studies described above have increased understanding of some important attributes of housing. A smaller set of results has provided insight into key aspects of density in residential areas. However, density specifications often have been imprecise. Relatively little can be said conclusively about the relationship between satisfaction and density, beyond the general finding that people prefer low-density living. In addition, the relationship among transit, density, and satisfaction is poorly understood. A few hedonic analyses indicate that proximity to transit stations increases housing value, but these studies focused primarily on neighborhoods of detached single-family houses.

This study focuses explicitly on the linkages among density, transit, and residential satisfaction. As such, it draws on the available data from the relevant studies described above to formulate hypotheses (stated in Chapter 1). It derives its methodological approach primarily from residential satisfaction studies. Stated preference techniques are used, in combination with computer-generated photosimulations of possible residential developments. By being able to directly manipulate combinations of buildings and settings,

this technique avoids the difficulty encountered with hedonic studies of not being able to measure that which doesn't exist. In addition, multicollinearity among the explanatory variables is controlled, at least to the extent they are included in the study design. The following chapter describes in detail the study methodology.

## CHAPTER 3 - METHODOLOGY

The methodology for this study was designed to measure respondent attitudes towards different housing densities and types in a controlled, quasi-experimental framework. This framework takes advantage of the strengths of stated preference techniques, described in Chapter 2. It controls for multicollinearity among explanatory variables, and permits judgments of and comparisons among particular combinations of housing and settings. These combinations are 'artificial environments,' created specifically

to examine the relationship between housing density and type and residential satisfaction.

Through the techniques used for selecting respondents and developing the simulated environments (described below), the study is able to address several additional variables of interest. Two of these are familiarity with and proximity to the sites used as bases for the simulated environments. Do respondents differ in their reactions to modifications made to a site based on their familiarity with that site? Does the proximity of their homes to the site affect their satisfaction with various residential developments? These issues are relevant in many planning settings, as planners increasingly must take into account the interests and desires of persons living in the vicinity of potential projects. However, little research has been done that describes the spatial dimensions of a "not-in-my-backyard" reaction. Providing such dimensions can help planners assess areas from which opposition to (or support for) a project might be most intense, as well as areas in which residents are not apt to hold as strong opinions.

These questions are addressed through the selection of specific sites for the visual simulations, and through the selection of respondents living near these sites. An additional variable of interest is whether locating the residential developments near different transportation nodes (transit stations or freeway interchanges) affects respondents' attitudes. Socioeconomic and demographic data collected from each respondent also permit investigation of the influence of background variables, such as income or children, on respondents' ratings of the simulated environments.

Developing the methodology for this study required addressing four interrelated but distinct topics: selecting specific sites which would provide both the settings for the residential developments and the bases of the population sample, preparing the visual component of the study, developing a sampling frame, and designing the questionnaire.

Each of these topics is discussed separately below, as is the actual field surveying.

SITE SELECTION

A total of four sites were selected for use as bases around which housing would be placed through computer-generated photosimulation. These sites also identified the areas from which respondents would be drawn. The selection of specific sites was influenced by several factors:

1) Sites were selected in two metropolitan areas, to increase the generalizability of results. Sacramento and the East Bay area of the San Francisco region were selected as the two areas in which specific sites would be identified.[5]

2) Reactions to transit-based housing would be better understood if they were compared to reactions towards housing at non-transit sites. By doing so, reactions independent of housing type and density but particular to a transit environment could be ascertained. Reactions to transit station sites could have at least two components: the visual presence of the station as a part of the built landscape, and the accessibility opportunities the station represents. The non-transit sites were selected to match as closely as possible these two station components. The accessibility opportunities of transit dictated the selection of some other portion of the transportation system.

Two types of transportation infrastructure were considered as comparisons: freeway interchanges and intersections of major arterials. The freeway interchange was selected as somewhat more appropriate than an arterial intersection due to the similarity of the functional roles of the rail systems and the freeways. Both are primarily concerned with

[5] These areas were chosen as representative of cities with new light rail transit systems and somewhat older heavy rail systems.

moving through traffic as opposed to providing local access. Major arterials may also serve this role, but their functions are more apt to include some local access provision (Stover and Koepke, 1988). With the particular systems chosen, this functional similarity is reinforced by the parallel service provided by the rail line and the freeway in each urban area. Both the LRT and Route 50 provide direct access to downtown Sacramento; BART and I-880 provide similar access to downtown Oakland and from there (through transfer or switching freeways) to other parts of the Bay Area.

Combining these first two factors produced the site-selection matrix shown in Figure 3-1. A regional map in Figure 3-2 shows the respective locations of the chosen sites.

3) The selection of specific sites served two purposes: it provided settings on which different types of housing would be overlaid in the visual simulation process, and it provided areas from which the respondent sample would be drawn. Choosing respondents living near the environments being modified through simulation allowed the effects of proximity on attitudes could be measured. Showing respondents slides of (simulated) developments near their homes as well as (simulated) developments in a different metropolitan region would provide an indication of the influence of a "not-in-my-backyard" (NIMBY) attitude on the ratings of various developments, and permit the analysis of familiarity as a potential intervening variable in the relationship between density and satisfaction.[6]

---

[6] Respondents were not specifically asked if they were familiar with the sites shown; it was assumed that most respondents would have at least some familiarity with the site nearest their home, while very few, if any, would be familiar with the sites in the other urban area. Familiarity was predicated on both the proximity of sites to respondents' homes and to the sites' significance (and magnitude) in the regional transportation system and the local landscape. In Sacramento the Route 50 interchange with Bradshaw Road is the closest interchange onto Route 50 (the major freeway in that portion of Sacramento) for all Sacramento respondents, while the Butterfield LRT station is the closest LRT station, as well as being a terminal station

and located along a major arterial. Both are well-signed, approximately a mile-and-a-half apart, and easily noticeable to anyone traveling in the area. In the East Bay, the two sites are slightly further apart (approximately four miles). Nevertheless, both the Union City BART station and the Tennyson Road/I-880 interchange are major parts of the transportation infrastructure in the East Bay.

This imposed two additional requirements on site selection: the sites had to be close to residential developments, and within the particular metropolitan area, the sites had to be relatively close to each other. This latter requirement permitted the assumption that, within a metropolitan area, respondents living near, say, the transit station would also be familiar with the freeway-based site, and thus might also have a "NIMBY" component to their responses to development around the freeway-based site. Determining an acceptable theoretical distance between sites was difficult due to the lack of research on spatial limits to a "NIMBY" reaction. In practice, proximity of the freeway site to the transit site (the latter of which was selected first in each metropolitan area) was used as one factor in the selection process, along with the other two factors described below.

4) Sites were selected so as to be similar to one another on key census variables. Specifically, sites were compared (at the census tract level) on median household income, percentage of owner-occupied units, percentage of households with children, median value of owner-occupied units, median rent, median age, and average travel time to work (see Appendix 3-1). Matching populations within census tracts for each of the four sites on these key variables made it less likely that one or more of these variables might vary significantly among the samples and thus confound the study findings.

5) Requirements of the visual simulation process placed certain restrictions on sites. Slides were taken at a distance of 300 - 500 feet from the sites; in some instances, pictures could not be taken from this distance because of signs, trees, or other obstacles partially or completely blocking the freeway interchange. (The transit sites selected did not have any visual blockages.) Other sites could not be used due to curves in the road leading to the site, or, in one instance, a significant rise in elevation from the perspective of the viewer to the site. Finally, it was felt that the roadways leading to each site should not be bordered by a

large number of existing buildings, as these structures would be removed during the simulation process. Removal of a number of existing buildings might provoke a different opinion from the respondent, whether positive or negative, and thus distort the significance ratings of each scene.

In the actual process of site selection, the Butterfield LRT station in Sacramento was selected first (see map of Sacramento sites in Figure 3-3). It was chosen for its suitable sight lines for photography, the existence of parking lots which provided "empty space" to overlay with various developments, and its proximity to local residential developments. Matches were then made between the Butterfield station census tract and appropriate census tracts in Sacramento (for a freeway-proximate site) and the East Bay (for transit- and freeway-proximate sites). In order to control for differences between the two metropolitan areas, the values of the key census variables for each census tract were standardized to the average values for their respective counties (Sacramento and Alameda), and selection of Alameda County sites was made by searching for census tracts that had similar standardized values to the census tract around the Butterfield station. In particular, this helped control for the large difference in housing costs between Sacramento and Alameda counties. Appendix 3-1 presents both absolute and standardized values for each key variable for each of the four census tracts.

The most appropriate freeway-proximate match in Sacramento County to the Butterfield census tract was a tract about a mile-and-a-half away, south of Route 50 and east of Bradshaw Road (see Figure 3-3).[7] Although this site did not actually border the census

[7] The Bradshaw Road interchange with Route 50 which actually bordered this census tract was not suitable as a simulation base, largely due to the presence of intensive land uses on both sides of Bradshaw Road. The north side of the Bradshaw Road/Route 50 interchange was selected instead as the base in the photosimulation process, as the existing land uses were fewer in number and considerably less visible.

tract from which respondents would be drawn, the proximity of the site to the census tract ensured that the vast majority of the respondents living in the census tract would be familiar with the site. Additionally, this site was slightly closer to the Butterfield LRT station census tract, thus likely increasing the familiarity of Butterfield census tract residents with the Bradshaw Road site.

In the East Bay, the BART station census tract that provided the best match with the Butterfield LRT station census tract was the one encompassing the Union City BART station (see map of East Bay sites in Figure 3-4). As with Butterfield, this station had good sight lines, a parking lot on which residential development could be simulated, and nearby residences from which to draw a site-based sample.

The most difficult site to select was the freeway-proximate site in the East Bay, as matches on the census variables were not as close as with the other sites (see Appendix 3-1) and good sight lines were difficult to obtain. The selected site was in Hayward, north of Tennyson Road and east of I-880. As in Sacramento, the adjacent freeway interchange did not prove suitable as a base for the simulations (due, in this instance, to poor sight lines); thus the west side of the Tennyson Road/I-880 interchange was used instead. As in Sacramento, it was assumed that all residents of the Hayward census tract would be familiar with the freeway interchange site, although it was not actually part of the tract. The Hayward and Union City sites are slightly over 4 miles apart.

## VISUAL SIMULATION

Central to the research questions explored in this study is the evaluation by respondents of various density and building types, while controlling for effects of locational and contextual variables. This evaluation required a visual element to the materials

presented to the respondents, as opposed to purely written descriptions of the residential environments. Pictures convey more information than can be provided through written descriptions, no matter how detailed, and they are also apt to capture respondents' interest more readily and hold it longer than lengthy written descriptions. Respondents could have rated pictures of individual buildings with no setting, but this would not have permitted the evaluation of the effects of the different site attributes: proximity of the site to the residence of the respondent, and transit- vs. freeway-proximate sites. Additionally, it seems unlikely that people evaluate individual buildings irrespective of other aspects of the physical environment. Placing these buildings in a setting - showing how they related to the buildings and streets around them over roughly a one-block area - provided a more realistic context for evaluating satisfaction. As described below, the buildings and settings were depicted from street level (as opposed to a bird's-eye view), as this is the viewpoint from which people regularly experience their environment.

Computerized photosimulation techniques were used to hold settings constant while varying building type and density of the residential environments. In this process, slides of existing buildings and settings are scanned into a computer file. Specialized software then permits the computer user to manipulate the images in a wide variety of ways.[8] Objects can be deleted and new objects can be added; the overall image can be made lighter or darker, sharper or more blurred. To some extent, perspectives can be changed: views of objects at an angle can be shifted in order for the object to be seen more or less directly. Also, slight variations in grade can be introduced so the object appears slightly higher or lower (relative to the viewer). These alterations are limited by distortions to the images, however; large

[8] The specific software program used in this study was Aldus PhotoStyler, Version 1.1, 1990/91, Aldus Corporation, Seattle, WA.

changes in perspective produce images that appear curved or bent, and look "unreal" from the viewer's perspective.

For this study, buildings, parking lots, and other land uses along existing streetfronts or driveways were eliminated, and replaced by the desired residential environments. These new images were saved in a computer file, then reproduced on regular slide film. Appendix 3-2 presents a complete set of prints made from both the original slides and from the slides produced by photosimulation.

A basic purpose of this study is to understand the effect of external density (e.g., dwelling units per acre) on satisfaction. Because of this focus on external density, respondents were shown slides with multiple dwelling units visible. The information presented in the slides and the instructions given to respondents called their attention to groups of dwelling units, not just an individual unit. In the slides, two street fronts were shown with several residences on each side. The instructions to the respondents stated "you will be shown slides of some residential developments of different types and densities. For each slide, imagine you were given the opportunity to move into the residential development, and indicate how satisfied you believe you would be living there". The satisfaction ratings therefore reflect peoples' reactions to groups of residential buildings, not just single dwelling units.

As described in the section on site selection, four sites were used as bases around which residential developments of varying densities were placed (see Figure 3-1). For each setting, six slides depicted the varying building types and densities to be evaluated; thus, each respondent rated a total of 24 slides (six building types and densities by four settings). The building types and densities are as follows:

1) Single-family homes, at approximately 8 dwelling units/acre

2) Duplexes, at approximately 12 du/acre

3) Two-story townhouses, at appr. 11 du/acre

4) Two-story apartments, at appr. 23 du/acre

5) Three-story apartments, at appr. 44 du/acre

6) Four-story apartments, at appr. 89 du/acre

These building types and densities provide a broad range of development options around transit stations. Less dense development (such as single-family houses on quarter-acre lots) would not provide the number of residents desired by transit planners, while buildings larger than four stories are generally not considered to be acceptable to residents.[9]

Several criteria guided the selection of the residential developments described above. As noted, one was to represent a number of feasible options for transit-oriented development. A second criterion was to hold constant, to the extent possible, factors of the specific residential developments (other than building type and density) that could influence respondents' judgments. In particular, age of the development and landscaping were controlled as much as possible. Relatively new developments were used to depict various building types and densities; although the ages of all developments are not known, it is unlikely that any are over 20 years old, and most are less than 10.[10] Restricting the age of

---

[9] Pushkarev and Zupan (1982) report that, under the best conditions, light rail service can be supported with residential densities as low as 9 dwelling units/acre, and rapid transit with densities as low as 12 dwelling units/acre. They note, however, that both the density of nonresidential destinations and the distance between trip ends are more important factors in predicting or encouraging transit use than residential density per se.

[10] Choosing recent developments was somewhat arbitrary; depicting developments built 30 to 40 years ago would also control for actual building age. However, to the

the depicted developments to a narrow range was meant to reduce the extent to which an individual's response was predicated on the apparent age of the development. (It should be noted, however, that respondents could only react to apparent age, not actual age.)

Developments were also chosen to match each other as much as possible with respect to the landscaping around the development. Levels and quality of landscaping have been shown to significantly increase evaluations of residences (Marcus and Sarkissian, 1986), and were held constant to the extent possible. Additionally, as described below, developments with low levels of landscaping were preferred so that respondents could actually see the buildings they were being asked to evaluate. Depicting only residences with low levels of landscaping does not permit testing for an interaction effect of landscaping and density, an interaction which might be significant under certain conditions. For example, it was not possible in this study to test the hypothesis that pleasant landscaping ameliorates the negative visual impacts of high-density development.

A third set of criteria that guided selection of residential developments was the requirements of the photosimulation process. The photos of the transit stations and freeway interchanges were taken 300 to 500 feet from the sites with a straight and level line of sight; residential developments were placed on both sides of the road or driveway leading to the site. Several factors controlled the selection of residential units that could be used. One was the necessity of using developments on level terrain. Views of housing that were not level could not fit into the settings. Curved streets or driveways also posed a barrier to

---

extent that different developments appear to age at different rates (due to differences in building materials, variations in levels of maintenance and upkeep, intensities of use, and exposure to different climates), choosing older developments would probably introduce more variation in apparent age of buildings. Using newer developments hopefully kept the number of judgments that were influenced by apparent differences in age among the developments to a minimum.

selecting certain residential sites, although slight roadway curvatures could be adjusted in the simulation process. These features of the physical terrain were most problematic in selecting a single-family residential development, as many such developments in the Bay Area, particularly newer developments, are located in hilly areas and/or along winding streets.

A clear picture of the building was a requirement for using a particular residential development. Buildings with residential units that did not directly face the street were difficult to use, as were buildings largely in the shadow of or blocked by other buildings. The most common barrier to a clear visual impression of residential units in a building was large amounts of landscaping. Many settings that were otherwise suitable for use in the photosimulation process could not be used because relatively little of the actual building was visible, either in person or on film. As mentioned above, landscaping in a residential setting is a crucial factor shaping attitudes towards an environment. It is possible that showing developments with relatively little landscaping produced lower satisfaction ratings than would have been attained using similar developments in more lush surroundings. A study of the interaction effects of landscaping and density would provide useful information on these determinants of residential satisfaction, but visual depictions of such environments would need to find ways of presenting both high levels of landscaping and a clear indication of building types and densities.

The criteria listed above indicate some of the factors that were controlled for in this study. Other important factors, however, were not controlled for; these include the architectural design of the buildings, the setback of buildings from the street, the amount of blue sky shown in the slides, and presence of pedestrians in the slides. Any or all of these factors may have influenced respondents' ratings. Suggestions for future research that take

some of these factors into account are discussed in Chapter 5.

The presence of parked and moving traffic was also not deliberately controlled for, although the freeway-based slides show consistently greater traffic volumes than do the transit-based slides. Volumes of both autos and pedestrians might be expected to increase with density; however, for a given site, auto and foot traffic was held constant in the slides.

The prints shown in Appendix 3-2 vary somewhat in quality and resolution. This is largely an artifact of the print production process; resolution of the slides was moderately high, and both quality and resolution did not vary much from slide to slide.

A final factor that may have influenced results was the use of only a single perspective, that of an oblique view of the residences. Additional views of a neighborhood, such as a direct frontal view, a view of backyards or street intersections, or views from inside the dwelling looking out, would have provided a more complete environment for the respondents to evaluate.

Visual simulation permitted modification of the images to clarify important or missing aspects of the setting. In a few instances, trees or other vegetation were removed from the picture to provide a clearer view of the buildings behind them. One-way arrows on the driveway of the Union City BART station were removed so respondents would not judge the desirability of that setting based on possible accessibility problems relating to one-way traffic. The greatest changes to the existing visual environment occurred at the Tennyson Road/I-880 interchange in Hayward. The interchange was difficult to discern in the base slides used for the freeway-proximate East Bay setting; trees in the roadway median obscured much of the overpass, and the only sign indicating a freeway entrance was difficult to see, much less to read. Through the use of the computer photosimulation program, an artificial freeway sign was "painted" and placed much more prominently in the

picture, so that viewers (especially those unfamiliar with the setting) could recognize the area as immediately adjacent to a freeway interchange. Discussions with pre-test respondents indicated that none of them recognized the "sign" as being out of the ordinary, and none of the regular respondents mentioned anything verbally or on their questionnaires that suggested they interpreted the "sign" as being anything other than a regular Caltrans freeway indicator. (See Appendix 3-2 for prints made from the slides discussed in this paragraph.) This suggests, although it does not prove, that this change probably did not influence respondents who were familiar with the area, any more than an additional actual road sign could be expected to have an impact on residents' satisfaction with an existing area or neighborhood.

CONTACTING RESPONDENTS

The use of specific geographic areas around the selected sites permitted testing for the effects of proximity of residential developments to respondents' homes. However, it placed strict demands on the sampling procedures used to contact respondents. The difficulty in sampling respondents from a small geographic area lies in developing a comprehensive and unbiased list of respondents (or dwelling units) from which to draw the sample. Several methods were considered; the following discussion summarizes these methods and their advantages and disadvantages.

* Sample respondents through door-to-door solicitation of interest of a randomly-selected group of respondents.

  Advantages: This method would likely generate the "best" random sample, as contact could be made with all randomly-chosen respondents. The only limits to the

representativeness of the sample would be that caused by individual respondents' refusal to participate, which is a limitation of all the sampling strategies.

Disadvantages: This method was estimated to be extremely time-consuming, particularly as repeated efforts to reach respondents would be required to keep the sample from being heavily weighted towards respondents who are more often home. The time and money necessary to produce an appropriate sample through person-to-person contact prohibited its use in this study.

* Obtain telephone numbers of all residents within the desired geographic areas through parcel registration information at the city or county planning offices. Solicit a random sample of residents through telephone calls.

  Advantages: Contacting randomly-selected residents by telephone is much less expensive than contacting them in person. Using parcel information would ensure that selected respondents lived within the appropriate geographic area surrounding one of the four sites.

  Disadvantages: None of the planning departments had telephone numbers associated with particular parcels.

* Obtain telephone numbers of residents through a "reverse" telephone directory, which lists residents and telephone numbers by street address.

  Advantages: As with using parcel listings to generate phone numbers, this method allows selection of respondents living within certain areas of the city. It also permits respondents to be contacted by telephone, saving time and money.

  Disadvantages: Only 24% of a sampling of reverse-directory street addresses near

the Butterfield LRT station provided a telephone number or name, raising concerns about the representative nature of samples generated through this method. This was ultimately judged to be too uncertain a means of generating an unbiased sample.

* Identify all addresses within the desired geographic area through parcel maps and/or direct observation. Mail letters regarding the project to a random sample of residents and invite them to participate in the project by calling a (toll free) telephone number.

  Advantages: Provides a complete listing of dwelling units in the target area. Does not require obtaining telephone numbers, which may be difficult for the reasons described above.

  Disadvantages: Requires respondents to actively express interest in the project, which may reduce response rates and bias results. Sampling within households would be difficult. The costs of this method, including both letters and telephone calls, would be greater than any method except the first.

* The chosen method involved purchasing lists of geographically-based telephone numbers from Survey Sampling, Inc., a company that specializes in developing specific sampling frames. For this study, a random sample of at least 300 telephone numbers was drawn for each of the four census tracts chosen in the site selection process. These numbers were called, and a within-household screening procedure, described below, was used to randomize respondent selection.

  Advantages: This method met the requirements of obtaining four geographically-specific samples, quickly and at a relatively low cost, while allowing for within-

household screening procedures. Overall, it was judged the best available method.

Disadvantages: The primary disadvantage was that only listed telephone numbers could be drawn on a census tract basis. Unlisted numbers were not used in the sampling process. This eliminated a fairly large number of households from the pool of possible respondents; approximately 65 percent of households in the Sacramento metropolitan area and 64 percent of households in the metropolitan area that includes Hayward and Union City have unlisted numbers (Survey Sampling, Inc., 1994).

The lack of access to unlisted telephone numbers may have biased results somewhat, as households with listed and unlisted telephone numbers may differ on various socioeconomic and demographic variables, such as age of household members, income, and length of residence. [11] Otherwise, the numbers provided by Survey Sampling, Inc., appear to fairly represent the residential populations. Few numbers were disconnected, and even fewer were connected to businesses or offices or had been changed to other numbers (reflecting households that had very likely moved out of the selected census tracts). The large majority of numbers were usable numbers connecting to residences in the appropriate tracts. (See Appendix 3-3 for a breakdown of the results of the telephone portion of the survey.)

Once the general method of obtaining a sample was chosen, a "call sheet" was prepared (see Appendix 3-4). This script identified the caller as part of a research team from U.C. Berkeley, gave a brief description of the project, told the respondent he or she

[11] In Chapter Four, key socioeconomic and demographic variables from the respondents are compared to census tracts figures, to provide a check on the representativeness of the samples from the various populations.

would receive $20 for participating, and specified the dates, times, and locations of the Sacramento or Hayward/Union City sessions, as appropriate. (Sacramento interviews were held on August 8 and 10, 1993; Hayward and Union City interviews were held on August 12 and 14 and on October 9.) Respondents agreeing to participate were sent letters thanking them for their help and confirming the agreed-upon date, time, and location. Respondents also received maps to the session sites.

One screening question was asked, in order to randomly select an adult within the household. In general, phone surveys that query the person answering the telephone usually do not obtain a representative sample; "telephone answerers" are generally older and more likely to be female than a typical cross-section of the adult population. To avoid this, and to provide an equal chance for each adult to be selected, the caller was instructed to talk to the adult in the household who most recently had a birthday. This screening technique has been used by several survey researchers (Salmon and Nichols, 1983; O'Rourke and Blair, 1983; see also Gaziano, 1988), who generally report that it appears to produce representative samples of the population of interest. A direct and fairly simple question such as this also avoids the confusion that can develop when multi-level screening questions are asked. Such procedures typically inquire as to the number of adults in the household, then the number of adults of a particular gender, then require the interviewer to consult a matrix to determine which adult (whether the 'oldest female,' the 'second-youngest male,' etc.) to survey (Groves and Kahn, 1979; Gaziano, 1988). These procedures ask more of both the callers and the respondents, and do not appear to provide any more 'accurate' samples than do simpler techniques such as the birthday method.[12]

[12] The birthday method is not without its flaws, however. A number of persons answering the phone assumed the caller wished to speak to someone who recently had a birthday; if no one had, it was not always easy to convince the person that the 'most recent' birthday could have occurred many months ago. This difficulty was at

A total of 152 respondents agreed to participate; based on the 1,083 persons actually contacted, this represents a success rate of approximately 14 percent. (See Appendix 3-3 for a complete breakdown of calling results.) This was lower than anticipated. Some persons indicated they would be out of town on the days of the survey, while others had work or school commitments at those times. A small number of respondents did not have access to a car or were otherwise physically unable to get to the survey locations. Most refusing respondents, however, provided no specific information as to why they were not participating. The offer of $20 did not seem to sway many respondents; it seems likely that the majority of respondents attended because they were interested in the topic, not primarily to receive the $20. This suggests that persons agreeing to attend may be more interested in topics of residential selection, or perhaps housing and transportation, than were those persons who chose not to attend.

QUESTIONNAIRE DESIGN

The questionnaire consisted of two parts. An initial section inquired about current and past residences and travel behavior, and also asked basic socioeconomic and demographic questions. The second section asked respondents to rate their satisfaction with

---

times exacerbated by language barriers. Other persons interpreted the screening question to apply only to those persons in the home at the time the interviewer called; persons home alone often appeared to 'appropriate' the respondent role for themselves. When the request was correctly understood by the person answering the phone, the target person (the one who had most recently had a birthday) was usually easily identified. Also, very few persons appeared to find it odd that callers were asking this question - again, once it was understood what was actually wanted. However, it is likely that only about 60-70 percent of the respondents fully understood the screening question. To the extent that the 'wrong' person was identified by this process, the sample departs from that which would have been obtained by a completely accurate within-household screening procedure.

their current and past residences. Respondents then used the rest of the second section to respond to slides showing various residential development-by-setting combinations. (See Appendix 3-5 for a copy of the questionnaire.)

As described above, each slide showed a particular residential development in a specific setting. A total of four settings were used; Figure 3-5 demonstrates how these settings related to key study variables. Respondents provided individual satisfaction scores for each slide, then chose a 'most liked' and 'least liked' slide for each of the four settings. To provide some indication of financial constraints, respondents were asked to specify the amount they were willing to pay to live in their 'most liked' choice for each setting. They were also asked why they made the selections they did, and at the end of the survey they were asked what factors influenced their satisfaction rankings.

These sections of the survey were pretested with seven respondents living in the East Bay. Discussion with them following the pre-test led to several changes in question wording, sequencing, etc. It also confirmed the belief that respondents could readily discern differences among the slides and make appropriate judgments of assumed satisfaction with the depicted environments.

As a method of collecting more in-depth qualitative information, group discussion or focus groups were considered, but rejected. By themselves, such groups would not provide sufficient information to address the hypotheses; the groups would have had to been conducted in addition to the survey procedure described above. A brief discussion of important features of the buildings or settings would largely have repeated the comments the respondents provided in written form in the questionnaires. A more in-depth focus group would have been time-consuming and probably would have taxed the patience of many of the respondents (some of whom were getting restless before the end of the slides).

In addition, the groups generally were too large for successful focus or discussion group interaction, with two groups exceeding 20 respondents each. A dozen participants is typically recommended as the maximum group size (Krueger (1988); Stewart and Shamdasani (1990)).

Estimation of Costs: Following the pre-test, a final section was added in an effort to more systematically measure the effects of cost on satisfaction ratings. For one set of slides that they had already seen, respondents were provided with cost information for each residential development and asked to make another satisfaction rating. Whereas the 'willingness to pay' question asked respondents to consider cost after they had decided which development they most preferred, this question inserted cost as a key factor with which respondents made their satisfaction judgments. Comparisons of satisfaction ratings of the same set of slides with and without cost information provide an indication of the effects of including cost as a factor to be considered in making such judgements.

Efforts were made to contact professional appraisers to provide specific cost estimates for each slide; however, it became apparent that such information was proprietary, and could not be obtained from appraisers or real estate brokers. Instead, cost estimates were developed using information provided by Means Square Foot Costs Guide (1993), City and County planning offices, available information from specific projects, and consultation with experts.

Appendix 3-6 provides detailed calculations for the cost estimates for each dwelling, taking into account setting-specific characteristics. The basic procedure was to obtain dwelling unit size information from the City Planning or County Assessor's office and, using the appropriate dwelling unit type category in the Means Guide, estimate a basic cost

for each dwelling unit.[13] This figure was increased by one-third to account for various 'soft' costs such as site development and preparation, service and infrastructure extension, and development, impact and planning fees. Location factors from the Means Guide were applied to this overall dwelling unit cost figure, to account for relatively higher housing prices in the Bay Area. Lot size information was obtained from City Planning offices; the application of cost/square foot estimates to these figures produced overall land prices for each residential development.[14] In the case of multi-unit developments, this price was then divided among the units. Final per-unit costs were calculated by increasing the dwelling unit plus land total by 15% to account for developer profit.

The range of costs developed through this process, as shown in Table 3-1, seems plausible; prices decrease as density increases, and Sacramento-area costs are consistently lower than costs in the Bay Area. The range of costs also appear reasonable, with the most expensive development being nearly double the least expensive development. However, the costs should only be seen as order-of-magnitude indicators of likely cost distinctions among the different developments depicted in the slides. The current recession in California may distort the accuracy of these cost estimates. In Sacramento in particular, several respondents wrote comments to the effect that the prices were too high for all slides shown, particularly

---

[13] This estimate was based on a combination of dwelling type (e.g., detached single-family house) and estimated square footage of the unit. It was not modified to account for cost variation due to number of bedrooms or bathrooms or other internal features of the dwelling unit. This estimate was sufficient for the purposes of this study, as respondents were reacting only to external features of the dwelling unit, and did not see (and were given no information on) internal aspects of the unit.

[14] Per unit land costs were estimated using unpublished data from the TRW-Ready computer property files assembled by Professor John Landis in U.C. Berkeley's Department of City and Regional Planning; this provided cost estimates for different residential types in Sacramento and Hayward (but not Union City). Land cost estimates specific to the four sites were not available.

in light of the current downturn in housing prices.

Table 3-1

Average Estimated Purchase Costs per Owner-Occupied Unit

| | Sacramento | East Bay |
|---|---|---|
| Single-family houses | $176,000 | $211,000 |
| Duplexes | $173,000 | $205,000 |
| Townhouses | $136,000 | $165,000 |
| Two-story apartments | $108,000 | $153,000 |
| Three-story apartments | $102,000 | $145,000 |
| Four-story apartments | $ 94,000 | $116,000 |

DATA COLLECTION

Four group interview sessions were held in August: two in Sacramento (on August 8 and 10) at a local public television station headquarters, and two at the California State University at Hayward (on August 12 and 14). In each location, one session was held during the afternoon on a weekend day, and the other was held on a weekday evening. A total of 75 respondents signed up for one of the Sacramento sessions, of whom 43 attended. In Hayward, 29 out of 66 respondents attended one of the two sessions.[15] A fifth session was held October 9, at the Fremont Main Library near Union City. Twelve out of 21 respondents attended this session. The total number of respondents by city and site is indicated in Table 3-2.

[15] August is a common vacation period; this may have contributed to the low participation rate during this time.

The group sessions began with a brief statement thanking the respondents for attending and describing the purpose of the study. The statement noted that the development options depicted at various settings did not represent plans, policies, or intentions of the particular land owners or developers. (See Appendix 3-7 for the complete script used in the group sessions.) The first questionnaire, which dealt with current and past housing and transportation experiences and with socioeconomic and demographic factors, was then distributed (see Appendix 3-5 for a copy of the questionnaire).

After respondents completed the initial questionnaire, the second questionnaire (satisfaction ratings) was distributed. The format of the slides was described, and the satisfaction indices were explained. The respondents began this section by rating their satisfaction with their current home and indicating the most and least satisfied they had ever been with past homes. Following these questions, the slides were shown in four groups of six slides each. [16] At the beginning of each group, the site was identified (e.g., "Here are some residences located near the I-880/Tennyson Road interchange in Hayward"). Each slide was shown for approximately 30 seconds as respondents indicated, on a scale of 1 to 9, how satisfied they felt they would be in each depicted environment. Each slide was then shown more briefly (5-8 seconds) as respondents indicated which of the six developments they would most and least like to live in and why; respondents also indicated how much they would be willing to pay to live in their 'most liked' residence. This procedure was followed for each of the four groups. (Prints from each of the slides are reproduced in Appendix 3-2.)

After all the slides had been shown, respondents were given the final questionnaire (Slide Group E), with cost information for each of the six slides (the East Bay version of

[16] Within each group, the slides were shown in a consistent order, from lowest to highest density. However, the order of the slide blocks was changed in each session, to control for any ordering effects. Figure 3-6 indicates the order in which blocks of slides were shown to the five groups of respondents. See Appendix 4-2 for a discussion of possible ordering effects and analyses of these data.

this questionnaire is included in Appendix 3-5). The particular slide group that was included as Slide Group E was varied for each of the four sessions, so that each of the four settings (Sacramento transit-proximate, Sacramento freeway-proximate, East Bay transit-proximate, and East Bay freeway-proximate) was shown once with cost information. The Slide Group E setting was a local one for each group, so that cost information would have greater validity for the respondents. Respondents re-rated the slides in Group E using the cost information, and again indicated which residential development they would most and least prefer to live in. The final survey question asked them to indicate any features of the environments they saw that they used in determining how satisfied they would likely be in the depicted residences.

## CONCLUSIONS

The goal of the research design was to provide a controlled framework within which data would be gathered on the impacts of building density and type on expressed satisfaction. Several controls were introduced to increase reliability of data and to provide information on variables that might influence the relationship between density and satisfaction. Some of these variables, such as siting the residential developments near transit stations or freeway interchanges, were accounted for within the research framework itself. Other variables, such as respondents' current residential proximity to the transit stations or freeway interchanges, were controlled for by gathering background information about the respondents.

Although some attributes of the residential environments, such as age of the buildings, were held relatively constant, others were not; these include architectural design and building setbacks. The lack of controls on these variables may have influenced the

ratings of the residences to an unknown extent. In addition, presenting the dwelling units from only a single perspective did not provide respondents as much visual information as they would receive in most real-life situations.

Artificial environments were visually depicted as slides of varying combinations of buildings and settings. The buildings varied in density from 8 dwelling units/acre to 89 du/acre, and in type from single-family detached houses to four-story apartments. The settings varied in metropolitan location (Sacramento or the East Bay south of Oakland) and in proximity to regional transportation facilities (transit or highway). Twenty-four slides of various combinations of buildings and settings were produced by computer photosimulation.

Respondents lived in census tracts in which the settings were located, or in adjacent census tracts. [17] Selecting respondents living close to one or more of the settings enabled familiarity with the setting to be considered as an intervening variable between density and satisfaction. Additionally, information on proximity of respondent's homes to the nearest setting was obtained, to determine the influence of proximity on the relationship between density and satisfaction.

A total of 84 respondents participated in the study; roughly equal numbers came from each of the four sites. The respondents rated each slide on a nine-point scale indicating satisfaction with the residential development. In addition, the respondents indicated in which developments they would most and least like to live and how much they would be willing to pay to own the most desired residence. They also indicated their satisfaction with six residences shown with supporting cost information.

---

[17] The specific settings used in the photosimulation were the Butterfield LRT station in Sacramento, the Bradshaw Road/Route 50 interchange in Sacramento, the Union City BART station, and the Tennyson Road/I-880 interchange in Hayward.

Through the use of visual simulation methods, stated preference techniques, and geographically-specific sampling frames linking respondents with sites used in the simulation process, the methodology described in this chapter provides a basis for associating residential densities with residential satisfaction. It also accounts for intervening or potentially confounding variables in the density-satisfaction relationship. The magnitude of this relationship and the extent to which it is affected by the other variables discussed in this chapter are described in detail in Chapter Four.

## CHAPTER 4 - DATA ANALYSIS AND RESULTS

This chapter addresses the issues raised at the beginning of this study through analysis of the data gathered by the methods described in Chapter 3. The data will be analyzed to answer the questions posed as hypotheses in Chapter 1. The hypotheses are restated below:

1) On average, people are more satisfied with low-density dwellings than with high-density dwellings.

2) People will be more dissatisfied with high-density housing on a site with

which they are familiar than on a site with which they are unfamiliar.

3) People living near a site at which high-density housing might be built will be more dissatisfied with such development than people living further from the site.

4) Satisfaction levels with varying residential densities will be the same at transit-based sites as at freeway-based sites.

5) Older residents will be more satisfied with housing in general than will younger residents.

6) Persons with higher incomes will be more satisfied with high-density housing than persons with lower incomes.

7) Persons with children will be more dissatisfied with high-density housing than persons without children.

8) Gender will have no effect on satisfaction with various densities.

This chapter uses the questionnaire data collected in this study to address these hypotheses. The chapter is divided into five major sections. In the first section, the overall respondent sample is described and compared to the population from which the sample was drawn. Secondly, respondents' satisfaction ratings of the dwelling-site combinations are analyzed in depth. These ratings form the heart of the data analysis. Next, analyses of respondents' selections of "most-liked" and "least-liked" slides are used to supplement the findings of the satisfaction ratings. The following section describes respondents' willingness to pay for their "most-liked" selections, and the effects of cost information on the satisfaction ratings. The final section analyzes respondent comments about the slides, and uses this information to elaborate on results presented earlier in the chapter.

## DESCRIPTION OF SAMPLE

As described previously, respondents were selected from four sites, two in the Sacramento metropolitan region (Butterfield LRT and Bradshaw/Rt 50 Interchange) and two in the East Bay region (Union City BART and Tennyson/I-880 Interchange). In order to increase comparability of respondents from different sites, the selection of the sites was partly controlled for by selecting sites similar to one another on several key variables. (See Appendix 3-1 for census tract values for each key variable.) The questionnaire used in this study collected information on each of these key variables for all respondents, permitting comparisons of the census tract samples and the population values.

As noted in the study design, sites were selected that served both as a source of a transit or freeway environment around which housing could be placed in the photosimulation process, and as a source of respondents familiar with and living in proximity to those environments. Being able to compare the responses of transit-based residents to development on the site nearest their home with responses of freeway-based residents to development on the site closest to their home was desirable, to determine if transit stations were viewed as more or less appropriate locations for high-density developments by residents of the immediate area. Similarly, it was desirable to compare the responses of Sacramento-area residents with those of East Bay residents, to determine if the findings might be generalizable beyond a particular urban area.

It is likely that respondents' satisfaction ratings were partially influenced by personal characteristics of the respondents; indeed, age, income, and presence of children are hypothesized to have an effect on satisfaction ratings, either overall or for particular housing densities. It is also quite possible that other socioeconomic and demographic variables

might play a role in respondents' reactions to various densities. When examining the effects of transit vs. freeway settings and Sacramento vs. East Bay residences on the relationship between density and satisfaction, it was judged important to hold constant as many of these other variables as possible, to avoid confounding the results. In other words, it was desired to have four groups of respondents - Sacramento transit, Sacramento freeway, East Bay transit, and East Bay freeway - as similar as possible on key variables, so that any differences that might occur in satisfaction ratings would be due to the different residential locations.

Such controls could have been developed two ways. One method would have been to introduce statistical controls after the data had been collected; crosstabulation of respondents on key variables could then have been done to identify comparable groups of respondents at each of the four sites. However, this would have required considerably larger sample sizes at each of the four sites. Achieving larger sample sizes would have been difficult because of limits that would have been reached in the process of intensively sampling a finite population.[18]

The other method of controlling for socioeconomic and demographic variables, and the one used in this study, is to introduce methodological controls prior to the data collection. With this approach, variation among respondents is limited by drawing from sample populations that are similar on key variables. This ensures that the samples drawn from each of the four sites will be relatively comparable to one another, reducing the need for statistical controls. However, this approach reduces the generalizability of the results to the larger population to some degree. All respondents were drawn from predominantly

[18] A limited number of potential respondents lived within one mile of each site. This pool was made even smaller by the reliance on listed telephone numbers and some respondents' refusal to participate.

white, middle-class areas; Sacramento residents lived on the edge of the city itself, while East Bay residents were drawn from older suburbs. The results of the study likely can be generalized to other respondents and neighborhoods of this type, but may not be valid for substantially different areas, such as central cities or outer-ring suburbs. Generalizability of results is explored at greater length in Chapter 5.

Table 4-1 presents the sample statistics for key socioeconomic and demographics variables. The following discussion is based on this table, as well as on the table in Appendix 4-1 that compares sample statistics with population parameters at the census tract level. Comparison of the sample statistics with the population parameters is a useful means of determining whether the sampling procedures introduced any bias into the respondent selection process. Appendix 4-2 presents the total number of responses for each question in the initial questionnaire.

Employment/Commute Variables

Overall, 73% of the 84 surveyed respondents were employed. This figure was diminished by the large number of retirees (33%) in the Butterfield census tract.[19] Of the employed respondents, 74% always drove alone to and from work. Persons living close to transit (at the Butterfield and Union City sites) were actually somewhat more likely to drive alone as their only commute mode than persons living in the Bradshaw/Route 50 and Tennyson/I-880 census tracts (78% vs. 69%). This may reflect worksites that are not accessible by transit. Of the overall sample, slightly under half had had no experience commuting other than by driving alone.

[19] The overall sample proportion of retirees was 19%. This is likely higher than the retirement rate in the population as a whole. The 1990 census reports that 10.6 percent of the population in both Sacramento and Alameda counties was 65 or over (Bureau of the Census (1994)).

The mean commute time for the overall sample was 23.5 minutes. This averages out some fairly wide disparities among the census tracts. These times are compared with the 1990 census average commute times in Appendix 4-1. The Butterfield and Tennyson samples are somewhat below the census average travel times, while the Union City sample is quite close to the census tract figure. Bradshaw has a sample travel time somewhat higher than its Census figure, but this sample is skewed by an extreme outlier[20]; when this is removed, the sample commute time of 17.8 minutes is slightly under the population parameter of 20.7 minutes.

Demographic Variables

The sample is well-matched to the population on income, as shown in Appendix 4-1. Of the four census tract samples, only Hayward deviated noticeably from the census income data. The Hayward and Union City samples also accurately reflected census figures on percentages of houses with children; the Sacramento samples, however, had fewer households with children than would be expected from the census figures. This is likely due to the overrepresentation of retirees in the sample, particularly in the Butterfield census tract.

The samples from Union City and Bradshaw are well-matched on median age with their census tract populations. Hayward and Butterfield samples' ages are somewhat higher than the respective population median ages. The Butterfield sample may again be distorted due to the large number of retired respondents. The reason for the older sample among Hayward residents is unclear, but may relate to the much longer residence of Hayward respondents (see below).

[20] A respondent with a one-way commute of 120 minutes.

Finally, three of the four census tracts are reasonably well-balanced in gender of respondents, with only Bradshaw having a predominance of one sex (males). Overall, 56% of the respondents are male.

Residence Variables

Several survey questions asked about aspects of respondents' residences. Overall, 87% of the respondents live in a single-family house, and four out of five own their own home. Home ownership was somewhat higher in the sample than in the population as a whole. In Butterfield, the higher home ownership of the sample is probably due to the large numbers of retirees. The samples drawn from the East Bay census tracts did not fully represent the census tract populations, as non-English speakers were not surveyed. This may have reduced the proportion of renters participating in the study, and thus increased the proportion of homeowners.

The median monthly mortgage and property tax payments for homeowners in the sample is $710. Census median costs are somewhat higher than sample median payments because the census figures include additional household expenses. [21] In addition, the large share of homeowning retirees may lower the average mortgage costs, as they likely bought homes at relatively low prices some years back and now have low mortgage payments compared to newer homes of similar quality. The median rent for the respondent sample is $705, somewhat above the Census figures for all renters in the census tract. Only 14 renters responded to the survey, so median rents for the sample cannot be broken down by census tracts of respondents.

[21] The Census Bureau defines selected monthly owner costs as "the sum of payments for mortgages, deeds of trust, contracts to purchase, or similar debts on the property...; real estate taxes; fire, hazard, and flood insurance on the property; utilities ... and fuels" (p. B-46, Bureau of the Census, 1992).

The average number of years respondents have lived at their current residence is 11.4. Tennyson respondents have lived in their homes an average of 19.1 years, over twice the average of the other three groups.[22] It is not clear why this difference exists, although as shown in Appendix 3-1, both the standardized median household income and the standardized median value of owner-occupied units are lower in Hayward than in the other census tracts. Given these figures, and the knowledge that homeownership is relatively high in the Hayward census tract, it is possible that the Hayward respondents might be less capable of easy mobility than other respondents; barriers to relocation, such as lower incomes, might therefore produce longer average tenures.

The final residence-oriented variable, and one that will be explored in depth later, is proximity of the respondents' homes to the closest site (see Table 4-2).[23] The goal of the sampling scheme was for all respondents to live within 1 mile of a site; Table 4-2 shows this was achieved for 95% of the respondents. Most respondents live between one-half and three-quarter mile from the site (42%) or between one-quarter and one-half mile (29%). This does not vary significantly by location of residence.

Summary of Sample

Overall, the sample reflects the total population from which it was drawn. So too, with some exceptions, do the individual census tract samples. The one variable on which all census tract samples departed substantially from census tract population data was home ownership, with all four samples reporting considerably higher rates of home ownership than were found in the census data.

The Union City sample was very representative of the broader population from

---

[22] This difference is statistically significant at the .001 level.

[23] As noted in Chapter 3, two sites - Bradshaw and Tennyson - are not actually in the census tracts from which the respondent samples were drawn, but are instead within contiguous tracts.

which it was drawn, except for home ownership. The Bradshaw sample was also well-matched with its population, although fewer sample households had children in them than was expected. The Butterfield sample was primarily distorted by a large number of retirees, increasing the median age and reducing the percentage of households with children. The least representative sample was Hayward, with an older than expected sample making a shorter than expected journey to work, from homes in which they have lived an inordinately long time. Even this set of respondents, however, was representative of its population on income and percentage of households with children.

## SATISFACTION RATINGS

As described in Chapter 3, ratings of satisfaction were used as the primary dependent variable to assess respondents' attitudes towards different levels of density, and different combinations of density and settings. This section examines respondents' satisfaction ratings in detail, and uses these findings to address the hypotheses stated at the beginning of this section. Overall satisfaction ratings are described first; they then are broken down by key variables.

Satisfaction ratings are also used to determine whether any ordering effects exist in the data. By comparing the mean ratings a particular slide received when it was presented at various times in the sequence of slides, the extent to which slide ratings are dependent on their order can be shown. In general, no such effects are present in the satisfaction ratings. A detailed description of this analysis and findings is in Appendix 4-3.

The primary statistical methods used in the analysis of the satisfaction ratings are t-tests and analysis of variance with separate estimates of variance. The satisfaction ratings were collected on an interval scale, permitting calculation of means and standard deviations.

Most of the independent variables, however, are categorical. Many of the analyses are based on comparisons of mean ratings across two categories (such as the simulation being set near transit vs. near freeway, Sacramento vs. East Bay residents, or children present vs. children absent in a household). For these analyses, t-tests are the appropriate statistical tool. If an independent variable has more than two categories, analysis of variance is applied. Some of the analyses compare different responses from the same individuals; for example, determining whether satisfaction ratings differ if a particular building is shown near a transit station or near a freeway setting. All respondents rated each slide, so the statistical comparison is not between different groups of respondents, but between different ratings of the same group of respondents. In such instances, the assumption of independent random samples necessary for a standard t-test is clearly violated. Instead, a matched sample design is used (see Healey (1990), pp. 175-178). This technique allows the comparison of different ratings from the same respondents, and tests the difference in the mean ratings for statistical significance.

Overall Satisfaction Ratings

How does residential density affect respondent satisfaction? Is increasing density an inevitable indicator of decreasing satisfaction? Hypothesis 1 states that respondents will be more satisfied with low-density dwellings. Table 4-3 confirms this hypothesis, showing that, with one exception, respondents on average report less satisfaction with each slide that shows incrementally higher density than the previous slide.[24] The exception is the slight preference for the three-story apartment of 44 dwelling units (du)/acre, over the two-story

[24] Overall satisfaction ratings for each of the six residences were calculated by averaging the ratings each residence received in each of the four settings; see Chapter 3 for a detailed description of each residence and each setting.

apartment of 23 du/acre. This likely reflects the higher level of amenities associated with the three-story apartments (see Appendix 3-2 for examples of slides using these two apartment buildings). Based on the various densities depicted in the slides (ranging from 8 to 89 du/acre), it is clear that density does play a significant role in respondent satisfaction with residences.

Table 4-4 shows differences in sample means for all 15 pairs of slides. As can be seen, all differences in means are significant at the .01 level. The comparison of two-story apartments and three-story apartments shows a significant difference in the opposite direction (i.e., the denser apartment is significantly preferred to the less-dense one). Also, duplexes are rated significantly higher than townhouses, although the residential densities are virtually identical (12 du/acre and 11 du/acre, respectively). These departures from a strict inverse relationship between density and satisfaction indicate that density, while important, is not the only factor respondents consider when making satisfaction judgments. Building factors that were not controlled for, such as architectural style and design and building setbacks, may have influenced these reactions.

Satisfaction with Buildings at Individual Sites

The above analyses show a fairly consistent pattern of declining satisfaction as densities increase, with comparisons of the two- and three-story apartment buildings running in the opposite direction. Grouping sites by transit and freeway settings produces similar findings (see Appendix 4-4). Do these relationships hold at the level of the individual site? Table 4-5 presents the average satisfaction score for each slide at each of the four sites. Table 4-6 shows the differences between means for each pair of slides at each site.

At the Butterfield LRT station and Union City BART station, the relationships are completely consistent with the overall findings shown in Table 4-4. All differences are significant at the .01 level, and all less dense buildings are favored over more dense buildings with the exception of the two- and three-story apartments. (As is the pattern in all these comparisons, duplexes are rated significantly higher than townhouses, despite their nearly equal densities.)

Findings for the two freeway-based sites are not quite so consistent, with each other or with the overall findings. However, the general pattern of differences in means is still largely in evidence. For the Bradshaw Rd/Rt 50 site, no significant difference is found between the means of single-family detached houses and duplexes. In addition, the differences of the means of townhouses and three-story apartments, and two- and three-story apartments are not significant. All other differences are statistically significant at the .01 level. For the Tennyson Rd/I-880 site, the means of single-family detached houses and duplexes are virtually identical. The means of two- and three-story apartments also do not differ significantly. All other differences are significant at the .01 level.

As noted in the section on respondents' comments later in this chapter, the slides of Bradshaw and Tennyson settings provoked many negative remarks about traffic. Respondents' concerns about traffic in these settings might be a contributing factor to their negative reactions to increasing density, as higher densities produce more traffic than lower densities in the same area, all else equal. However, the transit sites (Butterfield and Union City) did not produce many negative remarks about traffic, yet respondents were equally negative in their reactions to increasing densities at transit sites. This suggests that traffic concerns, although real, are not of sufficient importance by themselves to significantly alter satisfaction ratings.

Summary of Basic Satisfaction-Density Relationship

The relationship between satisfaction ratings and density from the overall sample can be summarized as follows:

* The relationship between density and satisfaction is strong and consistent. Almost all less-dense residential buildings are rated more positively than denser buildings, and the overwhelming majority of differences in satisfaction ratings are statistically significant at the .01 level. Through their comments (discussed below), respondents indicated that they recognized these differences in density, and that they perceived the distinctions as important.

* The three-story apartments are consistently more highly rated than the two-story apartments. Respondent comments indicate this is likely due to the more attractive architectural style of the three-story apartment. This distinction is stronger in the transit-based settings than in the freeway-based settings.

* The townhouses are approximately the same density as the duplexes. Nevertheless, the duplexes are consistently rated more favorably than the townhouses. Again, the distinction seems to be in the architectural style of the two residences.

* The relationship between density and satisfaction is somewhat more pronounced at the transit-based sites than at the freeway-based sites. In particular, no difference is found at the freeway-based sites in satisfaction ratings for the single-family detached house and the duplex.[25] At the transit-based sites, this difference averages 0.9 points and is significant at the .01 level.

[25] Several respondents explicitly stated that busy streets and freeway interchanges are inappropriate locations for single-family detached houses.

Further analyses of the data tests the other hypotheses, examining the extent to which the satisfaction-density relationship described above holds among various subsets of the overall sample. Such subsets include respondents familiar and unfamiliar with particular sites, respondents living close to and further from sites, and respondents divided along various socioeconomic and demographic lines. These analyses test the hypotheses listed previously, and provide further insights into the density-satisfaction relationship.

Effects of Familiarity on Satisfaction Ratings

The relationship between residential densities and satisfaction ratings might be influenced by respondents' familiarity, or lack of familiarity, with the sites depicted in the slides. Hypothesis 2 states that people would be more dissatisfied with high-density housing on a site with which they are familiar than one with which they are unfamiliar. Drawing samples from census tracts adjacent to the sites used in the photosimulations ensured that respondents would be familiar with the sites nearest their homes, while conducting the study in both the Sacramento and East Bay areas lessened the chances that a respondent from one area would be familiar with sites in the other area.

As discussed previously, at low densities the satisfaction ratings are affected by the location of the photosimulated residences around transit or freeway sites. To control for this effect in examining the impacts of familiarity, the two transit-based sites are compared with each other, as are the freeway-based sites. Table 4-7 presents these results, broken down by residence of respondents. Thus, the first portion of Table 4-7 compares Butterfield respondents' ratings of slides based around "familiar" and "unfamiliar" transit settings (the Butterfield LRT station and the Union City BART station), and the second portion compares Butterfield respondents' ratings of "familiar" and "unfamiliar" freeway settings

(the Bradshaw/Rt 50 interchange and the Tennyson/I-880 interchange).[26]

An examination of the results in Table 4-7 shows only a few significant differences between familiar and unfamiliar ratings. However, even these few differences are often significant only at the .10 probability level, a somewhat permissive standard for establishing the significance of statistical findings. More importantly, the significant differences do not cluster around any particular slide (such as single-family homes or two-story apartments) or any particular group of respondents. Nor does the type of site (i.e., transit-based or freeway-based) appear to influence the effects of familiarity on the density-satisfaction relationship. Although most of the significant differences are found on pairs of ratings in which the unfamiliar setting is rated more highly than the familiar setting, the results are most likely attributable to random fluctuations in the data. Appendix 4-4 presents familiar and unfamiliar ratings grouped by location (Sacramento and East Bay). Again, no effects of familiarity are apparent.

Based on these data, familiarity with a site does not appear to affect respondents' ratings of satisfaction with possible residential developments on that site. This is true whether the site is oriented around a transit station or a freeway interchange. It is also possible that the respondents were not, in fact, familiar with the sites, even with the visual information and the spoken instructions identifying each site. In the next section, a more fine-grained examination of respondent reaction to the location of the site will be undertaken, as proximity of the respondent's residence to the nearest site is examined for its effects on the satisfaction-density relationship.

Proximity to Site

It is expected that people will react more strongly the closer they live to a simulated

[26] Note that for Sacramento residents, the Butterfield and Bradshaw sites are "familiar" and the Union City and Tennyson sites are "unfamiliar," while the reverse is true for East Bay residents.

site. If so, proximity of residence should influence satisfaction ratings. Respondents living very close to a site being developed at certain densities might react quite differently than respondents living some distance from the site. This "not-in-my-backyard" response is increasingly common in urban areas, as residents voice their complaints about unwanted land uses in their neighborhoods. This type of response is the source of the third hypothesis, which states that people living closer to the sites will be more dissatisfied with high-density development at those sites than people living further away.

Drawing samples from the areas surrounding or adjacent to the sites used in the photosimulation process permitted this hypothesis to be empirically tested. Respondents indicated on the questionnaire the cross-streets nearest their residence. This information was used to code respondents into one of five groups, as noted in Table 4-2. Almost all respondents live between one-quarter mile and one mile from the nearest site.[27]

Drawing a clear distinction between proximity and familiarity is somewhat arbitrary. Respondents are very likely familiar with sites near their homes. The analysis here can be thought of as a closer look at the impacts of respondents' residential location on the relationship between density and satisfaction. Where familiarity deals with exposure to a portion of an urban area, proximity relates more specifically to the physical distance from a respondent's house to the nearest site.

Table 4-8 presents mean satisfaction ratings for each of the six buildings broken down by proximity of respondents to the nearest site.[28] The residential units in the slides

[27] For the purposes of the analysis presented below, the 3 respondents living within one-quarter mile of the nearest site and the 4 respondents living over 1 mile from the nearest site were dropped from the data set.

[28] The ratings for the nearest site are actually averages of the ratings of the Butterfield site as judged by the Butterfield respondents, the Union City site as judged by the Union City respondents, and so on.

are all placed within one-quarter mile of the site (see Appendix 3-2 for examples). To the extent people self-select how near they live to transit stations or freeway interchanges, slides of residences in close proximity to these features should reasonably be rated most favorably by residents living nearest to them. This is what happened, although the differences among groups of residents are not statistically significant. It should be noted, however, that not all persons living near a transit station or a freeway interchange have explicitly selected proximity as a desirable feature. The station or interchange might have been built after they were already living there, and they might resent the additional activity generated by the station or interchange. Alternately, they might have selected their location in spite of, not because of, the station or interchange. The lack of a statistical relationship between proximity and satisfaction suggests that the advantages and disadvantages of proximity may balance out across the spectrum of respondents.

Differences among the means for each building density are presented in Appendix 4-4. Proximity of residence to the site does not substantially change the patterns of differences, although the difference between satisfaction ratings of single-family detached houses and duplexes gradually shrinks as distance from the site increases. In addition, a distance greater than three-quarters of a mile from the site may reduce the effect of building density on satisfaction. It is possible that a particular site (e.g., Union City) might produce an identifiable proximity effect solely for that site. However, the sample sizes for individual sites are too small to support an analysis of the effects of proximity on the density-satisfaction relationship at each site.[29]

Overall, proximity of residence to a site has relatively little effect on the relationship between satisfaction and density. Low-density development around a site is preferred by all

[29] For example, the largest sample was Butterfield, with 24 respondents. Three of these lived within one-quarter mile of the station, five between one-quarter and one-half mile, eleven between one-half and three-quarter mile, and five between three-quarter mile and one mile.

respondents, although residents in close proximity to a site may prefer low-density development to a slightly greater extent than residents living further away. Increased distance from the site lessens differences between satisfaction with townhouses and with two- or three-story apartments. However, these distinctions are relatively minor, and do little to affect the general trend of increased densities producing decreased satisfaction ratings.

Sites Near Transit vs. Freeway Facilities

Hypothesis 4 states that satisfaction levels with varying residential densities will be the same at transit-based sites as at freeway-based sites. As indicated in Table 4-9, slides depicting housing near transit stations are favored over those near freeway interchanges. Single-family detached houses, duplexes, townhouses, and three-story apartments are rated significantly higher when placed near transit stations. This difference is greatest with single-family houses. Virtually no differences are found for the two- and four-story apartments. As these are the two building types receiving the lowest overall ratings, the general unpopularity of these residences may be strong enough to suppress a general tendency to favor transit sites over freeway sites.

Impacts of Demographic and Socioeconomic Variables

The density-satisfaction relationship may be impacted by several respondent background variables. Respondents' age and income, whether or not they live with children, their gender, and whether they currently own or rent their homes are examined in this section for their effects on satisfaction ratings.

Age: Hypothesis 5 states that satisfaction levels would be higher among older

respondents than younger respondents, regardless of density. Based on questionnaire responses, respondents are grouped by quartiles into the categories shown in Table 4-10. The four groups differ significantly in their ratings of two, three, and four-story apartments, with the youngest group (ages 18-32) rating these dwellings considerably higher than the other groups. This might be due to a maturational effect among the older groups, which have had more exposure to societal housing norms. Alternately, it might demonstrate a reconciliation of satisfaction and purchasing power among the youngest respondents. Although no prices were provided with these particular slides, respondent comments sometimes suggested that implied costs were a consideration in their satisfaction ratings.[30] The psychological theory of cognitive dissonance suggests that attitudes and opinions may be altered to reflect existing constraints on possible behaviors, if such an attitude shift reduces psychological tension. A final possibility is that differences among the age groups reflect a real shift in attitudes towards higher-density housing among persons who have grown up in an era of energy shortages, attacks on low-density "sprawl" development, and increased awareness of the harmful effects of automobile use on the environment.

The effects of age on the density-satisfaction relationship are consistent when responses are divided into those at transit-based sites and those at freeway-based sites (see Table 4-11). At transit-based sites, significant differences among the groups are found for the two, three, and four-story apartments. At the freeway-based sites, differences among the groups on the ratings of the townhouses and the two and three-story apartments are significant. In each instance ratings of the youngest group are considerably higher than other group ratings.

Income: Persons with higher incomes are hypothesized to be more satisfied with high-density dwellings than persons with lower incomes, in Hypothesis 6. Three income

[30] This topic will be explored at greater length in the section below on the impacts on satisfaction ratings of providing cost information.

categories are created from the survey data to compare ratings across income groups. Table 4-12 presents overall ratings for low, medium, and high income groups. Although differences among the groups are apparent for the three highest-density developments, only the differences for the two-story apartments are significant, with lower-income respondents more satisfied with this residence. Ratings at the transit- and freeway-based sites are shown in Table 4-13. At the transit sites, differences among the groups are significant for the two and four-story apartments. Comparison of group means for the freeway-based sites reveals no significant differences.

In all instances of significant differences among income groups, the lower income group rates the slides more highly than the medium and high income groups. This runs counter to Hypothesis 6 and the speculation of Baldassare (1979) that higher densities would be favored by upper-income groups able to pay for privacy and security within a high density setting. Instead, the findings suggest that lower income respondents may react to the slides based to some extent on what they think they can reasonably afford. If this is indeed a motivating factor, it apparently only influences transit-based ratings. Affordability and cost of the residence, implicit in this analysis, will be made explicit in the section below describing the impacts of cost information on the satisfaction ratings.

Presence or Absence of Children: The presence of children in a household is hypothesized to reduce satisfaction with higher-density dwellings, in Hypothesis 7. This is based on the assumption that parents or caretakers are sensitive to the restrictions higher-density environments place on a child's activities. Tables 4-14 and 4-15 compare satisfaction ratings by respondents in households with children to ratings by respondents in households without children. No differences are significant, and no particular pattern of differences emerge, either in the overall ratings or the transit-based and freeway-based

ratings.

The presence of children in a household is strongly associated with the age of the respondent. The average age of the respondent in households with children is 36, compared to an average age of 51 in childless households. [31] Age is thus a possible confounding variable in the relationship between presence of children and satisfaction. To control for the effects of age, all respondents under 21 and over 51 were dropped from the data set. [32] Tables 4-16 and 4-17 present satisfaction ratings for this truncated set of respondents. Both the overall ratings and the freeway-based ratings show significant differences between the two groups on the ratings of two and three-story apartments, with the childless group rating the slides higher than the group with children. Respondents without children also rate these buildings higher than did respondents with children in the transit-based setting, but these differences are not significant. These results show that when respondents of roughly equal ages are compared, the presence of children in a household does reduce respondent satisfaction with higher-density dwellings.

Gender: Hypothesis 8 states that no difference will be found between the satisfaction ratings men and women give to various densities. Table 4-18 displays satisfaction ratings across all sites broken down by gender. No significant gender-based differences exist between any pair of means, although low densities are rated slightly higher by male respondents. Nor are any gender-based differences significant when transit-based sites are separated from freeway-based sites (Table 4-19).

---

[31] This difference is statistically significant at the .01 level. In addition, the correlation coefficient of age and presence/absence of children is 0.4122, also significant at the .01 level.

[32] The respondents under 21 all appear to be living with younger siblings, rather than being parents themselves, and thus are not expected to respond as parents or other caretakers would. No respondent over 51 lives with children; therefore, comparing respondents between 21 and 51 effectively bounds the ages of primary caretaking responsibility.

Tenure: In addition to the hypothesized relationships tested above, satisfaction ratings are broken down by tenure (owning vs. renting) in Tables 4-20 and 4-21. Although renters generally report higher satisfaction than owners, this difference is significant only on the ratings of the four-story apartments. The differences between renters and owners are greater in ratings of the transit-based sites; renters favor all apartments in these settings significantly more than owners. Owners and renters do not differ in their satisfaction ratings of freeway-based sites.

The average ratings in these tables suggest that locating residences, particularly higher-density residences, near transit stations increases their attractiveness to renters more than to homeowners. Renters like apartments near transit stations more than owners do, while neither group particularly cares for apartments near freeways. In general, transit may be preferred to freeways as a neighboring land use, but at greater density levels this preference is suppressed by owners' desires to live in a lower-density neighborhood, perhaps due to concerns about property values. Renters, having less financial investment in an area, can ignore some of the perceived negative aspects of higher density living and focus on their preference for accessibility to transit over accessibility to freeways.

Summary of Expanded Satisfaction-Density Relationship

Examination of satisfaction responses while controlling for different variables produces some modifications to the relationship described earlier between satisfaction and density. Several variables of interest have no effect on the relationship, including familiarity and proximity of the respondents to the sites used in the photosimulations and gender of the respondents. Other groups of respondents do have different patterns of satisfaction: younger persons and those without children (controlling for age) are more

satisfied with higher density housing than older respondents and those with children. Location of the residence near transit or freeway is also important: the four most popular dwellings are liked significantly more next to transit stations than freeway interchanges. Lower-income respondents and renters are more favorably disposed to higher densities than middle- or upper-income respondents and homeowners, but only if the buildings are in a transit setting.

These findings expand on the earlier results and indicate that the relationship between satisfaction and density is mitigated by other factors. These factors are also considered in the following section, in which the connections between density and preference for one residence over another are explored.

## "MOST-LIKED" AND "LEAST-LIKED" SLIDES

The satisfaction ratings of individual slides indicate which buildings and densities people liked and disliked, but they do not provide a direct measure of preference for particular residences. To ascertain this, respondents were asked to choose the residence they "most liked" and that which they "least liked" from among each group of slides [33] This required the respondents to make direct comparisons of the six slides within each group, and forced a choice among the slides.

The data collected from these preference questions have two weaknesses: respondents did not always select just one "most liked" or "least liked" slide, and their choices at times seemed very inconsistent with their satisfaction ratings. When respondents listed more than one residence as their most or least preferred, with no indications in their

[33] The four groups of slides were Butterfield LRT, Bradshaw Rd/Rt 50, Union City BART, and Tennyson/I-880.

comments as to which might be slightly more (or less) preferred, their selections were not coded and analyzed; thus, the "most liked" and "least liked" data have a few more missing values than do other questions.[34]

The second problem was more difficult to resolve. On some questionnaires, the respondent selected a slide as "least liked" which he or she had rated quite highly on the individual satisfaction ratings, relative to the other slides in that group. [35] This often seemed to be due to confusion or carelessness on the part of the respondent; for example, the four-story apartment (slide #6) might have been given a "1" in the satisfaction rating, indicating extreme dissatisfaction with the residence. In answering the "least liked" question, however, the respondent might have entered a "1", not because he least liked slide #1 (single-family detached house), but because he mistakenly transcribed his low rating of slide #6 (a "1") into the space provided for the answer of the "least liked" question. In such instances of extreme disagreement between the satisfaction ratings and the "least liked" choices, respondents' comments were read for indicators as to which residence they really liked least. If such statements were clear (e.g., "I hate large apartments"), the "least liked" choice was coded on that basis. If the comments were not clear, or if no comment was

---

[34] Specifically, 8 of the "most-liked" responses could not be coded due to multiple responses, while 28 "least-liked" responses could not be coded. In 6 of the "most-liked" multiple responses, the single-family detached house and duplex were selected together, with no other dwellings chosen. Of the "least-liked" multiple responses, 26 included the four-story apartment in various combinations with other dwelling units. Only two of the 28 combinations included the single-family detached house; in both of these, the respondents indicated they disliked all six housing choices equally.

[35] A similar situation occurred with a few "most liked" slides, with actual ratings of the slide quite low relative to other slides in that group. However, most "inconsistencies" occurred with the "least liked" slides.

made, the choice was left blank. It should be emphasized that these coding procedures were done not to bring the satisfaction ratings and the preference choices into artificial agreement, but rather to ensure that the data entered for each respondent were as valid and accurate in reflecting that respondent's opinions and attitudes as could be determined from the questionnaire. Seeming inconsistencies that did not appear to be based on a misreading of previous answers, or that were supported by respondent comments, were judged to be valid and true for that respondent.

Analysis of the "most-liked" and "least-liked" slides is limited by the nature of the dependent variables. The densities of the six different building types could be viewed as interval (increasing from 8 to 89 dwelling units/acre); however, many other features of the buildings (such as landscaping, architectural style, and location of driveways) to which people reacted are categorical. Therefore, chi-square is used as the appropriate technique for analyzing "most-liked" and "least-liked" data.

Tables 4-22 and 4-23 indicate the slides selected as "most liked" and "least liked," respectively. Each table provides a total number of responses for all sites, and a breakdown of response frequencies for transit and freeway sites. The single-family detached house is most liked, with the duplex the next most popular residence. A small number of respondents selected the three-story apartment. Siting the single-family detached house at a transit station increases its popularity, while placing it next to a freeway interchange makes it less popular. Collapsing "most-liked" responses into "single-family detached" and "other" produces a chi-square of 14.94, with df=1 and $p<.01$.

The four-story apartment is by far the least-liked residence, with the two-story apartment and single-family dwelling selected by small numbers of respondents. In freeway settings, the single-family detached house is actually disliked more than the two-story

apartment, suggesting that some people view interchanges as very inappropriate locations for such housing. For "least-liked" responses of "single-family detached" and "other," chi-square=4.84, df=1, $p<.05$.

In general, these data support the relationship between density and satisfaction described earlier in this chapter: people prefer lower densities. As these tables indicate, however, this preference is not absolute. Some persons display different preferences, particularly if buildings are viewed as particularly attractive (e.g., the three-story apartment) or unattractive (e.g., the two-story apartment). In addition, transit locations are preferred to freeway sites for single-family homes. The effects of respondent's age, income, and presence or absence of children are described below, while analyses of familiarity and proximity of respondents to the site, which had little effect on respondents' selections, are presented in Appendix 4-4.

Age: As described previously, respondents are divided into four equal groups based on their age. Selections of most and least-liked residences are tabulated for each of the four age groups; as shown in Tables 4-24 and 4-25, this is done for all sites and for the transit and freeway-based sites separately. When the categories for the "most liked" data are collapsed into "three and four story apartments" and "all others," the youngest respondents are significantly more likely to choose the higher-density buildings than are the other respondents (chi-square=4.41, df=1, $p<.05$). When the two youngest groups are compared to the two oldest groups, the same result is found for the freeway-based sites (chi-square=4.56, df=1, $p<.05$). These results suggest that the youngest respondents are less negative towards higher densities than older respondents, especially when those densities are placed in close proximity to a freeway.

Results for the "most-liked" transit-based sites are somewhat more complex. In

these slides, the second-youngest group (age 33 to 44) is significantly more likely to select the single-family detached house, and significantly less likely to select duplexes, than any other group (chi-square=7.20, df=1, $p<.01$). For all other respondents, the duplex is a reasonable second choice if for some reason they don't select the single-family detached unit. For the second-youngest group, it is not an acceptable alternative; they only select the detached house. This may reflect the lifecycle position of this group; they are the group most likely to have young children, as well as the group most likely to be considering starting or adding to their family. Such influences may persuade members of this group that only a single-family detached house is acceptable. However, this difference does not appear in the freeway-based slides. The impact of this lifecycle factor would thus seem susceptible to the residential setting presented to respondents, and could be negated by a sufficiently undesirable context, such as location near a freeway.

Significant differences also occur among the "least-liked" slide choices (see Table 4-25). Members of the youngest age group are significantly less likely to select the four-story apartment as their "least-liked" choice than are respondents in the two oldest groups. Respondents in the second-youngest group are between these extremes (chi-square=18.99, df=2, $p<.01$). The same patterns exist when responses are broken into transit-based sites (chi-square=6.01, df=2, $p<.05$) and freeway-based sites (chi-square=15.25, df=2, $p<.01$). In addition, for the freeway-based sites, the two youngest groups select the single-family detached house significantly more often than do the two oldest groups (chi-square=4.47, df=1, $p<.05$). These findings all support the general tendency for increasing age to result in a stronger preference for lower-density housing, and a stronger dislike of higher-density housing. As increasing age is associated with increased incomes and purchasing power, the preferences of older respondents mirror the housing market in most American cities to a far

greater extent than do the preferences of younger respondents.

Income: Income also is related to the patterns of most- and least-liked slides selected by respondents (see Tables 4-26 and 4-27). For both most-liked and least-liked slides, the response patterns of medium and high income groups are fairly similar; thus, the appropriate income comparison is between the combined pattern of these groups and that of lower-income respondents.

For the most-liked slides, lower-income respondents significantly prefer the four-story apartments while the medium- and upper-income respondents favor duplexes (chi-square=27.08, df=3, $p<.01$). Considering just the freeway-based slides, a similar pattern is apparent, although small numbers in some categories do not allow for separate consideration of preferences for four-story apartments. Preference for duplexes is still strongly related to income (chi-square=5.99, df=2, $p<.05$). Transit-based slides also show this pattern, but the results are not significant.

For least liked slides, the major preference patterns are for lower-income respondents to dislike single-family detached houses and townhouses, while medium- and upper-income respondents dislike two- and four-story apartments (chi-square=15.30, df=2, $p<.01$). This pattern holds when the sites are divided into freeway-based sites (chi-square=7.51, df=1, $p<.01$) and transit-based sites, although cells sizes for the latter breakdown are too small to permit statistical testing. Reasons for this distinction are not clear, but may relate to expected costs of the various types of housing. Lower-income respondents may have least liked those dwellings they believed themselves least able to afford, while middle- and upper-income respondents did not feel constrained by cost. Issue of cost are explored further in the following section.

Presence/Absence of Children: Table 4-28 breaks down respondents aged 21 - 51 by

whether they live with children, and compares the "most-liked" responses across these groups. Respondents with children are significantly more in favor of the single-family detached home and less in favor of the duplex than respondents without children (chi-square=7.12, df=2, $p<.05$). Table 4-28 also divides responses into those at transit sites and those at freeway sites. The pattern of respondents with children preferring single-family homes and disliking duplexes holds at both types of sites, although only the transit site produces significant results (chi-square=11.22, df=2, $p<.01$). This is similar to the results of the crosstabulation by age at transit sites described above, where respondents aged 33-44 are more favorable towards single-family detached housing and less impressed with duplexes than other age groups.

Responses to the "least-liked" question are presented in Table 4-29, for the sample as a whole and for the transit and freeway sites separately. Respondents with children are much more strongly opposed to the two-story apartment than are other respondents, while being slightly less opposed to the single-family detached houses and townhouses (chi-square=11.88, df=2, $p<.01$). This tendency holds at both the transit and freeway sites, but the differences are not statistically significant.

Summary: Analysis of people's selection of "most-liked" and "least-liked" residences supports the findings of the relationship between satisfaction and density described in the previous section. The lowest-density building (the single-family detached house) is most liked, and the densest one (the four-story apartment) is least liked. As with the satisfaction ratings, familiarity and proximity with the site have little if any effect on the results. Age is associated with an increasing preference for lower-density housing, with the youngest respondents preferring higher-density buildings to a greater extent than anyone else. Lower-income respondents show a greater preference for denser residences than

wealthier respondents. Respondents with children show a preference toward single-family detached houses and away from duplexes relative to respondent without children. This is particularly strong at transit sites. Respondents with children are also more likely than others to select the two-story apartment as their "least-liked" dwelling. This may be due to the staircase in this residence, which opens directly onto the street.

Overall, the findings based on stated preference of dwelling units support the results of the satisfaction-density relationship. However, in neither of these analyses was the issue of housing cost explicitly raised. A few persons stated that they made their selections with some implicit cost criteria in mind, but most seemed to respond primarily to the visual image of the building and the setting presented in each slide. The following section describes two different methods used to ascertain the importance of cost factors in respondents' selections.

## HOUSING COSTS

The impact of housing cost on respondents' choices was measured in two ways: through a question regarding the amount respondents would be willing to pay to live in their most-liked choice, and by providing housing cost estimates of each dwelling by site combination as additional information for respondents to consider when making their satisfaction ratings. In analyzing the willingness-to-pay results, chi-square statistics were calculated for categorical independent variables (e.g., highway and transit sites). For ordinal independent variables (proximity and income), Kendall's tau-b was calculated if the table was square (identical numbers of rows and columns) and Somer's d was used if the table was rectangular. The results of these analyses are discussed below.

Willingness-to-Pay: Table 4-30 presents the octile breakdown for all answers to the

willingness-to-pay question.[36] The median response falls between categories 3 and 4, slightly below the population median. At least two factors probably contribute to this result:
1) many respondents likely stated a lower amount than they would actually be willing to pay, or a lower amount than they do pay, since they are not forced by the question to select any particular category;
2) respondents are dissatisfied with even the single-family detached house (the most popular dwelling type) compared to their stated satisfaction with their current home.[37] Thus, a willingness-to-pay amount somewhat below their current mortgage or rent would be consistent with respondents' expressed satisfaction.

Table 4-30 also presents breakdowns of willingness-to-pay responses for highway and transit sites. The difference between the sites is significant, with transit sites generally eliciting a higher willingness-to-pay response (chi-square=14.84, df=7, $p<.05$).

Willingness to pay is strongly related to proximity of respondents' homes to the nearest transit or freeway site. As shown in Table 4-31, the amount a respondent is willing to pay increases as proximity increases (Kendall's tau-b=0.42, $p<.01$). Table 4-32 shows this relationship for sites near transit stations and sites near freeways; again, a positive relationship between proximity and willingness-to-pay is demonstrated (transit: tau-b=0.47, $p<.01$; freeway: tau-b=0.37, $p<.01$). The cause of this relationship is not entirely clear. It is possible that a form of cognitive dissonance is at work. The slides depict housing quite close to freeway or transit sites; those respondents living in or near those actual neighborhoods (i.e., close to the site) may be loath to undervalue their own property by

---

[36] See Chapter 3 for a description of the development of this question.

[37] The mean satisfaction rating of respondents' home is 6.7, compared with a mean rating of 5.5 for the single-family detached house.

stating a low willingness to pay. However, this explanation is somewhat weakened by the distribution of respondents' homes relative to the actual site depicted in the slides. As described in Chapter 3, selection of sites used in the slides was difficult; for three of the four areas, the sites used were at least one-quarter mile, and often one-half mile, from the home of the nearest respondent. Thus, even the respondents within closest proximity to the sites did not see their immediate neighborhood depicted in the slides. It is also possible that the positive relationship between proximity and willingness to pay is due to closer residents being generally more satisfied with the slides, and thus willing to pay more. However, the mean satisfaction scores by proximity to the site provide little support for this hypothesis.[38]

[38] Respondents living 1/4 - 1/2 mile from the site had a mean satisfaction score across all slides of 4.1; respondents living 1/2 - 3/4 mile from the site had a mean satisfaction score of 3.7; and respondents 3/4 - 1 mile from the site had a mean score of 3.9. The difference in these means is not statistically significant.

As expected, respondents with higher incomes express a greater willingness to pay for their most preferred slide (Table 4-33). This is true for both transit and freeway-based slides (Table 4-34). Age is also related to willingness to pay, with respondents between the ages of 33 and 59 more willing to pay higher prices than either younger or older respondents (Table 4-35). This relationship holds for transit-based sites, but not for freeway-based sites (Table 4-36). Finally, presence or absence of children is strongly related to willingness to pay (Table 4-37), with respondents with children twice as likely to select a price above the median than respondents without children. As with age, this relationship holds for transit-based sites, but not for freeway-based sites (Table 4-38). Income, age, and presence of children clearly are not independent of one another. Income is not statistically related to either age or children, but the latter two variables are moderately correlated with each other.[39]

In summary, respondents will pay more for sites near transit than near freeways, for all but the least desirable housing. Middle-aged respondents and respondents with children will pay more than other respondents, but only at transit-based sites. Those with higher incomes will also pay more, irrespective of site. Willingness to pay higher prices is also seen among respondents living relatively near the transit stations and freeway interchanges used in the simulation process.

Housing Cost Estimates: As described in Chapter 3 and Appendix 3-6, housing cost estimates were developed for each dwelling-site choice. Each respondent provided a satisfaction rating for a set of six slides at one site with cost information; these ratings were then compared to the previous ratings the respondent had made of the same dwelling-site combination without cost information. The difference in the ratings, if any, indicates the effects of cost information on satisfaction.

---

[39] The correlation coefficients of these variables are: income and age, 0.0583 (not significant); income and children, -0.0384 (not significant); and age and children, 0.4122 (significant at the .01 level).

In general, the satisfaction by density ratings of the slides when cost information is provided is similar to ratings without cost information. As Table 4-39 indicates, differences between pairs of slides are significant, with most differences significant at the .01 level. As with other slide ratings, less dense dwellings are preferred to denser buildings, although the three-story apartment is significantly favored over the two-story apartment. These patterns hold when the responses were split into Sacramento and East Bay sites (Appendix 4-4).

Although providing explicit cost information about different dwelling units does not substantially alter the pattern of respondents' satisfaction ratings, it does affect the ratings of particular residences. Table 4-40 presents respondents' ratings of each of the six dwelling units, across all sites, with and without cost information, and the mean difference of these ratings. A negative mean value indicates that satisfaction without cost information is higher than satisfaction with cost information. A positive value indicates the opposite.

Cost information in general has a negative effect on slide ratings, with single-family detached homes and duplexes showing the sharpest drop in satisfaction. These dwellings and the two-story apartments are rated significantly lower after cost information is provided. In contrast, the ratings of the four-story apartments increase very slightly with the provision of cost information.

The effects of cost information on ratings of individual slides vary by area, as shown in Table 4-41. Sacramento respondents are much more negatively affected by cost information then are East Bay residents.[40] This may indicate that Sacramento residents are more sensitive to the effects of cost, or that they somehow process cost information differently than East Bay residents (an unlikely event). However, this finding may also be

[40] In rating slides with cost information, Sacramento respondents were shown slides set in Sacramento, and East Bay respondents were shown slides set in the East Bay.

an artifact of the housing cost estimate procedure. Cost estimates of land value near the transit and freeway sites are quite rough; these estimates may have inflated housing costs in Sacramento, deflated costs in the East Bay, or both. Verbal remarks by the participants as they viewed the slides with cost information, as well as their written comments, indicated that Sacramento respondents were particularly surprised by the high costs of the housing. Their satisfaction scores reflect this surprise. Nevertheless, the pattern of differences of the two groups of respondents is similar, with cost information having the greatest negative influence on ratings of single-family detached houses and duplexes. The positive difference for East Bay ratings of four-story apartments indicates that the cost information makes these residences significantly more attractive, a somewhat surprising finding considering the widespread unpopularity of these buildings.

The impacts of cost information on the density-satisfaction relationship differ based on the siting of the housing next to a transit station or freeway interchange. As Table 4-42 shows, cost information at transit sites produces an almost universal decrease in satisfaction; the change at freeway sites is not as great and for some dwelling units is slightly positive (indicating cost information increases satisfaction with the residence). Specifically, the drop in satisfaction with duplexes is significantly greater at transit sites than at freeway sites, while the satisfaction differences between transit and freeway sites approach significance for the townhouses and three-story apartments. It is unclear why this would be the case. Perhaps respondents, when viewing the slides without cost information, expected the transit-based dwelling units to be less expensive than the freeway-based units, and reacted negatively when the transit-based units were revealed to cost more than they had expected. It is possible that this reflects a general impression of transit-based housing as lower-cost housing, an impression that might have been formed through either personal

experience or societal stereotypes. Further research on this point would be necessary to better explain these findings.

Overall, these three residential types (duplex, townhouse, and three-story apartment) produce moderate satisfaction ratings; single-family detached houses are rated considerably higher than these dwelling units, and two- and four-story apartments are rated considerably lower. This suggests an uneven but significant interaction between dwelling type, site type (transit or freeway), and cost information. If the dwelling type is sufficiently popular or unpopular, the impacts of cost information are much the same no matter where the building is located. For dwellings of moderate popularity, however, cost information has a differential impact. Transit locations are viewed more negatively when cost figures are provided, while freeway locations, on the whole, are not.[41] This may reflect a general belief that for a medium-density residence at a given price, a freeway setting is preferable to a transit setting. Or it may indicate different cost assumptions respondents made when viewing the slides for the first time (i.e., without cost information). If (say) respondents attached an implicit price tag to the duplex in a transit setting that was lower (for whatever reason) than the assumed cost of the same dwelling in a freeway setting, they might react more negatively in their rating of the transit-based dwelling once information is provided that shows the costs of the duplex at the transit and freeway settings are, in fact, the same. It is not clear, however, why transit-based residences would initially be assumed to be less expensive than freeway-based residences.

This result was not anticipated, and in fact is somewhat counterintuitive based on

[41] Note that this difference is not due to differential prices for housing at transit and freeway sites. Within building types, residences at the Butterfield LRT setting were priced exactly the same as those at the Bradshaw/Rt 50 interchange, and dwellings near the Union City BART station cost the same as those near the Tennyson/I-880 interchange.

comments respondents made about the desirability of living near transit or freeways. Although the majority of respondents did not mention the transportation settings of the slides, those that did were more favorably disposed to living near transit than living near freeways (see the discussion of respondents' comments later in this chapter). This attitude, however, may not be typical of the majority of respondents.

This result also seems to contradict the finding that respondents are willing to pay somewhat more for dwellings located near transit rather than freeways, as described above. However, willingness-to-pay responses were collected only for those dwellings respondents chose as their "most liked". At transit settings, only 24% of the most-liked residences are the duplex, townhouse, or three-story apartment. At freeway settings, this proportion increases slightly (37%), but still represents well under half of the sample. The willingness-to-pay measure, therefore, is not directly comparable to satisfaction ratings using cost figures, which were obtained for all dwellings for the entire sample.

The effects of cost information on ratings were examined across several different socioeconomic and demographic groups. Analyses of variance find no differences in the ratings of groups broken down by age, income, or gender (see Appendix 4-4). One respondent breakdown, by owner or renter, is analyzed somewhat differently due to the relatively small number of renters in the sample. Table 4-43 shows that owners and renters have a similar reaction to cost information; both groups rate single-family detached houses and duplexes significantly lower after dollar amounts are provided. Renters, however, did show a slight tendency to express more satisfaction with higher density dwellings.

For respondents of child-rearing ages (21 to 51), presence or absence of children does affect the impact of cost information on the satisfaction ratings of the single-family detached house (see Table 4-44). Respondents without children are strongly influenced by

cost information in their ratings of these houses, with satisfaction scores declining by almost two points. In contrast, satisfaction scores of respondents with children decline only a little over one-half point. Respondents with children apparently view single-family detached housing as by far the most preferable living environment, and are not substantially dissuaded of this belief by the potentially high cost of such housing.

Overall, explicit cost information lowers respondent satisfaction with the most popular dwellings (single-family detached houses and duplexes) and does not increase satisfaction with any dwelling. The effects of cost information are more pronounced in Sacramento than in the East Bay, although this might be due to the information used in developing the cost estimates, rather than a real difference between the populations. Age, income, gender, and tenancy do not influence the effect cost information has on satisfaction ratings of various dwelling units. However, respondents with children are more immune (or resigned) to the high cost of single-family detached housing than are respondents without children. Finally, cost information on dwellings of moderate popularity (duplexes, townhouses, three-story apartments) substantially decreases satisfaction in transit-based settings, but has little impact in freeway-based settings. The reasons for this effect are not clear, but may relate to different expectations respondents make about housing costs in the absence of explicit price information. It is also possible that these results may simply reflect sampling fluctuations.

## RESPONDENT COMMENTS

The questionnaire provides several opportunities for respondents to state what features of the residences and sites they like and dislike, and what factors are most

important to them in their selections. In classifying the results, 16 separate categories of comments are identified; these are loosely grouped under the headings "transportation," "site-design elements," "off-site elements," and "intangibles".

Transportation: The single factor most often mentioned in the open-ended comments is concern over traffic or busy streets (mentioned by 52 percent of the respondents). This is clearly prompted by the slides of Bradshaw and Tennyson roads leading to the freeway. Respondents are concerned about noise, congestion, and the inconvenience of living on a busy road. Several also express concerns about the safety of children in such an environment. A few people explicitly state that the single-family detached house is not their "most-liked" dwelling along these busy streets, because the street environment is incongruous with the presumed peacefulness of a single-family house.

Of lesser concern, but still mentioned by a fairly large proportion of respondents (20 percent), are issues of parking or garage access. Virtually all of these comments express the desire for easily accessible parking to the residence and some indicate a preference for two-car garages.

Several comments relate to how close the dwelling is to the transit stations or freeway interchanges shown in the slides. Of these comments, transit is usually viewed in a positive light (13 favorable comments out of 17), while freeways were almost always viewed negatively (only 1 favorable comment out of 8). Although the majority of respondents do not refer to the transportation setting in their comments on the ratings, it is clear that transit stations are more attractive neighbors than freeway interchanges.

Site-design elements: Several types of comments can be grouped under a broad heading of site-design elements. Prominent among these is diversity vs. sameness of dwelling units (mentioned by 23 percent of respondents). Single-family detached houses

are valued for their flexibility and adaptability to the needs or desires of the owner. As one respondent puts it, "I prefer houses that have some uniqueness and character to them, and don't look exactly the same". This contrasts with the apartments, where another respondent says "[there is] no evidence of freedom of expression for the individual," and a third states the "buildings look the same. Like Russia". The condominiums and duplexes draw mixed reactions. One respondent says of the former, the "neighborhood looks like there might be many restrictions, codes of ordinances [sic] to abide by". Others find the uniformity of such developments to be "neat and nicer".

Comments regarding greenery and landscaping are common (33 percent). To some extent, this is a result of the simulation process; as the emphasis is on respondent ratings of the buildings themselves, dwellings were chosen that could easily be seen. This led to a deliberate avoidance of heavily landscaped or wooded grounds. The comments of a number of respondents reflect their displeasure with the rather stark and severe results.

The emphasis on yards and open space is somewhat different than that on landscaping (43 percent). Although a few of these statements seem to stem from the same desires for nicely landscaped grounds that are present in the above comments, most are a reflection of the desire for privacy, both from neighbors (a desire for side yards) and from the street (a desire for front yards). This conceptual distinction is supported by the fact that 18 percent of respondents commented on both landscaping and open space, suggesting that they perceived these attributes as separate qualities. (Overall, 15 percent of respondents commented only on greenery and landscaping, 25 percent only on yards and open space, and 18 percent on both.)

This desire for privacy is expressed explicitly by 27 percent of respondents, including many who simply say they value it highly. As one respondent puts it, "I love

privacy to the last letter of the word so I hate overcrowded subdivisions".

Off-Site Elements: An off-site element closely related to the desire for privacy is the perceived amount of congestion or crowding immediately around the dwelling unit. This feature is mentioned by 27 percent of respondents in their comments on the higher-density housing. One person bluntly states he "hate[s] apartments and close proximity to neighbors". Another says the "horrendous overcrowding" is "ok for sardines, but not me," while another simply writes, "apartment living is atrocious". Very few respondents expressed sentiments similar to the person who states apartment living is desirable because you are "likely to know a lot of people who live around you".

Another off-site element of considerable concern is noise (32 percent). Sometimes noise is perceived as a by-product of high volumes of traffic, while at other times it is a result of large numbers of people living in close proximity to one another. This is illustrated by one respondent's statement that "I don't want to hear people flushing [their] toilet in the middle of the night or with their t.v. on".

Safety or security issues are explicitly raised by 18 percent of respondents. This is a nexus for a variety of other concerns, including traffic, children, congestion, privacy, the quality of the neighborhood, and living in a high-density environment. Given the frequent combination of safety concerns with other topics, it is likely that safety or security may be implicit factors within comments about these other areas. For example, a respondent who simply says that a neighborhood or a high-density building is bad for children may have safety concerns in mind.

The density of the area in the slide provokes considerable reactions; high densities generate strong negative comments (25 percent). Some of these comments are quite direct (all references are to the four-story apartment unless otherwise indicated):

"Multiple units tend to turn into slums after awhile."

"Looks like slum when new or old."

"Looks like project or low income housing to me."

"No matter how good you try to make it look, a slum is still a slum."

"Ugly, crowded tenement house."

"It looks cheap and slum-like to me." (three-story apartment)

"Area would deteriorate rapidly."

"Tenement type, will surely be a slum in a few short years."

"I hate apartment complexes.... This one also looks like a slum - considering the neighborhood, it would probably turn into a slum quickly."

As well as categorizing apartments as slum-like, respondents generalized about the types of people who would live there (again, all references are to the four-story apartment unless otherwise indicated):

"Too many people to worry about. You could expect poor families to live there."

"Looks like an intercity [sic] government housing project for low-income families."

"Cluttered and messy presentation of front of dwellings, more likely to appeal to people with 'cluttered lives'." (two-story apartment)

"That type of complex will attract a lesser class of people; eventually more neighbor problems and crime."

"[In] apartments, seemingly the people have no respect for the building or each other. The children stand around on the street looking angry and unhappy. Breeds crime."

"Looks like low-income housing and personally cause poverty and crime in small towns."

"High density housing doesn't appeal to me. It brings in low income people with a high crime potential. Drugs."

One respondent may have been motivated by an unconscious fear of crime when he wrote that the four-story apartment has the "appearance of cells, not homes".

It should be reiterated that the slides show very few people (most show none), and that all the buildings are in reasonably good condition, with no evidence of vandalism, graffiti, deterioration, or neglected maintenance. (See prints made from slides in Appendix 3-2). Indeed, the four-story apartment is a new, seemingly attractive wood-paneled building set in a well-to-do Bay Area suburb. In their comments, respondents are not directly describing visual images from the slides, but instead are using the density of buildings to infer attributes to the building, its residents, and its likely condition in the near future. Possible causes of this process, and what it might mean for planners interested in higher residential densities around transit stations, will be explored in the next section.

Intangibles: This section describes factors that do not easily fit within one of the other categories of comments; these include the quality of the neighborhood or community, neighbors, children, and the cost or investment factors of the residences.

Comments on the neighborhood or community (mentioned by 18 percent of respondents) emphasize the quality or feel of the area in which people live. This differs

from the comments described above that identify high-density living as being good or (usually) bad. Many of the neighborhood comments simply express a desire for a "neighborhood atmosphere" or a "community feel," although one respondent states that it is important that the "neighborhood... always look 'good' and uniform". Implicit throughout many of these statements is that high-density living (perhaps including townhouses and condominiums, and certainly apartments) is not conducive to a neighborhood feel. One respondent draws an interesting distinction when she states that the single-family detached house "looks like a residential area, not apartments". Apartments contain far greater numbers of residences than a single-family development of comparable size - but numbers of residences is not what she feels constitutes a "residential area".

Much of the concern over neighbors (expressed by 20 percent of the respondents) relates to the supposed shortcomings of apartment dwellers, as described above. Other comments note the disadvantage of proximity: "Do not like apartment living - too close to neighbors"; "Apartments have too much chance of undesirable neighbors in adjoining apartments". Another respondent, who dislikes apartments because "you have no control over who your neighbors will be," states "I like independence. My house, on my property". Of course, this independence can be exercised also by the respondent's neighbors if they choose to sell (or rent) their house, without any thought of who the respondent might prefer his new neighbors to be. What these respondents seem to be reacting to is not the inability to choose one's neighbors, or the habits or activities of the people that move in; rather, it is the ability of a detached house to shelter one from "undesirable neighbors". This is very similar to the desires for privacy mentioned above, and may simply be a less direct way of expressing the same interest.

High-density living is considered especially bad for children (23 percent). Some of

the concerns relate to issues of traffic safety ("little kids and cars don't mix"), while others seem based on the intrinsic undesirability of high-density housing. Comments from the latter group include "American children are much happier in [a] single[-family] home.... [In apartments] the children stand around on the street looking angry and unhappy"; "[In the duplexes], children don't have room to play and grow up.... [In the four-story apartment] the neighborhood may be a bad place to raise kids"; "[the three-story apartment] looks like a nightmare for kids". Much of this concern relates to a lack of play area for children, but other comments suggest a broader disapproval of high-density housing: "I would never consider living in an apartment with my family".

The cost of the dwelling is a concern of 29 percent of the respondents. The cost information provided during the survey was more favorably received in the East Bay than in Sacramento; comments from the former include "the cost of the homes are far below the market value," while the latter respondents said "the price of these units in the current market seemed too high". Most respondents, however, mention cost in more general terms, as one factor of importance to them in deciding which dwelling unit they prefer.

Related to cost, a small number (8 percent) refer to the investment advantages of homebuying, particularly a single-family detached house. As one respondent notes, "single family units appreciate more in value over [a] period of time"; another agrees, "single family residences are always better investments". In contrast, "in high-density neighborhoods the place goes down hill so fast you can't recover your investment even if you live to sell it". It is important to distinguish these comments from the actual performance of the local real estate market. Although these perceptions may or may not be accurate, people who believe them will act as if they are. Indeed, this process of acting on a possibly erroneous belief can produce the effect that was originally assumed to occur. Such

a process would be similar to the well-documented 'self-fulfilling prophecy' of racial integration lowering housing prices in all-white neighborhoods (Jackson (1985)).

Summary of Respondent Comments: Most respondents wrote openly and at length about their reactions to the slides. The typical respondent mentioned several different features of the buildings, settings, or other aspects of the slides. Often, however, the comments centered around an overall theme, such as privacy, safety, or dislike of high-density buildings. These themes illuminate the dissatisfaction with high-density housing described earlier in this chapter.

People have a strong desire for privacy, and do not believe this can be satisfied in a multi-unit dwelling. For most, privacy means a single-family detached house, with a yard to provide distance from other houses and from the street. People also want safety and security, particularly for their children. This is best obtained by living on a lightly-traveled street, in a home with either a separate yard or a large central play area. The apartments shown in the slides are distrusted, both for their lack of open space for children and for the types of people presumed to live in them.

High-density living is considered inferior to single-family detached housing for both privacy and safety. It also is often viewed as unattractive, inflexible, unfriendly, or a bad investment. Given these reactions, it is not surprising respondents overwhelmingly prefer lower density dwellings.

## CONCLUSIONS

The data collected through this survey strongly support the first hypothesis: residential satisfaction is negatively related to building density. The single-family detached house is by far the most popular and desired residence for the persons surveyed. It received

the highest satisfaction ratings, and was "most-liked," by every category of respondent, regardless of socioeconomic or demographic breakdown, location of residence, or proximity to or familiarity with the site.

Differences do emerge. The strength of the relationship between satisfaction and density is affected by both age and income. Younger and poorer respondents are more favorably inclined towards higher-density housing, perhaps out of economic necessity. The hypothesis that higher incomes are related to greater satisfaction with high density is not supported. [42]

Several additional a priori hypotheses were tested with these data. Contrary to expectations, familiarity with the sites shown in the slides and proximity of respondents' residences to these slides do not affect the satisfaction-density relationship. Also against expectations, transit settings are preferred to freeway settings for most types of housing, the exceptions being the two least popular residences (the two- and four-story apartments).

Other hypotheses dealt with respondent socioeconomic and demographic variables. As expected, gender plays no role in satisfaction ratings and respondents not living with children are relatively more satisfied with high-density buildings. Two other hypotheses were not supported: older respondents did not indicate generally higher levels of satisfaction than younger respondents (the youngest respondents tended to be the most satisfied), and higher-income respondents were not more satisfied with high densities than lower-income

---

[42] It should be noted that all respondents were drawn from solidly middle-class neighborhoods. "Lower," "middle," and "upper" incomes are convenient descriptors of fairly modest differences in income, not effective demarcations of the very poor and the very affluent. The truly wealthy might have a stronger favorable reaction to higher density living, as suggested by Baldassare (1979). This response, however, is not present among the "wealthier" respondents (an annual pretax household income of at least $50,000) in this sample.

respondents (the reverse was true). It is likely that both of these results are partly due to judgments of respondents being affected by their expectations as to the type of housing they could afford.

Amenities affect the relationship between satisfaction and density and, to some extent, can counteract otherwise unpopular densities. Respondents living very close to a rail station or freeway interchange are willing to pay more for housing there than respondents living somewhat further from the site, although they are no more satisfied with it; this puzzling finding may reflect cognitive dissonance among the closer respondents.

Explicit cost information reduces respondents' satisfaction with single-family houses and duplexes, but does not increase satisfaction with higher density housing. This effect is relatively independent of respondent characteristics; only presence or absence of children modifies this finding, with cost information lowering satisfaction ratings of respondents not living with children, but not changing the ratings of respondents living with children.

The final chapter of this study discusses the policy relevance of these findings. What can planners learn from these results to apply to transit-based housing projects? It also discusses the strengths and weaknesses of the techniques used in this study, and recommends how computer-aided simulation may be of increasing use to planners and policymakers.

## CHAPTER 5 - RECOMMENDATIONS AND CONCLUSIONS

This study applies stated preference and computer photosimulation techniques to better understand people's attitudes towards density, providing guidance for planners when developing higher residential densities around transit stations. In this final chapter, key research findings are summarized, and policy inferences are drawn from these results. The strengths and weaknesses of the research design are discussed, and possible directions for future research in this area are examined.

## FINDINGS AND POLICY INFERENCES

### Summary of Findings

Two broad policy conclusions emerge from this study: low-density single-family living still has a strong hold on large segments of the population, and the tendency to favor such housing can be mitigated by several factors, including architectural style and design and location near transit stations as compared to freeway interchanges. Several factors may need to work together for an individual or household to choose a townhouse over a detached residence, or a multi-level apartment over a single-family unit. These factors are described individually below, as the results of the analysis are recapitulated and extended, where possible, to policy recommendations.

1) Density is a strong determinant of individuals' projected satisfaction with residential neighborhoods. All other factors being equal, most people will select lower density units over higher density ones. However, the impacts of density can be partially mitigated by other factors, such as landscaping and architectural style.

2) Where a proposed development is located, with one exception, does not influence respondents' attitudes towards density. People do not view density positively or negatively

based on their familiarity with a site. Nor does proximity of the respondents' homes to the transit or freeway site being densified change their attitudes towards density. This suggests that reactions towards density are not simply based on a NIMBY response to proposed development, but rather are deep-seated attitudes likely to be expressed independently of a specific project or particular location. (Of course, a NIMBY response may be generated by proposals for specific projects.)

3) Residences near transit stations are preferred over residences near freeway interchanges. This is true of all but the least popular dwelling units. The most popular dwelling-by-site combination was single-family detached housing near transit. If such preferences are translated into action by local residents in neighborhoods with new transit stations, significant political opposition may develop to block proposed rezoning of these residential areas for higher-density housing. This is in fact what has happened in areas such as Oakland's Rockridge neighborhood, as planners' efforts to increase densities around the BART station have been stymied by the effective political opposition of neighborhood residents.

This finding supports the notion that transit can be viewed as a tolerable neighbor in a residential area, although two aspects of the research design may have inadvertently increased the attractiveness of the transit station relative to the freeway interchange:

a) the transit developments depicted residences where park-and-ride lots would normally be located. The attractiveness of transit-based residences might diminish if they are constructed further from transit stations than shown here, and if they are separated from the stations by large amounts of parking.

b) the transit developments were located along local streets in the slides, while the freeway developments were located along major arterials. This is a confounding factor; respondents may have reacted as much or more to the differences in streets as to the differences in transit

or freeway settings. The research design is limited in not being able to separately account for the effects of these two variables.

4) Beliefs that apartments are no place for children are expressed in this study, consistent with the findings of similar studies. Childless adults may be overrepresented in high-density housing, as respondents with children are less satisfied with such housing. This distinction held when cost information on each dwelling was provided to respondents.

5) Another group that would be overrepresented in transit-based high-density housing would be lower-income respondents. To some extent this reflects the lower cost of high-density housing. But lower-income respondents were no more satisfied with high-density housing near freeway interchanges than were middle- and upper-income respondents. The presence of the transit station was an important factor in their increased satisfaction, and may reflect an intention or desire to make some trips by transit, to save money by relying less on automobiles.

6) The age group most in favor of high-density housing is 18-32 year-olds. The reasons for this are not clear, but may include lack of financial resources, incomplete socialization in American housing norms, or a generational shift in housing preferences. Assuming that the latter is not the case, this preference, combined with the strong dislike other age groups have for high-density housing, suggests that transit-based high-density housing may be populated predominantly by young adults, and that residents at one point in time may likely move to lower-density dwellings as they age, resulting in steady turnover of tenants.

The "ladder of life" concept proposed by Perin (1977) suggests that younger respondents' preferences for high densities may be due to their internalization of social norms that identify such housing as appropriate for them. She discusses the hierarchy of residences among Americans, and the extent to which many people believe that multi-family living is appropriate only for persons of a certain age. The comments of several of

the respondents to this study reflect this belief:

"(Townhouse) A nice model for apartments. Good for newlyweds and single people."

"(A)partments are good starting units for the young, or can be good for the elderly who are simplifying their lives... or are unable to care for large homes and gardens."

"If I was single, the [high-density] development would not be bad."

The idea of a progression from apartment renter to owner of a single-family house is nicely expressed by one respondent:

"Spent too many years in single family house to go back to apartments.... Not ready to go back to apartment life at any cost."

Although few respondents made direct comments about the appropriate stage of life for residents of various housing types, nothing in the survey (beyond the images of the buildings themselves) would have provoked such comments; the topic was one introduced by the respondents themselves. It is quite possible that other respondents might have similar beliefs, although this supposition cannot be tested with these data.

The elderly are often envisioned as possible tenants for transit-based housing. Somewhat surprisingly, the older respondents in the study (aged 60 and over) were no more favorably inclined towards higher-density living (or transit-based living) than younger respondents. It is possible that transit-based high-density housing could be constructed that would appeal to older people; a few such developments have been constructed, such as Del Norte Place near the El Cerrito del Norte BART station. It is not clear, however, that the elderly - particularly the retired elderly - would be prone to using rail transit to any great degree. Their travel patterns differ from younger respondents, and may not be well served by rail transit. Additional study of this point is needed.

These respondent variables - age, income, and presence/absence of children -are not strongly related to one another, although the categories do contain moderate overlap. To some extent, each of these could be thought of as a market niche, and indeed apartment complexes and condominium developments often target one or more of these groups.

7) Attaching costs to each dwelling unit lowered people's satisfaction with the most popular dwellings (single-family detached houses and duplexes) and did not increase satisfaction with any unit. This result was independent of age, income, gender, and tenancy, although respondents with children continued to prefer single-family detached housing. An unexplained finding is that cost information on the dwellings of moderate popularity (duplexes, townhouses, and three-story apartments) substantially decreased satisfaction when placed near transit stations, but did not have this effect next to freeway interchanges.

Policy Inferences

The findings of this study support the belief that American residential preferences, at least in the near future, will continue to be dominated by desires for single-family houses and yards. What do the relatively low residential densities that result from these land use patterns mean for transit planners? Pushkarev and Zupan (1982) note that 9 dwelling units/acre is the minimum residential density for a light rail system (12 units/acre for a rapid rail system), but they also state that the density of the nonresidential center and the distance between the residential and nonresidential areas are most important. Richardson (1988) notes that single-family detached housing at 10-12 units/acre might be possible, "but serious compromises in (liveability and appearance) are necessary in projects with more than seven to eight units per acre, compromises that are likely to be unacceptable to consumers" (p. 20). Alexander and Reed (1988) arrive at a similar figure, identifying 10 units/acre as the highest feasible density for single-family detached housing.

Transit-oriented developments will likely contain a mix of single- and multi-family residences. A recent study evaluated a sample of ten projects representative of emerging concepts in suburban planning and design (Urban Mass Transportation Administration (1991)). Although not all the projects explicitly included transit, all contained land-use patterns which were relatively compatible with transit services. Of the ten projects, all included a mix of housing types, with eight of the ten including at least three different types of housing. Projected residential densities in the built-up areas range from 5 to 10 units per acre, suggesting that detached single-family housing is a significant component in most of the developments. This may make the projects more attractive to potential residents, while reducing the number of prospective transit patrons.

This study provides both positive and negative indicators regarding the possible success of such projects, and transit-based housing in general. It is not clear that even relatively low densities such as 5 to 10 units per acre would be acceptable to many of the respondents in this study. A strong preference for single-family detached housing was expressed, combined with concerns about multi-family housing that at times bordered on antipathy. The segregation of housing types planned for some of the projects might simply exacerbate the tendency for apartment dwellers to be seen as 'different,' which might lead to the creation of a 'high-density ghetto' within the overall project.

However, new transit-based high-density housing projects also provide an opportunity for the most undesirable features of high-density developments to be removed. Apartments can be arranged so as to maximize privacy and feelings of safety and security (see Marcus and Sarkissian (1986)). Location of residences (whether single- or multi-family) near transit instead of freeway interchanges may increase their attractiveness, as might their location on streets carrying little through traffic. As suggested by the findings of this study, architectural style and design can increase residential satisfaction, as can

landscaping and vegetation. Potential residents, too, will differ as to their attraction to high-density housing, with younger, poorer, or childless households more likely to be satisfied with multi-unit buildings.

From their comments it is clear that some respondents viewed the higher-density buildings, particularly the four-story apartments, as symbolic of a variety of urban problems: lack of privacy, lack of safety, proximity to potentially undesirable neighbors, even breeding grounds for crime and drugs. Transit planners and others that wish to encourage higher-density developments will have to recognize both the objective shortcomings of such developments (more traffic, no private outside space) and also the symbolic qualities attached to these residences. This suggests that non-traditional forms of multi-family dwellings, such as garden or clustered apartments, may meet less resistance from prospective inhabitants and neighbors. Additionally, such dwellings provide opportunities for architects and planners to mitigate to some degree the other negative aspects of high-density living mentioned previously, such as privacy, safety, and landscaping (see Marcus and Sarkissian (1986) for examples of non-traditional multi-family units).

## RESEARCH DESIGN

In this section, the strengths and weaknesses of the research design for this study are discussed, with emphasis on the use of the stated preference framework and the development of the specific computer simulations shown to the respondents. This is preceded by a short discussion of the strengths and weaknesses of the general process of computer simulation, and followed by a discussion of possible directions for future research.

Computer simulations

A novel feature of this study is the use of computer-simulated slides to depict a series of dwelling-site combinations, permitting a quasi-experimental framework measuring respondents' satisfaction with varying densities. This technique, like any other, has strengths and weaknesses, which are described briefly below.

Strengths: A major strength of the computer simulation process is that it can create environments, or building-environment combinations, that do not exist. This is not limited to combining existing features of the real world, as was done here. A skilled technician can produce realistic images of non-existent buildings, settings, or other portions of the environment. This obviously allows an opportunity for tremendous flexibility and creativity by planners or policy-makers wishing to investigate possible reactions to new buildings, settings, or combinations. As technology has advanced, computer simulations have gained increasing realism. As recently as 1987, Craik and Feimer could describe computer-constructed images as "cartoonish" or "artistic". This is no longer the case; computer simulations can now produce realistic images at relatively low cost.

Weaknesses: A drawback of all types of simulation processes is that they only replicate the visual environment. The sounds, smells, and feel of a new environment are not captured in the simulation. This decreases the realism of the simulation to an unknown degree, and requires participants to make judgments about a new building, development, or environment with only partial sensory information. Such characteristics may be imputed to the environment by the participants, such as the respondents in the current study who stated that noise would be a problem in high-density buildings. To the extent such characteristics are wrongly assumed, the evaluations of the simulated environment may be distorted. It seems likely that advances in simulation techniques will continue to improve the ability of artificial environments to provide other sensory information, and therefore enhance the

realism of the simulation.

Applications to this study

As respondents in the study report what their attitudes and preferences would be under certain circumstances, this method is prone to the weaknesses inherent in stated preference techniques. These weaknesses, and how the study mitigated them, are described below:

(1) difficulties in respondents giving meaningful answers. This is countered by having them first rate their own dwelling and places they had lived in the past, anchoring their responses in a familiar context.

(2) the possibility of 'game playing' or strategic bias in responses: giving false (or less than completely accurate) answers in order to influence the survey results. The hypothetical nature of the questions likely reduces any strategic bias; there is no obvious reason for any question to provoke a 'game playing' response, except perhaps the willingness to pay question. In addition, research has shown that strategic bias may be less important than sometimes thought, particularly in hypothetical situations (Brookshire et al, 1982; Mitchell and Carson, 1989).

(3) what respondents say they would do may be at odds with what they actually do. This is likely the greatest concern of stated preference research, and is a problem with no easy solution. The comments made by respondents suggest that many of them have strong and well-defined opinions and attitudes which have served as the bases of past actions, and might be expected to do so in the future; this lends some credibility to the assumption that respondents will behave in a manner consistent with their stated intentions.

(4) respondents state what is convenient, socially acceptable, or what they believe

the interviewer wants to hear. In this survey it was no more convenient to respond one way or another; there is no 'default' option, nor does supplying a particular response end the survey session more quickly. Being paid for their time may encourage respondents to consider their answers more seriously. The answers do not seem to match a socially acceptable ideal, particularly the comments regarding high density living. Many respondents indicated relative dissatisfaction with all the slides they saw, which does not suggest that they were attempting to give the interviewer what they thought he wanted to hear.

Application of stated preference methods and simulation of artificial environments allowed this study to investigate reactions to different densities in various settings while controlling for potentially confounding variables. Two such variables were age of the structure and amount of landscaping, although low levels of the latter may have reduced all the satisfaction ratings to an unknown degree. In addition, background characteristics of respondents were controlled to some extent by sampling within relatively similar census tracts. This permitted comparisons among groups of respondents (for example, between Sacramento and the East Bay) with relatively little concern that socioeconomic or demographic variables (other than location of residence) might confound the results.

A weakness of this study design was the lack of controls on architectural styles. Although it is clear from the results that architecture matters, a more systematic comparison of varying densities while holding style constant could better determine the contribution of style and design elements to residential satisfaction. Similarly, setbacks of buildings and provision of front lawns could be systematically varied to more accurately determine their contribution to residential satisfaction.

Providing additional perspectives of the housing units would allow respondents to make more informed judgments. Such perspectives could include full frontal views, views

of the side and back yards or play and other public areas, and perhaps views from inside the dwelling unit looking out. These perspectives would introduce other elements into the visual presentation (such as play areas for children) that could be systematically varied.

The results of the survey were generally consistent between the two metropolitan areas studied, and support the belief that the results can be extended to similar areas in these and other regions. However, it is not clear that respondents from other parts of a metropolitan area, such as central cities or outer suburbs, would respond in the same way; generalizations of these results to such areas may not be appropriate. In addition, both Sacramento and the San Francisco metropolitan area are rapidly-growing regions whose residents may have different attitudes about appropriate residential densities than residents of other parts of the country.

Respondents mostly lived in single-family detached houses that they owned (81 percent); this may have biased their responses in favor of slides of such housing, as people generally report preferences for the type of housing in which they live. As discussed in Chapter 4, the small number of renters (largely apartment dwellers) did not substantially differ from owners of detached single-family houses in their expressed preferences, suggesting that the overall sample preference for single-family detached housing is not simply a product of response bias. However, the results of this study could be extended by drawing on a sample with larger numbers of renters and condominium owners, to see if their responses differed significantly from those found in this research.

Another caution against wholesale application of these findings is that several respondents from one urban area responded negatively to the idea of living in the other urban area, irrespective of the actual residence (e.g., some Sacramentoans did not want to live in the Bay Area). Although these dislikes do not show up in comparisons of the ratings, they are expressed in comments, and could be a confounding factor if a simulated

development is placed in an area which large numbers of people find particularly attractive or unattractive.

Possible directions for future research

Computer Simulations: As software programs for manipulating computer images become more widespread, these techniques can play a more substantial role in planning deliberations. A recent application (McClure, 1992) used computer simulations to study alternative designs and planning strategies for rural community development. As the author notes, technological capabilities are well ahead of planning and design applications. Simulation techniques can be used in a variety of settings, including transportation corridors, planned unit developments, and urban redevelopment areas. They can even allow planners and others to see the impacts of proposed general plan or zoning ordinance changes.

Computer simulations can be taken a step further than in this study and be based on three-dimensional scale models. These models can either be presented in static form, through a series of photos, or dynamically, by guiding miniature cameras through the model of the landscape or environment and producing a video that simulates movement through the setting (Sheppard, 1989). Bosselmann and Craik (1987) discuss the latter type of application in their description of the Environmental Simulation Laboratory at the University of California, Berkeley. The detail and dynamic aspects of the three-dimensional model enhances the realism of the simulation, but at a price; an accurate scale model of an environment can cost as much as $10,000 to produce.

Trade-off Games: The research method used here provides measures of individuals' satisfaction with various dwelling-site combinations, but offers only limited information about preferences among different combinations of density, building type, and setting. A

more direct way of assessing such preferences would be to conduct some type of trade-off game, in which important factors of housing (size, proximity to transit, number of shared walls, etc) are presented to respondents, who are able to choose among different levels of these factors (such as high, medium, low; or detached housing, one shared wall, two or more shared walls) to determine the level of trade-offs among the housing features they find most desirable. To force trade-offs, such techniques commonly employ a constraint, expressed in dollar amounts; respondents are given a certain amount of 'money', and told to 'purchase' their desired levels of building type, amenities, etc. The dollar cap is typically below what would allow the respondents to select all their most favored characteristics.

Trade-off games studying issues of housing and urban design have been employed by a small number of researchers (Dowall and Juhasz (1978); Robinson (1987)). Robinson notes that "it is important that the environmental dimension or attributes and their quality levels be presented in as concrete and realistic a manner as possible" (p. 154). The use of simulated photos or slides could considerably increase the realism of the material presented in a trade-off game context, and presumably would lead to more accurate and realistic trade-offs by participants. With advances in simulation technology, respondents may soon be able to construct a preferred residence or neighborhood from choices presented in a trade-off game through an interactive computer program mixing and matching building type and density, yard and landscaping, location near transportation or shops, and other possible amenities.

Additional topics: This study found that familiarity with and proximity to an area being "developed" (at least through simulation) have little or no effect on people's reactions to the development. People respond similarly to the density of the building and to the setting (and to additional factors such as amenities and the streetscape) whether they live almost next door to the site or have never seen it before. This suggests that techniques such

as computer-aided simulations may be quite transferable from one site to another.

This lack of a "NIMBY"-type finding may not hold in situations where a particular development is being proposed or actively discussed. In this study, respondents knew that they were not rating developments that were on the drawing board or being planned. If they had been, it is likely that their ratings might have been different, and familiarity and proximity might have played substantial roles in their judgments. Clearly, many projects similar to the developments shown here will provoke NIMBY reactions if an immediate threat of development is perceived, particularly among project neighbors.

If a site is not under immediate development pressures, it could be suitable for use as a simulation setting to be shown to people both familiar and unfamiliar with it. This suggests that development possibilities around existing rail stations in one urban area could be shown to residents of an area that does not yet have rail. This can provide early feedback for system planners regarding public opinions towards possible joint venture development at future rail stations, either in their community or elsewhere. It also suggests that people in different parts of the country can rate the same simulations without concern of confounding the results by lack of familiarity or proximity.

Other extensions of the research done here could expand on the results in several ways. The respondents in this study were all drawn from middle-class, predominantly white neighborhoods in what might be termed "inner ring suburbs" (although the Sacramento area residents actually lived just inside the city limits). Although Sacramento and the Bay Area are different, both are rapidly-growing urban areas from one portion of the country. Additional research on the satisfaction impacts of varying densities could use different populations to determine the generalizability of these findings: would central city dwellers or residents of outer-ring suburbs or exurban areas react similarly to these respondents? Would responses be different from other parts of the country? Would a more ethnically

diverse population have similar attitudes?

This study has not investigated the role that a mix of land uses - shopping, office, residential, and personal business - might play in enhancing the attractiveness of transit-based residential development. The presence of shops and a lively street life might well play a role in increasing satisfaction with a residential area, perhaps to the point of outweighing some of the perceived disadvantages of duplexes, townhouses, or apartments. On the other hand, additional traffic generators that draw in people from outside the immediate neighborhood could reinforce feelings that housing in such an area, particularly higher-density housing, might lack privacy and be unsafe. Mixed-use development is a key aspect of many proposed transit-based developments, and should be thoroughly studied in order to best match commercial, office, and housing opportunities at transit stations.

In addition, further research should be undertaken to clarify the role actual densities and other factors have on perceived densities. The most successful higher-density projects are apt to be those that can reduce subjective densities while maintaining relatively high objective densities.[43] Rapoport (1976) states that "in dealing with the negative effects of density, one finds that the [important] variable is perceived density, and this is basically the way people 'read' the cues indicating the number of people per unit area" (p. 28). This study provides some empirical evidence for what those cues are: traffic, lack of landscaping, and lack of yards, as well as objective density (units/acre). The presence of transit and freeway infrastructure also provides cues for some respondents that such areas are apt to be busy, hectic places. Many cues, however, are not visible: the types of neighbors, the amount of privacy, and the amount of noise.[44] These are implicit qualities that have attached

[43] As one respondent stated, "I prefer my privacy. If I can't have privacy, I prefer a very convincing illusion of privacy."

[44] In Rapoport's categorization, these would be associational/symbolic cues.

themselves to the explicit and visible portion of the environment shown in the slides - most significantly, the high-density buildings. Additional research could further assess people's reactions to higher-density living by building on the qualities identified here and the respondent variables that seem to influence the extent to which people perceive these qualities or judge them to be important.

## CONCLUSIONS

This study provides additional insight into the role of density in determining residential satisfaction, and identifies some key attributes of density and important background variables of respondents that mediate the relationship between density and satisfaction. As described above, the findings support both the belief that people prefer low-density living and the belief that this preference is not absolute, but is influenced both by attributes of the physical environment and by characteristics of the respondents.

This study has focused specifically on new developments around transit stations, but many of the conclusions, as well as many of the questions yet to be answered, have relevance for any type of development that promotes clustering housing and increasing densities. Academic and professional interest in developing new forms of community is increasing, as indicated by the spread of concepts such as "neotraditional development" and "pedestrian pockets" (see Urban Mass Transit Administration (1991)). A better understanding of how these new types of development will be perceived and accepted by both the existing community and potential residents is crucial in evaluating the likely long-term success of these new styles of living.

As noted by Jackson (1985) and others, the Federal government has significantly aided homeowners in their desire to purchase single-family detached units, particularly in

suburbia. This government support has both responded to and helped to shape American attitudes regarding "appropriate" types of housing. By the mid-1970s, these attitudes were so firmly entrenched among developers, homeowners, and would-be homeowners that Perin (1977) identified them as a prevailing set of cultural norms, helping to define how people viewed both themselves and others.

Planners working to enact and promote concepts of alternative forms of development may need to identify alternative cultural norms that can draw on the strengths of more compact, higher-density housing. A need for community, a desire for mixed-use, pedestrian-oriented environments, an emphasis on energy conservation and efficiency, and a recognition that automobiles may not be the suitable mode for every trip are values and ideas that planners might utilize in presenting an alternative type of development to low-density sprawl. At the same time, recognition of the negative externalities of sprawl development can be translated into actions that internalize these costs for each residence. Steps being taken to accomplish this include impact fee programs, growth management plans, and efforts at congestion pricing and capturing more of the societal costs of operating automobiles through increases in fuel taxes and licensing fees.

Early proponents of joint development ventures between rail transit operators and commercial developers assumed that little more was needed for a successful joint venture than a rail station and a willing investor. Experience has shown that the ability of rail systems to act as magnets for development depends on several factors besides the rail systems themselves: a healthy local economy, sufficiently large parcels of land for development activities, the location of stations in desirable and accessible areas, appropriate rezoning around stations, and a positive attitude on the part of local government towards working with private developers (Knight and Trygg, 1977; Cervero, 1984). Efforts at developing housing around rail stations may be at a similar stage; more is needed than just

rezoning land for large apartment complexes and finding willing developers.

As plans for mixed-use and residential developments around transit stations increase, a better understanding of the desirable features of such developments will be necessary to ensure project successes (or even to convince lenders to support such projects). As demonstrated here, stated preference techniques and computer-aided simulations can play a significant role in determining who potential residents might be, and what attributes are most important to them. The results of this study suggest that reversing the century-long trend of strong preference for single-family detached housing will not be easy, even for a small segment of the population. Planners, developers, and others will need to proceed carefully and with considerable information and insight to ensure the overall success of transit-based high-density housing.

**TABLE 2-1**

**VARIABLES TESTED IN HEDONIC STUDIES OF RAIL TRANSIT PROXIMITY**

| Study and Sample | Variables that significantly affected price | Variables that did not significantly affect price |
|---|---|---|
| Dewees (1976). N=690 in 1961, N=1,174 in 1971. Houses within one mile of Bloor Street in Toronto | * Number of rooms<br>* Number of bathrooms<br>* Number of garage parking spaces<br>* Solid brick or stone structure<br>* Condition of structure<br>* Logarithm of age of structure<br>* Hot air heating<br>* Zoning permitting duplexes<br>* Average sale price of houses in the school district<br>* Transport time to Bloor Street[45] | * Floor space<br>* Fully attached or multiplex structure<br>* Less than 40 percent of school children are native English speakers<br>* Total trip cost (time valuation plus monetary expense) to Bloor Street [only used for 1961 data set]<br>* Total trip cost to Bloor Street, then to CBD [only used for 1961 data set] |
| | The following housing attributes were significant in 1971, but were not significant in 1961:<br>* Detached structure<br>* Zoning permitting only single-family dwellings<br>* Light auto traffic only<br>* Distance along Bloor Street to CBD<br>* Time cost to Bloor Street, then to CBD.<br>* Time cost to Bloor Street, treating all properties more than one-third mile away as located at one-third mile<br>* Time cost to Bloor Street, then to CBD, truncated as above | The following housing attributes were not significant in 1971, but were significant in 1961:<br>* Brick or stone facing<br>* Gas or electric heat<br>* Shortest walking distance to Bloor Street<br>* Shortest walking distance to Bloor Street, treating all properties more than one-third mile away as located |

[45] Transport time to Bloor Street is the sum of the weighted walking time, waiting time, and travel time, with weights of 1 assigned to travel time, 1.5 to waiting time, and 3 to walking time.

**TABLE 2-1 (CONT.)**

| Study and Sample | Variables that significantly affected price | Variables that did not significantly affect price |
|---|---|---|
| Diamond (1980). N=414; houses throughout Chicago metro area | * Distance to CBD along major roadways<br>* Distance to nearest commuter rail stations<br>* Dummy variable indicating residence within 5 miles of Lake Michigan<br>* Incidents of crimes against persons (by municipality)<br>* Average annual air particulate count<br>* Number of 5-feet contour lines within a half-mile of house | * None reported |
| Al-Mosaind, Dueker, and Strathman (1993). N=235; houses within 1,000 meters of Portland LRT line | * Distance from nearest LRT station (dummy variable indicating proximity within 500 meters)<br>* Lot size<br>* House size<br>* Presence of basement<br>* Number of bedrooms<br>* Age of house<br>* Single-family zoning<br>* Located in Portland<br>* Located in Multnomah County | * None reported; for the 90 houses within 500 meters of the station, no statistically significant relationship was found between the sale price of the house and the distance in meters from the nearest station. In addition, for these 90 houses, presence of basement, number of bedrooms, and location in Portland were not related to sale price. |

**FIGURE 3-1**

**SITE SELECTION MATRIX**

| | Sacramento | East Bay |
|---|---|---|
| Site near transit station: | Butterfield LRT | Union City BART |
| Site near freeway interchange: | Bradshaw Rd/ Rt 50 | Tennyson Rd/ I-880 |

**FIGURE 3-5**

**RELATIONSHIP OF SETTINGS TO KEY STUDY VARIABLES**

| Setting | Location | Close To | Would be familiar to |
|---|---|---|---|
| Butterfield LRT | Sacramento | Transit | Sacramento residents |
| Bradshaw Rd/Rt 50 | Sacramento | Freeway | Sacramento residents |
| Union City BART | East Bay | Transit | East Bay residents |
| Tennyson Rd/I-880 | East Bay | Freeway | East Bay residents |

**FIGURE 3-6**

**VIEWING ORDER OF SLIDE BLOCKS BY GROUP OF RESPONDENT**

| | Sacramento Groups | | East Bay Groups | |
|---|---|---|---|---|
| | Group 1 | Group 2 | Groups 3&5 | Group 4 |
| First Slide Block: | Butterfield | Bradshaw | Tennyson | Union City |
| Second Slide Block: | Bradshaw | Butterfield | Union City | Tennyson |
| Third Slide Block: | Union City | Tennyson | Bradshaw | Butterfield |
| Fourth Slide Block: | Tennyson | Union City | Butterfield | Bradshaw |

Note: Respondents in groups 1 and 2 were from the Butterfield and Bradshaw neighborhoods in Sacramento. Respondents in groups 3, 4, and 5 were from the Union City and Tennyson neighborhoods in the East Bay. Ideally, respondents in one group would have been from only one neighborhood, so that the order in which blocks of slides were shown could have been more closely correlated with the specific neighborhood of the

respondents. Logistically this was not possible, as it was necessary to present potential respondents with two possible dates on which they could attend in order to increase participation.

**TABLE 3-2**

**NUMBER OF RESPONDENTS BY CITY AND SITE**

| Respondents living in: | Respondents living near: Freeway | Transit | Total |
|---|---|---|---|
| Sacramento | 19 | 24 | 43 |
| East Bay | 20 | 21 | 41 |
| Total | 39 | 45 | 84 |

**TABLE 4-1**

**KEY RESPONDENT VARIABLES, TOTAL SAMPLE AND BY CENSUS TRACT**

| | Butterfield | Bradshaw | Union City | Tennyson | Total |
|---|---|---|---|---|---|
| Total Respondents | 24 | 19 | 21 | 20 | 84 |
| | | | | | |
| Employment/Commute Variables | | | | | |
| Percent of resps. employed | 58% | 74% | 86% | 75% | 73% |
| Percent only driving alone as regular commute mode | 71% | 71% | 83% | 67% | 74% |
| Percent having only driven alone to past jobs as reg. commute mode | 44% | 47% | 35% | 61% | 46% |
| Mean commute time (minutes) | 20.5 | 25.1 | 26.8 | 20.7 | 23.5 |
| | | | | | |
| Demographic Variables | | | | | |
| Median income | $45,000 | $38,750 | $43,000 | $40,000 | $42,895 |
| Percent of hhds with children | 29% | 21% | 42% | 40% | 33% |
| Median age (years) | 51.5 | 39 | 38 | 48 | 44 |
| Percent male | 58% | 68% | 43% | 55% | 56% |
| | | | | | |
| Residence Variables | | | | | |
| Percent living in s.f. houses | 100% | 89% | 67% | 90% | 87% |
| Percent owning own home | 92% | 79% | 71% | 80% | 81% |
| Median monthly mortgage and | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| property taxes | $575 | $800 | $500 | $650 | $710 | | |
| Median rent | * | | * | | * | * | $705 |
| Mean number of years at cur. residence | 10.7 | 6.7 | 9.5 | 19.1 | 11.4 | | |

* No census tracts included more than 5 renters; numbers were too small to calculate meaningful medians

**TABLE 4-2**

**PROXIMITY OF RESPONDENTS' RESIDENCES TO SITES USED IN PHOTOSIMULATIONS**

| Proximity of Residence | Butterfield | Bradshaw | Union City | Tennyson | Total |
|---|---|---|---|---|---|
| Within 1/4 mile | 12.5% | 0.0% | 0.0% | 3.6% | |
| 1/4 to 1/2 mile | 20.8% | 21.1% | 33.3% | 40.0% | 28.6% |
| 1/2 to 3/4 mile | 45.8% | 31.6% | 38.1% | 50.0% | 41.7% |
| 3/4 to 1 mile | 20.8% | 42.1% | 19.0% | 5.0% | 21.4% |
| Over 1 mile | 0.0% | 5.3% | 9.5% | 5.0% | 4.8% |
| | (N=24) | (N=19) | (N=21) | (N=20) | (N=84) |

**TABLE 4-3**

**OVERALL SATISFACTION RATINGS**

**TOTAL SAMPLE (N = 84)**

| Slide | Mean (Std Dev) |
|---|---|
| Single-family detached house (8 dwelling units/acre) | 5.5 (1.3) |
| Duplex (12 du/acre) | 5.0 (1.3) |
| Townhouse (11 du/acre) | 4.1 (1.3) |
| Two-story apartment (23 du/acre) | 3.1 (1.3) |
| Three-story apartment (44 du/acre) | 3.5 (1.5) |
| Four-story apartment (89 du/acre) | 2.4 (1.4) |

Note: Ratings are average of dwelling unit ratings across 4 base sites.

**TABLE 4-4**

**DIFFERENCES IN MEANS BETWEEN PAIRS OF SLIDES, AVERAGED ACROSS ALL SITES**

**TOTAL SAMPLE (N = 84)**

| | Duplex | | Townhouse | | 2-st apt | 3-st apt | 4-st apt | |
|---|---|---|---|---|---|---|---|---|
| Sf detached house | 0.5** | 1.4** | 2.4** | 1.9** | 3.1** | | | |
| Duplex | ---- | | 1.0** | 1.9** | 1.5** | 2.6** | | |
| Townhouse | | | ---- | | 0.9** | 0.5** | 1.7** | |
| Two-story apt. | | | | ---- | | (0.4)** | | 0.7** |
| Three-story apt. | | | | | | | ---- | 1.1** |
| Four-story apt. | | | | | | | | ---- |

* p<.05
** p<.01

Note: (parentheses) indicate negative value.

**TABLE 4-5**

**SITE-SPECIFIC SATISFACTION RATINGS**

**TOTAL SAMPLE (N = 84)**

Mean (Std Dev)

| | Butterfield LRT | Bradshaw | Union City BART | Tennyson |
|---|---|---|---|---|
| Sf detached house | 6.3 (1.4) | 4.5 (2.1) | 6.0 (1.5) | 5.0 (1.9) |
| Duplex | 5.4 (1.6) | 4.5 (1.7) | 5.2 (1.7) | 5.0 (1.7) |
| Townhouse | 4.3 (1.6) | 3.6 (1.6) | 4.4 (1.6) | 3.9 (1.5) |
| Two-story apt. | 3.1 (1.5) | 3.2 (1.4) | 3.2 (1.6) | 3.0 (1.5) |
| Three-story apt. | 3.7 (1.8) | 3.5 (1.7) | 3.7 (1.9) | 3.2 (1.6) |
| Four-story apt. | 2.4 (1.6) | 2.4 (1.6) | 2.5 (1.6) | 2.4 (1.5) |

**TABLE 4-6**

**DIFFERENCES IN MEANS BETWEEN PAIRS OF SLIDES AT INDIVIDUAL SITES**

**TOTAL SAMPLE (N=84)**

A. BUTTERFIELD LRT

| | Duplex | Townhouse | 2-st apt | 3-st apt | 4-st apt |
|---|---|---|---|---|---|
| Sf det house | 0.9** | 2.0** | 3.2** | 2.7** | 4.0** |
| Duplex | ---- | 1.1** | 2.3** | 1.7** | 3.0** |
| Townhouse | | ---- | 1.2** | 0.7** | 2.0** |
| 2-story apt | | | ---- | (0.5)** | 0.8** |
| 3-story apt | | | | ---- | 1.3** |
| 4-story apt | | | | | ---- |

B. BRADSHAW RD/ROUTE 50

| | Duplex | Townhouse | 2-st apt | 3-st apt | 4-st apt |
|---|---|---|---|---|---|
| Sf det house | 0.1 | 0.9** | 1.3** | 1.0** | 2.2** |
| Duplex | ---- | 0.9** | 1.3** | 1.0** | 2.1** |
| Townhouse | | ---- | 0.4** | 0.1 | 1.2** |
| 2-story apt | | | ---- | (0.3) | 0.8** |
| 3-story apt | | | | ---- | 1.1** |
| 4-story apt | | | | | ---- |

* p<.05
** p<.01

**TABLE 4-6 (CONT.)**

C. UNION CITY BART

| | Duplex | Townhouse | 2-st apt | 3-st apt | 4-st apt |
|---|---|---|---|---|---|
| Sf det house | 0.8** | 1.6** | 2.9** | 2.3** | 3.6** |
| Duplex | ---- | 0.8** | 2.0** | 1.5** | 2.8** |
| Townhouse | | ---- | 1.2** | 0.7** | 1.9** |
| 2-story apt | | | ---- | (0.5)** | 0.7** |
| 3-story apt | | | | ---- | 1.3** |
| 4-story apt | | | | | ---- |

D. TENNYSON RD/I-880

| | Duplex | Townhouse | 2-st apt | 3-st apt | 4-st apt |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Sf det house | 0.0 | 1.1** | 2.0** | 1.7** | 2.6** |
| Duplex | ---- | 1.1** | 2.0** | 1.7** | 2.6** |
| Townhouse | | ---- | 0.9** | 0.6** | 1.5** |
| 2-story apt | | | ---- (0.3) | 0.6** | |
| 3-story apt | | | | ---- | 0.9** |
| 4-story apt | | | | | ---- |

* p<.05
** p<.01

**TABLE 4-7**

**MEAN SATISFACTION RATINGS, FAMILIAR AND UNFAMILIAR SETTINGS: SITE-SPECIFIC SAMPLES**

Site: Butterfield LRT Station (N=24)

| Slide | Familiar Transit | Unfamiliar Transit |
|---|---|---|
| Sf detached house | 6.2 (1.4) | 6.1 (1.4) |
| Duplex | 5.3 (1.4) | 5.1 (1.3) |
| Townhouse | 4.2 (1.3) | 4.2 (1.2) |
| Two-story apt. | 3.2 (1.3) | 3.2 (1.2) |
| Three-story apt. | 3.6 (1.8) | 3.6 (1.8) |
| Four-story apt. | 2.3 (1.3) | 2.5 (1.3) ** |

| Slide | Familiar Freeway | Unfamiliar Freeway |
|---|---|---|
| Sf detached house | 4.3 (1.7) | 4.6 (1.8) |
| Duplex | 4.3 (1.5) | 4.8 (1.6) |
| Townhouse | 3.5 (1.6) | 3.7 (1.3) |
| Two-story apt. | 3.5 (1.7) | 3.0 (1.5) * |
| Three-story apt. | 3.6 (2.0) | 3.0 (1.6) * |
| Four-story apt. | 2.3 (1.3) | 2.5 (1.3) |

Site: Union City BART Station (N=21)

| Slide | Familiar Transit | Unfamiliar Transit |
|---|---|---|
| Sf detached house | 6.1 (1.5) | 6.2 (1.5) |
| Duplex | 5.0 (1.6) | 5.2 (1.4) |
| Townhouse | 4.3 (1.3) | 4.2 (1.2) |
| Two-story apt. | 3.4 (2.1) | 3.0 (1.4) |
| Three-story apt. | 4.1 (2.0) | 4.0 (2.0) |
| Four-story apt. | 2.5 (2.1) | 2.2 (1.7) |

| Slide | Familiar Freeway | Unfamiliar Freeway |
|---|---|---|
| Sf detached house | 4.3 (1.9) | 4.0 (1.9) |
| Duplex | 4.6 (1.3) | 4.4 (1.6) |
| Townhouse | 3.5 (1.3) | 3.6 (1.3) |
| Two-story apt. | 3.0 (1.8) | 3.0 (1.1) |
| Three-story apt. | 3.1 (1.3) | 3.7 (1.6) * |
| Four-story apt. | 2.3 (1.7) | 2.6 (1.8) |

* p<.10
** P<.05

**TABLE 4-7 (CONT.)**

**MEAN SATISFACTION RATINGS, FAMILIAR AND UNFAMILIAR SETTINGS: SITE-SPECIFIC SAMPLES**

Site: Bradshaw Rd/Rt 50 Interchange (N=19)

| Slide | Familiar Freeway | Unfamiliar Freeway |
|---|---|---|
| Sf detached house | 4.2 (2.5) | 4.9 (1.8) |
| Duplex | 3.9 (1.9) | 4.9 (1.7) ** |
| Townhouse | 3.2 (1.8) | 3.7 (1.4) * |
| Two-story apt. | 3.2 (1.6) | 3.0 (1.5) |
| Three-story apt. | 3.6 (1.6) | 4.1 (1.6) |
| Four-story apt. | 2.4 (1.7) | 2.5 (1.6) |

| Slide | Familiar Transit | Unfamiliar Transit |
|---|---|---|
| Sf detached house | 6.3 (1.4) | 5.9 (1.7) |
| Duplex | 5.2 (2.0) | 5.1 (2.0) |
| Townhouse | 3.8 (1.5) | 4.1 (1.7) |
| Two-story apt. | 2.9 (1.4) | 3.1 (1.5) |
| Three-story apt. | 3.5 (1.8) | 3.9 (1.6) |
| Four-story apt. | 2.5 (1.6) | 2.4 (1.3) |

Site: Tennyson Rd/I-880 Interchange (N=20)

| Slide | Familiar Freeway | Unfamiliar Freeway |
|---|---|---|
| Sf detached house | 6.1 (1.8) | 5.7 (1.9) |
| Duplex | 5.5 (1.9) | 5.4 (1.6) |
| Townhouse | 4.6 (1.7) | 4.2 (1.5) |
| Two-story apt. | 2.9 (1.4) | 3.3 (1.3) |
| Three-story apt. | 2.9 (1.6) | 3.2 (1.6) |
| Four-story apt. | 2.2 (1.4) | 2.4 (1.5) |

| Slide | Familiar Transit | Unfamiliar Transit |
|---|---|---|
| Sf detached house | 6.1 (1.6) | 6.8 (1.5) * |
| Duplex | 5.7 (1.8) | 5.9 (1.6) |
| Townhouse | 5.2 (2.0) | 5.2 (1.9) |
| Two-story apt. | 3.0 (1.8) | 3.4 (1.8) * |
| Three-story apt. | 3.3 (1.9) | 3.6 (1.9) |
| Four-story apt. | 2.4 (1.9) | 2.5 (1.9) |

* p<.10
** p<.05

**TABLE 4-8**

**MEAN SATISFACTION RATINGS OF SITES NEAREST RESPONDENTS' HOMES, BY PROXIMITY OF RESIDENCE**

| | 1/4 to 1/2 mi (N=24) | 1/2 to 3/4 mi (N=35) | 3/4 to 1 mi (N=18) | F stat | Sign F |
|---|---|---|---|---|---|
| Sf detached house | 6.0 (1.6) | 5.3 (2.0) | 5.5 (2.3) | 0.913 | 0.406 |
| Duplex | 5.1 (2.2) | 4.7 (1.6) | 5.0 (1.7) | 0.441 | 0.645 |
| Townhouse | 4.2 (1.9) | 3.9 (1.5) | 3.8 (1.4) | 0.408 | 0.666 |
| 2-story apt. | 3.2 (1.9) | 2.9 (1.3) | 3.3 (1.6) | 0.529 | 0.591 |
| 3-story apt. | 3.7 (2.0) | 3.3 (1.5) | 3.7 (2.0) | 0.348 | 0.707 |
| 4-story apt. | 2.5 (2.0) | 2.2 (1.2) | 2.3 (1.7) | 0.207 | 0.813 |

**TABLE 4-9**

**EFFECTS OF TRANSIT VS. FREEWAY SITES ON MEAN SATISFACTION RATINGS**

**(N = 84)**

| | Transit Site | Freeway Site |
|---|---|---|
| Sf detached house | 6.2 (1.3) | 4.8 (1.8) ** |
| Duplex | 5.3 (1.5) | 4.7 (1.5) ** |
| Townhouse | 4.4 (1.5) | 3.8 (1.3) ** |
| Two-story apartment | 3.1 (1.4) | 3.1 (1.3) |
| Three-story apartment | 3.7 (1.7) | 3.4 (1.5) * |
| Four-story apartment | 2.4 (1.5) | 2.4 (1.4) |

* p<.05
** p<.01

**TABLE 4-10**

**EFFECTS OF AGE ON MEAN SATISFACTION RATINGS - ALL SITES**

| Slides | Age 18-32 | Age 33-44 | Age 45-59 | Age 60 + | F stat | Sign F |
|---|---|---|---|---|---|---|
| Sf det. | 5.4 (1.2) | 5.2 (1.4) | 5.6 (1.3) | 5.6 (1.5) | 0.893 | 0.449 |
| Duplex | 5.1 (1.4) | 4.5 (1.1) | 5.2 (1.1) | 5.3 (1.4) | 2.526 | 0.063 |
| Townhouse | 4.6 (1.2) | 3.6 (1.4) | 3.8 (1.2) | 4.2 (1.2) | 2.677 | 0.053 |
| 2-st apt. | 4.1 (1.4) | 2.7 (1.0) | 2.7 (1.2) | 3.0 (1.2) | 6.368 | 0.001 |
| 3-st apt. | 4.7 (1.3) | 3.4 (1.1) | 3.2 (1.5) | 2.9 (1.4) | 8.147 | 0.000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4-st apt. | 3.2 (1.8) | 2.3 (1.0) | 2.0 (1.3) | 2.1 (1.1) | 3.484 | 0.020 |

Note: All group Ns = 21

**TABLE 4-11**

**EFFECTS OF AGE ON MEAN SATISFACTION RATINGS BY LOCATION**

A. TRANSIT-BASED SITES

| Slides | Age 18-32 | Age 33-44 | Age 45-59 | Age 60 + | F stat | Sign F |
|---|---|---|---|---|---|---|
| Sf det. | 6.2 (1.3) | 6.4 (1.3) | 6.2 (1.3) | 6.0 (1.4) | 0.135 | 0.939 |
| Duplex | 5.3 (1.7) | 4.8 (1.1) | 5.7 (1.4) | 5.4 (1.7) | 1.410 | 0.246 |
| Townhouse | 5.0 (1.5) | 4.0 (1.6) | 4.2 (1.2) | 4.3 (1.3) | 1.869 | 0.142 |
| 2-st apt. | 4.2 (1.7) | 2.7 (1.0) | 2.7 (1.1) | 2.9 (1.2) | 6.552 | 0.001 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3-st apt. | 5.0 (1.6) | 3.6 (1.5) | 3.3 (1.7) | 2.9 (1.5) | 6.720 | 0.000 |
| 4-st apt. | 3.3 (2.2) | 2.4 (1.1) | 1.9 (1.2) | 2.0 (1.1) | 3.944 | 0.011 |

Note: All group Ns = 21

B. FREEWAY-BASED SITES

| Slides | Age 18-32 | Age 33-44 | Age 45-59 | Age 60 + | F stat | Sign F |
|---|---|---|---|---|---|---|
| Sf det. | 4.6 (1.3) | 4.1 (2.0) | 5.0 (1.6) | 5.3 (1.9) | 1.970 | 0.125 |
| Duplex | 4.9 (1.4) | 4.1 (1.4) | 4.8 (1.3) | 5.1 (1.6) | 2.056 | 0.113 |
| Townhouse | 4.3 (1.0) | 3.2 (1.5) | 3.5 (1.2) | 4.0 (1.4) | 2.920 | 0.039 |
| 2-st apt. | 3.9 (1.2) | 2.6 (1.1) | 2.7 (1.3) | 3.2 (1.3) | 5.097 | 0.003 |
| 3-st apt. | 4.5 (1.2) | 3.1 (1.4) | 3.0 (1.4) | 2.9 (1.5) | 5.877 | 0.001 |
| 4-st apt. | 3.1 (1.5) | 2.2 (1.2) | 2.2 (1.5) | 2.1 (1.2) | 2.596 | 0.058 |

Note: All group Ns = 21

**TABLE 4-12**

**EFFECTS OF INCOME ON MEAN SATISFACTION RATINGS - ALL SITES**

| Slides | Low Income | Medium Income | High Income | F stat | Sign F |
|---|---|---|---|---|---|
| Sf det house | 5.5 (1.4) | 5.6 (1.4) | 5.3 (1.3) | 0.972 | 0.383 |
| Duplex | 4.9 (1.3) | 5.1 (1.4) | 5.0 (1.1) | 0.185 | 0.832 |
| Townhouse | 4.2 (1.5) | 4.2 (1.1) | 3.8 (1.3) | 0.690 | 0.505 |
| 2-story apt. | 3.7 (1.6) | 3.0 (1.2) | 2.8 (1.1) | 3.167 | 0.047 |

| | | | | | |
|---|---|---|---|---|---|
| 3-story apt. | 3.9 (1.5) | 3.4 (1.6) | 3.5 (1.3) | 0.814 | 0.447 |
| 4-story apt. | 3.0 (1.9) | 2.2 (1.2) | 2.1 (1.1) | 2.921 | 0.060 |

Note: Low Income: <$30,000, N = 21
Medium Income: $30,000 - 49,999, N = 35
High Income: $50,000 +, N = 28

**TABLE 4-13**

**EFFECTS OF INCOME ON MEAN SATISFACTION RATINGS BY LOCATION**

A. TRANSIT-BASED SITES

| Slides | Low Income | Medium Income | High Income | F stat | Sign F |
|---|---|---|---|---|---|
| Sf detached | 6.2 (1.4) | 6.2 (1.4) | 6.2 (1.2) | 0.176 | 0.839 |
| Duplex | 5.2 (1.5) | 5.2 (1.7) | 5.5 (1.3) | 0.204 | 0.816 |

| | | | | | |
|---|---|---|---|---|---|
| Townhouse | 4.7 (1.8) | 4.4 (1.3) | 4.2 (1.3) | 0.727 | 0.487 |
| 2-story apt. | 3.9 (1.8) | 3.0 (1.2) | 2.8 (1.1) | 4.059 | 0.021 |
| 3-story apt. | 4.3 (1.8) | 3.5 (1.8) | 3.6 (1.5) | 1.548 | 0.219 |
| 4-story apt. | 3.2 (2.3) | 2.2 (1.2) | 2.1 (1.1) | 3.911 | 0.024 |

B. FREEWAY-BASED SITES

| Slides | Low Income | Medium Income | High Income | F stat | Sign F |
|---|---|---|---|---|---|
| Sf detached | 4.9 (1.8) | 5.0 (1.8) | 4.4 (1.8) | 1.003 | 0.371 |
| Duplex | 4.6 (1.6) | 4.9 (1.5) | 4.6 (1.4) | 0.480 | 0.621 |
| Townhouse | 3.8 (1.5) | 3.9 (1.2) | 3.5 (1.4) | 0.438 | 0.647 |
| 2-story apt. | 3.5 (1.6) | 3.2 (1.3) | 2.7 (1.1) | 2.060 | 0.134 |
| 3-story apt. | 3.5 (1.5) | 3.3 (1.6) | 3.4 (1.3) | 0.076 | 0.927 |
| 4-story apt. | 2.8 (1.7) | 2.3 (1.2) | 2.1 (1.2) | 1.590 | 0.210 |

Note: Low Income: <$30,000, N = 21
Medium Income: $30,000 - 49,999, N = 35
High Income: $50,000 +, N = 28

**TABLE 4-14**

**EFFECTS OF CHILDREN ON MEAN SATISFACTION RATINGS - ALL SITES**

| | Children In Household (N=27) | No Children In Household (N=55) |
|---|---|---|
| Single-family detached | 5.4 (1.3) | 5.5 (1.4) |
| Duplex | 4.7 (1.2) | 5.1 (1.3) |

| | | |
|---|---|---|
| Townhouse | 4.0 (1.5) | 4.1 (1.2) |
| Two-story apartment | 3.1 (1.4) | 3.1 (1.3) |
| Three-story apartment | 3.6 (1.5) | 3.5 (1.5) |
| Four-story apartment | 2.6 (1.6) | 2.3 (1.3) |

**TABLE 4-15**

**EFFECTS OF CHILDREN ON SATISFACTION RATINGS BY LOCATION**

A. TRANSIT-BASED SITES

| | Children In Household (N=27) | No Children In Household (N=55) |
|---|---|---|

| | | |
|---|---|---|
| Single-family detached | 6.4 (1.3) | 6.1 (1.3) |
| Duplex | 5.0 (1.3) | 5.5 (1.6) |
| Townhouse | 4.4 (1.7) | 4.4 (1.4) |
| Two-story apartment | 3.3 (1.5) | 3.1 (1.4) |
| Three-story apartment | 4.1 (1.8) | 3.5 (1.7) |
| Four-story apartment | 2.8 (1.9) | 2.3 (1.3) |

B. FREEWAY-BASED SITES

| | Children In Household (N=27) | No Children In Household (N=55) |
|---|---|---|
| Single-family detached | 4.4 (2.0) | 4.9 (1.7) |
| Duplex | 4.4 (1.5) | 4.8 (1.4) |
| Townhouse | 3.6 (1.4) | 3.8 (1.3) |
| Two-story apartment | 3.0 (1.4) | 3.2 (1.3) |
| Three-story apartment | 3.2 (1.5) | 3.5 (1.5) |
| Four-story apartment | 2.5 (1.6) | 2.3 (1.3) |

**TABLE 4-16**

**EFFECTS OF CHILDREN ON MEAN SATISFACTION RATINGS, FOR RESPONDENTS AGED 21 - 51, ALL SITES**

| Children in Household (N=24) | No Children in Household (N=24) |
|---|---|

| | | |
|---|---|---|
| Single-family detached | 5.3 (1.4) | 5.4 (1.2) |
| Duplex | 4.6 (1.3) | 5.0 (1.3) |
| Townhouse | 3.9 (1.4) | 4.2 (1.4) |
| Two-story apartment | 2.8 (1.0) | 3.5 (1.4) * |
| Three-story apartment | 3.4 (1.4) | 4.3 (1.2) * |
| Four-story apartment | 2.5 (1.4) | 2.8 (1.4) |

* $p<.05$

**TABLE 4-17**

**EFFECTS OF CHILDREN ON MEAN SATISFACTION RATINGS BY LOCATION, FOR RESPONDENTS AGED 21 - 51**

A. TRANSIT-BASED SITES

| | Children in Household (N=24) | No Children in Household (N=24) |
|---|---|---|
| Single-family detached | 6.3 (1.3) | 6.3 (1.2) |
| Duplex | 5.0 (1.4) | 5.4 (1.7) |
| Townhouse | 4.3 (1.6) | 4.6 (1.5) |
| Two-story apartment | 3.0 (1.1) | 3.6 (1.5) |
| Three-story apartment | 3.8 (1.8) | 4.4 (1.5) |
| Four-story apartment | 2.6 (1.5) | 2.8 (1.5) |

B. FREEWAY-BASED SITES

| | Children in Household (N=24) | No Children in Household (N=24) |
|---|---|---|
| Single-family detached | 4.3 (2.0) | 4.5 (1.4) |
| Duplex | 4.3 (1.5) | 4.6 (1.4) |
| Townhouse | 3.4 (1.4) | 3.8 (1.4) |
| Two-story apartment | 2.6 (1.1) | 3.5 (1.4) * |
| Three-story apartment | 3.0 (1.4) | 4.3 (1.2) ** |
| Four-story apartment | 2.4 (1.5) | 2.8 (1.5) |

* $p<.05$
** $p<.01$

**TABLE 4-18**

**EFFECTS OF GENDER ON MEAN SATISFACTION RATINGS -**

**ALL SITES**

| Slides | Male (N=47) | Female (N=37) |
|---|---|---|
| Sf detached | 5.7 (1.4) | 5.2 (1.2) |
| Duplex | 5.1 (1.3) | 4.8 (1.3) |
| Townhouse | 4.2 (1.5) | 3.9 (1.0) |
| Two-story apartment | 3.3 (1.3) | 2.9 (1.2) |
| Three-story apartment | 3.5 (1.5) | 3.6 (1.5) |
| Four-story apartment | 2.4 (1.3) | 2.4 (1.5) |

**TABLE 4-19**

**EFFECTS OF GENDER ON MEAN SATISFACTION RATINGS BY LOCATION**

A. TRANSIT-BASED SITES

| Slides | Male (N=47) | Female (N=37) |
|---|---|---|
| Sf detached | 6.3 (1.4) | 6.0 (1.2) |
| Duplex | 5.5 (1.3) | 5.1 (1.7) |
| Townhouse | 4.5 (1.7) | 4.3 (1.1) |
| Two-story apartment | 3.3 (1.4) | 2.9 (1.4) |
| Three-story apartment | 3.6 (1.6) | 3.9 (1.9) |
| Four-story apartment | 2.5 (1.5) | 2.4 (1.7) |

B. FREEWAY-BASED SITES

| Slides | Male (N=47) | Female (N=37) |
|---|---|---|
| Sf detached | 5.0 (1.8) | 4.4 (1.8) |
| Duplex | 4.8 (1.4) | 4.6 (1.5) |
| Townhouse | 3.9 (1.4) | 3.5 (1.2) |
| Two-story apartment | 3.3 (1.4) | 2.9 (1.3) |
| Three-story apartment | 3.3 (1.5) | 3.4 (1.5) |
| Four-story apartment | 2.4 (1.3) | 2.4 (1.5) |

**TABLE 4-20**

**EFFECTS OF TENURE ON MEAN SATISFACTION RATINGS - ALL SITES**

| | Owners (N=68) | Renters (N=16) |
|---|---|---|
| Single-family detached | 5.4 (1.3) | 5.8 (1.5) |
| Duplex | 5.0 (1.3) | 5.1 (1.4) |
| Townhouse | 4.0 (1.1) | 4.4 (1.8) |
| Two-story apartment | 3.0 (1.1) | 3.7 (1.8) |
| Three-story apartment | 3.4 (1.4) | 4.0 (1.7) |
| Four-story apartment | 2.2 (1.2) | 3.1 (2.0) * |

* $p<.05$

**TABLE 4-21**

**EFFECTS OF TENURE ON MEAN SATISFACTION RATING BY LOCATION**

A. TRANSIT-BASED SITES

| | Owners (N=68) | Renters (N=16) |
|---|---|---|
| Single-family detached | 6.1 (1.3) | 6.4 (1.5) |
| Duplex | 5.3 (1.5) | 5.3 (1.5) |
| Townhouse | 4.3 (1.3) | 4.8 (2.1) |
| Two-story apartment | 3.0 (1.2) | 3.8 (2.1) * |
| Three-story apartment | 3.5 (1.6) | 4.5 (2.1) * |
| Four-story apartment | 2.2 (1.1) | 3.4 (2.5) ** |

* p<.05
** p<.01

B. FREEWAY-BASED SITES

| | Owners (N=68) | Renters (N=16) |
|---|---|---|
| Single-family detached | 4.6 (1.7) | 5.3 (1.9) |
| Duplex | 4.7 (1.5) | 4.8 (1.4) |
| Townhouse | 3.7 (1.3) | 3.9 (1.6) |
| Two-story apartment | 3.0 (1.2) | 3.5 (1.6) |
| Three-story apartment | 3.4 (1.5) | 3.4 (1.4) |

| | | |
|---|---|---|
| Four-story apartment | 2.3 (1.3) | 2.8 (1.6) |

**TABLE 4-22**

**"MOST-LIKED" SLIDES - OVERALL AND BY SITE**

| | Total | Transit Sites | Freeway Sites |
|---|---|---|---|
| Single-family detached | 186 (59%) | 111 (69%) | 75 (47%) |
| Duplex | 87 (27%) | 35 (22%) | 52 (33%) |
| Townhouse | 4 ( 1%) | 2 ( 1%) | 2 ( 1%) |
| Two-story apartment | 6 ( 2%) | 1 ( 1%) | 5 ( 3%) |
| Three-story apartment | 27 ( 8%) | 9 ( 6%) | 18 (11%) |
| Four-story apartment | 11 ( 3%) | 4 ( 2%) | 7 ( 4%) |
| Total | 321 (100%) | 162 (100%) | 159 (100%) |
| (No answer) | (15) | (6) | (9) |

**TABLE 4-23**

**"LEAST-LIKED" SLIDES - OVERALL AND BY SITE**

| | Total | Transit Sites | Freeway Sites |
|---|---|---|---|
| Single-family detached | 23 ( 8%) | 6 ( 4%) | 17 (11%) |
| Duplex | 3 ( 1%) | 2 ( 1%) | 1 ( 1%) |
| Townhouse | 14 ( 5%) | 7 ( 5%) | 7 ( 5%) |
| Two-story apartment | 38 (12%) | 23 (15%) | 15 (10%) |
| Three-story apartment | 4 ( 1%) | 1 ( 1%) | 3 ( 2%) |
| Four-story apartment | 224 (73%) | 114 (75%) | 110 (72%) |
| Total | 306 (100%) | 153 (100%) | 153 (100%) |
| (No answer) | (30) | (15) | (15) |

**TABLE 4-24**

**"MOST-LIKED" SLIDES BY AGE**

A. ALL SITES

| | Youngest | Young-Medium | Old-Medium | Old |
|---|---|---|---|---|
| Single-family detached | 40 (49%) | 53 (64%) | 47 (59%) | 46 (60%) |
| Duplex | 23 (28%) | 16 (19%) | 25 (32%) | 23 (30%) |
| Townhouse | 1 ( 1%) | 2 ( 2%) | 1 ( 1%) | 0 ( 0%) |
| Two-story apartment | 3 ( 4%) | 2 ( 2%) | 1 ( 1%) | 0 ( 0%) |
| Three-story apartment | 10 (12%) | 8 (10%) | 4 ( 5%) | 5 ( 6%) |
| Four-story apartment | 5 ( 6%) | 2 ( 2%) | 1 ( 1%) | 3 ( 4%) |
| Total | 82 (100%) | 83 (100%) | 79 (100%) | 77(100%) |

B. TRANSIT-BASED SITES

| | Youngest | Young-Medium | Old-Medium | Old |
|---|---|---|---|---|
| Single-family detached | 25 (61%) | 35 (85%) | 26 (65%) | 25 (63%) |
| Duplex | 10 (24%) | 2 ( 5%) | 11 (28%) | 12 (30%) |
| Townhouse | 0 ( 0%) | 2 ( 5%) | 0 ( 0%) | 0 ( 0%) |
| Two-story apartment | 1 ( 2%) | 0 ( 0%) | 0 ( 0%) | 0 ( 0%) |
| Three-story apartment | 3 ( 7%) | 2 ( 5%) | 2 ( 5%) | 2 ( 5%) |
| Four-story apartment | 2 ( 5%) | 0 ( 0%) | 1 ( 3%) | 1 ( 3%) |
| Total | 41 (100%) | 41 (100%) | 40 (100%) | 40 (100%) |

C. FREEWAY-BASED SITES

| | Youngest | Young-Medium | Old-Medium | Old |
|---|---|---|---|---|
| Single-family detached | 15 (37%) | 18 (43%) | 21 (54%) | 21 (57%) |
| Duplex | 13 (32%) | 14 (33%) | 14 (36%) | 11 (30%) |
| Townhouse | 1 ( 2%) | 0 ( 0%) | 1 ( 3%) | 0 ( 0%) |
| Two-story apartment | 2 ( 5%) | 2 ( 5%) | 1 ( 3%) | 0 ( 0%) |
| Three-story apartment | 7 (17%) | 6 (14%) | 2 ( 5%) | 3 ( 8%) |
| Four-story apartment | 3 ( 7%) | 2 ( 5%) | 0 ( 0%) | 2 ( 5%) |
| Total | 41 (100%) | 42 (100%) | 39 (100%) | 37 (100%) |

## TABLE 4-25

## "LEAST-LIKED" SLIDES BY AGE

A. ALL SITES

| | Youngest | Young-Medium | Old-Medium | Old |
|---|---|---|---|---|
| Single-family detached | 10 (13%) | 7 ( 8%) | 3 ( 4%) | 3 ( 4%) |
| Duplex | 2 ( 3%) | 1 ( 1%) | 0 ( 0%) | 0 ( 0%) |
| Townhouse | 9 (12%) | 3 ( 4%) | 0 ( 0%) | 2 ( 3%) |
| Two-story apartment | 11 (14%) | 14 (17%) | 8 (12%) | 5 ( 6%) |
| Three-story apartment | 0 ( 0%) | 2 ( 2%) | 0 ( 0%) | 2 ( 3%) |
| Four-story apartment | 44 (58%) | 57 (68%) | 57 (84%) | 66 (85%) |
| Total | 76 (100%) | 84 (100%) | 68 (100%) | 78 (100%) |

B. TRANSIT-BASED SITES

| | Youngest | Young-Medium | Old-Medium | Old |
|---|---|---|---|---|
| Single-family detached | 8 ( 8%) | 1 ( 2%) | 1 ( 3%) | 1 ( 3%) |
| Duplex | 1 ( 3%) | 1 ( 2%) | 0 ( 0%) | 0 ( 0%) |
| Townhouse | 4 (11%) | 2 ( 5%) | 0 ( 0%) | 1 ( 3%) |
| Two-story apartment | 5 (13%) | 10 (24%) | 5 (15%) | 3 ( 8%) |
| Three-story apartment | 0 ( 0%) | 0 ( 0%) | 0 ( 0%) | 1 ( 3%) |
| Four-story apartment | 25 (66%) | 28 (67%) | 28 (82%) | 33 (85%) |
| Total | 38 (100%) | 42 (100%) | 34 (100%) | 39 (100%) |

C. FREEWAY-BASED SITES

| | Youngest | Young-Medium | Old-Medium | Old |
|---|---|---|---|---|
| Single-family detached | 7 (18%) | 6 (14%) | 2 ( 6%) | 2 ( 5%) |
| Duplex | 1 ( 3%) | 0 ( 0%) | 0 ( 0%) | 0 ( 0%) |
| Townhouse | 5 (13%) | 1 ( 2%) | 0 ( 0%) | 1 ( 3%) |
| Two-story apartment | 6 (16%) | 4 (10%) | 3 ( 9%) | 2 ( 5%) |
| Three-story apartment | 0 ( 0%) | 2 ( 5%) | 0 ( 0%) | 1 ( 3%) |
| Four-story apartment | 19 (50%) | 29 (69%) | 29 (85%) | 33 (85%) |
| Total | 38 (100%) | 42 (100%) | 34 (100%) | 39 (100%) |

## TABLE 4-26

## "MOST-LIKED" SLIDES BY INCOME

A. ALL SITES

| | Low | Medium | High |
|---|---|---|---|
| Single-family detached | 50 (61%) | 80 (60%) | 56 (53%) |
| Duplex | 11 (13%) | 39 (29%) | 37 (35%) |
| Townhouse | 3 ( 4%) | 0 ( 0%) | 1 ( 1%) |
| Two-story apartment | 2 ( 2%) | 4 ( 3%) | 0 ( 0%) |
| Three-story apartment | 7 ( 9%) | 10 ( 8%) | 10 ( 9%) |
| Four-story apartment | 9 (11%) | 0 ( 0%) | 2 ( 2%) |
| Total | 82 (100%) | 133 (100%) | 106 (100%) |

B. TRANSIT-BASED SITES

| | Low | Medium | High |
|---|---|---|---|
| Single-family detached | 27 (66%) | 49 (72%) | 35 (66%) |
| Duplex | 5 (12%) | 17 (25%) | 13 (25%) |
| Townhouse | 2 ( 5%) | 0 ( 0%) | 0 ( 0%) |
| Two-story apartment | 1 ( 2%) | 0 ( 0%) | 0 ( 0%) |
| Three-story apartment | 2 ( 5%) | 2 ( 3%) | 5 ( 9%) |
| Four-story apartment | 4 (10%) | 0 ( 0%) | 0 ( 0%) |
| Total | 41 (100%) | 68 (100%) | 53 (100%) |

C.FREEWAY-BASED SITES

| | Low | Medium | High |
|---|---|---|---|
| Single-family detached | 23 (56%) | 31 (48%) | 21 (40%) |
| Duplex | 6 (15%) | 22 (34%) | 24 (45%) |
| Townhouse | 1 ( 2%) | 0 ( 0%) | 1 ( 2%) |
| Two-story apartment | 1 ( 2%) | 4 ( 6%) | 0 ( 0%) |
| Three-story apartment | 5 (12%) | 8 (12%) | 5 ( 9%) |
| Four-story apartment | 5 (12%) | 0 ( 0%) | 2 ( 4%) |
| Total | 41 (100%) | 65 (100%) | 53 (100%) |

Note: Low Inc: <$30,000; Medium Inc: $30,000-49,999; High Inc: $50,000+

**TABLE 4-27**

**"LEAST-LIKED" SLIDES BY INCOME**

A. ALL SITES

| | Low | Medium | High |
|---|---|---|---|
| Single-family detached | 10 (13%) | 6 ( 5%) | 7 ( 7%) |
| Duplex | 1 ( 1%) | 1 ( 1%) | 1 ( 1%) |
| Townhouse | 9 (11%) | 3 ( 2%) | 2 ( 2%) |
| Two-story apartment | 6 ( 8%) | 20 (16%) | 12 (12%) |

| | | | |
|---|---|---|---|
| Three-story apartment | 0 ( 0%) | 4 ( 3%) | 0 ( 0%) |
| Four-story apartment | 53 (67%) | 92 (73%) | 79 (78%) |
| Total | 79 (100%) | 126 (100%) | 101 (100%) |

B. TRANSIT-BASED SITES

| | Low | Medium | High |
|---|---|---|---|
| Single-family detached | 3 ( 8%) | 2 ( 3%) | 1 ( 2%) |
| Duplex | 1 ( 3%) | 0 ( 0%) | 1 ( 2%) |
| Townhouse | 4 (10%) | 1 ( 2%) | 2 ( 4%) |
| Two-story apartment | 4 (10%) | 12 (19%) | 7 (14%) |
| Three-story apartment | 0 ( 0%) | 1 ( 2%) | 0 ( 0%) |
| Four-story apartment | 27 (69%) | 48 (75%) | 39 (78%) |
| Total | 39 (100%) | 64 (100%) | 50 (100%) |

C. FREEWAY-BASED SITES

| | Low | Medium | High |
|---|---|---|---|
| Single-family detached | 7 (18%) | 4 ( 6%) | 6 (12%) |
| Duplex | 0 ( 0%) | 1 ( 2%) | 0 ( 0%) |
| Townhouse | 5 (13%) | 2 ( 3%) | 0 ( 0%) |
| Two-story apartment | 2 ( 5%) | 8 (13%) | 5 (10%) |
| Three-story apartment | 0 ( 0%) | 3 ( 5%) | 0 ( 0%) |
| Four-story apartment | 26 (65%) | 44 (71%) | 40 (78%) |
| Total | 40 (100%) | 62 (100%) | 51 (100%) |

Note: Low Inc: <$30,000; Medium Inc: $30,000-49,999; High Inc: $50,000+

**TABLE 4-28**

**"MOST-LIKED" SLIDES BY PRESENCE/ABSENCE OF CHILDREN, FOR RESPONDENTS AGED 21 - 51**

A. ALL SITES

| | Children | No Children |
|---|---|---|
| Single-family detached | 65 (68%) | 48 (51%) |
| Duplex | 14 (15%) | 27 (28%) |
| Townhouse | 2 ( 2%) | 2 ( 2%) |
| Two-story apartment | 2 ( 2%) | 3 ( 3%) |
| Three-story apartment | 8 ( 8%) | 13 (14%) |
| Four-story apartment | 4 ( 4%) | 2 ( 2%) |
| Total | 95 (100%) | 95 (100%) |

B. TRANSIT-BASED SITES

| | Children | No Children |
|---|---|---|
| Single-family detached | 40 (82%) | 30 (63%) |
| Duplex | 2 ( 4%) | 14 (29%) |
| Townhouse | 2 ( 4%) | 0 ( 0%) |
| Two-story apartment | 0 ( 0%) | 1 ( 2%) |
| Three-story apartment | 3 ( 6%) | 3 ( 6%) |
| Four-story apartment | 2 ( 4%) | 0 ( 0%) |
| Total | 49 (100%) | 48 (100%) |

C. FREEWAY-BASED SITES

| | Children | No Children |
|---|---|---|
| Single-family detached | 26 (53%) | 17 (35%) |
| Duplex | 12 (24%) | 17 (35%) |
| Townhouse | 1 ( 2%) | 1 ( 2%) |
| Two-story apartment | 2 ( 4%) | 2 ( 4%) |
| Three-story apartment | 5 (10%) | 10 (21%) |
| Four-story apartment | 3 ( 6%) | 1 ( 2%) |
| Total | 49 (100%) | 48 (100%) |

**TABLE 4-29**

**"LEAST-LIKED" SLIDES BY PRESENCE/ABSENCE OF CHILDREN, FOR RESPONDENTS AGED 21 - 51**

A. ALL SITES

| | Children | No Children |
|---|---|---|
| Single-family detached | 7 ( 7%) | 10 (12%) |
| Duplex | 1 ( 1%) | 1 ( 1%) |
| Townhouse | 4 ( 4%) | 8 ( 9%) |
| Two-story apartment | 24 (25%) | 7 ( 8%) |
| Three-story apartment | 2 ( 2%) | 0 ( 0%) |
| Four-story apartment | 58 (60%) | 59 (69%) |
| Total | 96 (100%) | 85 (100%) |

B. TRANSIT-BASED SITES

| | Children | No Children |
|---|---|---|

| | | |
|---|---|---|
| Single-family detached | 2 ( 4%) | 2 ( 5%) |
| Duplex | 1 ( 2%) | 0 ( 0%) |
| Townhouse | 2 ( 4%) | 4 ( 9%) |
| Two-story apartment | 15 (31%) | 5 (11%) |
| Three-story apartment | 0 ( 0%) | 0 ( 0%) |
| Four-story apartment | 28 (58%) | 33 (75%) |
| Total | 48 (100%) | 44 (100%) |

C. FREEWAY-BASED SITES

| | Children | No Children |
|---|---|---|
| Single-family detached | 5 (10%) | 6 (14%) |
| Duplex | 0 ( 0%) | 1 ( 2%) |
| Townhouse | 2 ( 2%) | 4 (10%) |
| Two-story apartment | 9 (18%) | 5 (12%) |
| Three-story apartment | 2 ( 2%) | 0 ( 0%) |
| Four-story apartment | 31 (63%) | 26 (62%) |
| Total | 49 (100%) | 42 (100%) |

**TABLE 4-30**

**WILLINGNESS TO PAY**
**for "most-liked" choice located next to:**

| | Transit Site | Freeway Site | Total |
|---|---|---|---|
| $450 or less | 5 ( 3%) | 20 (12%) | 25 ( 8%) |
| $451 - 650 | 27 (17%) | 36 (22%) | 63 (20%) |
| $651 - 800 | 35 (22%) | 37 (23%) | 72 (22%) |
| $801 - 900 | 34 (21%) | 26 (16%) | 60 (19%) |
| $901 - 1000 | 26 (16%) | 16 (10%) | 42 (13%) |
| $1001 - 1200 | 21 (13%) | 17 (11%) | 38 (12%) |
| $1201 - 1450 | 10 ( 6%) | 7 ( 4%) | 17 ( 5%) |
| $1451 or more | 2 ( 1%) | 2 ( 1%) | 4 ( 1%) |
| Total | 160 (100%) | 161 (100%) | 321 (100%) |

**TABLE 4-31**

**WILLINGNESS TO PAY BY PROXIMITY**

| | 1/4 - 1/2 Mile | 1/2 - 3/4 Mile | 3/4 - 1 Mile | Total |
|---|---|---|---|---|
| $650 or less | 4 (17%) | 7 (20%) | 10 (59%) | 21 (28%) |
| $651 - 900 | 5 (21%) | 19 (54%) | 6 (35%) | 30 (39%) |
| $901 or more | 15 (63%) | 9 (26%) | 1 ( 6%) | 25 (33%) |
| Total | 24 (100%) | 35 (100%) | 17 (100%) | 76 (100%) |

Kendall's tau-b = 0.42

Standardized z-score = 4.09, $p<.01$

**TABLE 4-32**

**WILLINGNESS TO PAY BY PROXIMITY TO TRANSIT**

| | 1/4 - 1/2 Mile | 1/2 - 3/4 Mile | 3/4 - 1 Mile | Total |
|---|---|---|---|---|
| $650 or less | 1 ( 8%) | 2 (11%) | 5 (63%) | 8 (21%) |
| $651 - 900 | 3 (25%) | 12 (63%) | 2 (25%) | 17 (44%) |
| $901 or more | 8 (67%) | 5 (26%) | 1 (13%) | 14 (36%) |
| Total | 12 (100%) | 19 (100%) | 8 (100%) | 39 (100%) |

Kendall's tau-b = 0.47

Standardized z-score = 3.24, $p<.01$

**WILLINGNESS TO PAY BY PROXIMITY TO FREEWAY**

| | 1/4 - 1/2 Mile | 1/2 - 3/4 Mile | 3/4 - 1 Mile | Total |
|---|---|---|---|---|
| $650 or less | 3 (25%) | 5 (31%) | 5 (56%) | 13 (35%) |
| $651 - 900 | 2 (17%) | 7 (44%) | 4 (44%) | 13 (35%) |
| $901 or more | 7 (58%) | 4 (25%) | 0 ( 0%) | 11 (30%) |
| Total | 12 (100%) | 16 (100%) | 9 (100%) | 37 (100%) |

Kendall's tau-b = 0.37

Standardized z-score = 2.47, $p<.01$

**TABLE 4-33**

**WILLINGNESS TO PAY BY INCOME - ALL SITES**

| | Low | Medium | High | Total |
|---|---|---|---|---|
| $450 or less | 7 ( 9%) | 11 ( 8%) | 7 ( 6%) | 25 ( 8%) |
| $451 - 650 | 30 (38%) | 21 (16%) | 12 (11%) | 63 (20%) |
| $651 - 800 | 17 (22%) | 35 (27%) | 20 (18%) | 72 (22%) |
| $801 - 900 | 9 (11%) | 28 (21%) | 23 (21%) | 60 (19%) |
| $901 - 1000 | 11 (14%) | 17 (13%) | 14 (13%) | 42 (13%) |
| $1001 - 1200 | 5 ( 6%) | 14 (11%) | 19 (17%) | 38 (12%) |

| | | | | |
|---|---|---|---|---|
| $1201 - 1450 | 0 ( 0%) | 5 ( 4%) | 12 (11%) | 17 ( 5%) |
| $1451 or more | 0 ( 0%) | 1 ( 1%) | 3 ( 3%) | 4 ( 1%) |
| Total | 79 (100%) | 132 (100%) | 110 (100%) | 321 (100%) |

Somer's d = 0.27

Standardized z-score = 5.14, p<.01

**TABLE 4-34**
**WILLINGNESS TO PAY BY INCOME - TRANSIT SITES**

| | Low | Medium | High | Total |
|---|---|---|---|---|
| $450 or less | 2 ( 5%) | 2 ( 3%) | 1 ( 2%) | 5 ( 3%) |
| $451 - 650 | 13 (33%) | 10 (15%) | 4 ( 7%) | 27 (17%) |
| $651 - 800 | 9 (23%) | 17 (25%) | 9 (17%) | 35 (22%) |
| $801 - 900 | 5 (13%) | 17 (25%) | 12 (22%) | 34 (21%) |
| $901 - 1000 | 7 (18%) | 10 (15%) | 9 (17%) | 26 (16%) |
| $1001 - 1200 | 3 ( 8%) | 8 (12%) | 10 (19%) | 21 (13%) |
| $1201 - 1450 | 0 ( 0%) | 3 ( 4%) | 7 (13%) | 10 ( 6%) |

| | | | | |
|---|---|---|---|---|
| $1451 or more | 0 ( 0%) | 0 ( 0%) | 2 ( 4%) | 2 ( 1%) |
| Total | 39 (100%) | 67 (100%) | 54 (100%) | 160 (100%) |

Somer's d = 0.31; standardized z-score = 4.18, p<.01

**WILLINGNESS TO PAY BY INCOME - FREEWAY SITES**

| | Low | Medium | High | Total |
|---|---|---|---|---|
| $450 or less | 5 (13%) | 9 (14%) | 6 (11%) | 20 (12%) |
| $451 - 650 | 17 (43%) | 11 (17%) | 8 (14%) | 36 (22%) |
| $651 - 800 | 8 (20%) | 18 (28%) | 11 (20%) | 37 (23%) |
| $801 - 900 | 4 (10%) | 11 (17%) | 11 (20%) | 26 (16%) |
| $901 - 1000 | 4 (10%) | 7 (11%) | 5 ( 9%) | 16 (10%) |
| $1001 - 1200 | 2 ( 5%) | 6 ( 9%) | 9 (16%) | 17 (11%) |
| $1201 - 1450 | 0 ( 0%) | 2 ( 3%) | 5 ( 9%) | 7 ( 4%) |
| $1451 or more | 0 ( 0%) | 1 ( 2%) | 1 ( 2%) | 2 ( 1%) |
| Total | 40 (100%) | 65 (100%) | 56 (100%) | 161 (100%) |

Somer's d = 0.24; standardized z-score = 3.19, p<.01

**TABLE 4-35**

**WILLINGNESS TO PAY BY AGE - ALL SITES**

| | Young | Medium | Old | Total |
|---|---|---|---|---|
| $650 or less | 27 (32%) | 32 (20%) | 29 (39%) | 88 (27%) |
| $651 - 900 | 31 (37%) | 69 (43%) | 32 (43%) | 132 (41%) |
| $901 - 1200 | 18 (21%) | 51 (31%) | 11 (15%) | 80 (25%) |
| $1201 or more | 8 (10%) | 10 ( 6%) | 3 ( 4%) | 21 ( 7%) |
| Total | 84 (100%) | 162 (100%) | 75 (100%) | 321 (100%) |

Chi-square = 16.35, df = 6, $p<.05$

**TABLE 4-36**

**WILLINGNESS TO PAY BY AGE - TRANSIT SITES**

| | Young | Medium | Old | Total |
|---|---|---|---|---|
| $650 or less | 11 (26%) | 8 (10%) | 13 (34%) | 32 (20%) |
| $651 - 900 | 17 (40%) | 35 (44%) | 17 (45%) | 69 (43%) |
| $901 - 1200 | 10 (24%) | 31 (39%) | 6 (16%) | 47 (29%) |
| $1201 or more | 4 (10%) | 6 ( 8%) | 2 ( 5%) | 12 ( 8%) |

| | | | | |
|---|---|---|---|---|
| Total | 42 (100%) | 80 (100%) | 38 (100%) | 160 (100%) |

Chi-square = 14.45, df = 6, p<.05

**WILLINGNESS TO PAY BY AGE - FREEWAY SITES**

| | Young | Medium | Old | Total |
|---|---|---|---|---|
| $650 or less | 16 (38%) | 24 (29%) | 16 (43%) | 56 (35%) |
| $651 - 900 | 14 (33%) | 34 (41%) | 15 (41%) | 63 (39%) |
| $901 - 1200 | 8 (19%) | 20 (24%) | 5 (14%) | 33 (20%) |
| $1201 or more | 4 (10%) | 4 ( 5%) | 1 ( 3%) | 9 ( 6%) |
| Total | 42 (100%) | 82 (100%) | 37 (100%) | 161 (100%) |

Chi-square = 5.52, df = 6, NS

**TABLE 4-37**

**WILLINGNESS TO PAY BY PRESENCE/ABSENCE OF CHILDREN - ALL SITES**

| | Children | No Children | Total |
|---|---|---|---|
| $450 or less | 6 ( 6%) | 19 ( 9%) | 25 ( 8%) |

| | | | |
|---|---|---|---|
| $451 - 650 | 12 (11%) | 51 (25%) | 63 (20%) |
| $651 - 800 | 23 (22%) | 46 (22%) | 69 (22%) |
| $801 - 900 | 15 (14%) | 43 (21%) | 58 (19%) |
| $901 or more | 49 (47%) | 49 (24%) | 98 (31%) |
| Total | 105 (100%) | 208 (100%) | 313 (100%) |

Chi-square = 20.37, df = 4, p<.01

**TABLE 4-38**

**WILLINGNESS TO PAY BY PRESENCE/ABSENCE OF CHILDREN - TRANSIT SITES**

| | Children | No Children | Total |
|---|---|---|---|

| | | | |
|---|---|---|---|
| $650 or less | 6 (12%) | 26 (25%) | 32 (20%) |
| $651 - 800 | 10 (19%) | 24 (23%) | 34 (22%) |
| $801 - 900 | 6 (12%) | 26 (25%) | 32 (21%) |
| $901 or more | 30 (58%) | 28 (27%) | 58 (37%) |
| Total | 52 (100%) | 104 (100%) | 156 (100%) |

Chi-square = 15.31, df = 3, p<.01

**WILLINGNESS TO PAY BY PRESENCE/ABSENCE OF CHILDREN - FREEWAY SITES**

| | Children | No Children | Total |
|---|---|---|---|
| $450 or less | 5 ( 9%) | 15 (14%) | 20 (13%) |
| $451 - 650 | 7 (13%) | 29 (28%) | 36 (23%) |
| $651 - 800 | 13 (25%) | 22 (21%) | 35 (22%) |
| $801 - 900 | 9 (17%) | 17 (16%) | 26 (17%) |
| $901 or more | 19 (36%) | 21 (20%) | 40 (25%) |
| Total | 53 (100%) | 104 (100%) | 157 (100%) |

Chi-square = 7.65, df = 4, NS

**TABLE 4-39**

**DIFFERENCES IN MEANS BETWEEN PAIRS OF SLIDES, WITH COST INFORMATION**

**TOTAL SAMPLE (N=84)**

| | Duplex | | Townhouse | | 2-st apt | 3-st apt | 4-st apt |
|---|---|---|---|---|---|---|---|
| Sf det house | 0.7** | 1.0** | 1.8** | 1.3** | 2.3** | | |
| Duplex | ---- | | 0.3 | | 1.1** | 0.6* | 1.6** |
| Townhouse | | | ---- | | 0.9** | 0.4 | 1.3** |
| 2-st apt | | | | ---- | | (0.5)** | 0.5* |
| 3-st apt | | | | | | ---- | 1.0** |
| 4-st apt | | | | | | | ---- |

* p<.05
** p<.01

**TABLE 4-40**

**DIFFERENCE IN SATISFACTION SCORES WITH AND WITHOUT COST INFORMATION, ALL RESPONDENTS**

| | Mean | Std Dev | t statistic |
|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Single-family house | | -0.958 | 1.807 | 4.830 ** |
| Duplex | -1.167 | 1.784 | | 5.959 ** |
| Townhouse | | -0.321 | 1.590 | 1.839 |
| Two-story apartment | -0.337 | 1.486 | | 2.054 * |
| Three-story apartment | -0.125 | 1.456 | | 0.782 |
| Four-story apartment | 0.084 | 1.372 | | 0.554 |

* p<.05
** p<.01

**TABLE 4-41**

**DIFFERENCE IN SATISFACTION SCORES WITH AND WITHOUT COST INFORMATION, SACRAMENTO RESPONDENTS**

| | Mean | Std Dev | t statistic |
|---|---|---|---|
| Single-family house | -1.407 | 1.552 | 5.875 ** |
| Duplex | -1.372 | 1.563 | 5.689 ** |
| Townhouse | -0.628 | 1.427 | 2.852 ** |
| Two-story apartment | -0.667 | 1.360 | 3.140 ** |
| Three-story apartment | -0.453 | 1.409 | 2.084 * |
| Four-story apartment | -0.333 | 1.300 | 1.640 |

**DIFFERENCE IN SATISFACTION SCORES WITH AND WITHOUT COST INFORMATION, EAST BAY RESPONDENTS**

| | Mean | Std Dev | t statistic |
|---|---|---|---|
| Single-family house | -0.488 | 1.951 | 1.582 |
| Duplex | -0.951 | 1.987 | 3.027 ** |
| Townhouse | 0.000 | 1.703 | 0.000 |
| Two-story apartment | 0.000 | 1.549 | 0.000 |
| Three-story apartment | 0.220 | 1.441 | 0.966 |
| Four-story apartment | 0.512 | 1.325 | 2.444 * |

* $p<.05$
** $p<.01$

**TABLE 4-42**

**DIFFERENCE IN SATISFACTION SCORES WITH AND WITHOUT COST INFORMATION, FREEWAY AND TRANSIT SETTINGS**

| | | Freeway | | Transit | F value | Signif. |
|---|---|---|---|---|---|---|
| Single-family house | | -0.92 | | -0.99 | 0.03 | 0.86 |
| Duplex | -0.65 | | -1.57 | 5.90 | 0.02 | |
| Townhouse | | 0.01 | | -0.59 | 3.01 | 0.09 |
| Two-story apartment | -0.14 | | -0.50 | 1.24 | 0.27 | |
| Three-story apartment | 0.22 | | -0.39 | 3.75 | 0.06 | |
| Four-story apartment | 0.17 | | 0.02 | 0.23 | 0.64 | |

**TABLE 4-43**

**DIFFERENCE IN SATISFACTION SCORES WITH AND WITHOUT COST INFORMATION, BY TENURE**

| | Owners<br>Mean (Std Dev) | Renters<br>Mean (Std Dev) |
|---|---|---|
| Single-family house | -0.86 (1.72) ** | -1.36 (2.24) * |
| Duplex | -1.06 (1.60) ** | -1.79 (2.49) * |
| Townhouse | -0.31 (1.60) | -0.43 (1.50) |
| Two-story apartment | -0.28 (1.49) | -0.50 (1.56) |
| Three-story apartment | -0.20 (1.52) | 0.29 (1.14) |
| Four-story apartment | -0.01 (1.39) | 0.54 (1.33) |

* $p<.05$
** $p<.01$

**TABLE 4-44**

**DIFFERENCE IN SATISFACTION SCORES WITH AND WITHOUT COST INFORMATION, BY PRESENCE/ABSENCE OF CHILDREN**

| | Children | | No Children | | F value | | Signif. |
|---|---|---|---|---|---|---|---|
| Single-family house | | -0.58 | | -1.79 | 6.12 | 0.02 | |
| Duplex | -1.08 | | -1.75 | 1.65 | 0.20 | | |
| Townhouse | | -0.10 | | -0.42 | 0.40 | 0.53 | |
| Two-story apartment | -0.25 | | -0.63 | 0.60 | 0.44 | | |
| Three-story apartment | 0.29 | | -0.38 | 2.22 | 0.14 | | |
| Four-story apartment | 0.17 | | -0.13 | 0.40 | 0.53 | | |

## TABLE A4-1

## PAIRED COMPARISONS OF SATISFACTION RATINGS, BY DWELLING TYPE

| Dwelling type | Means | t value | 2-tailed prob. |
|---|---|---|---|
| Single-family detached houses: | | | |
| 1st vs. 2nd viewing: | 5.3 vs. 5.7 | -1.44 | 0.152 |
| 1st vs. 3rd viewing: | 5.3 vs. 5.7 | -2.31 | 0.023 * |
| 1st vs. 4th viewing: | 5.3 vs. 5.4 | -0.51 | 0.608 |
| 2nd vs. 3rd viewing: | 5.7 vs. 5.7 | -0.03 | 0.972 |
| 2nd vs. 4th viewing: | 5.7 vs. 5.4 | 1.24 | 0.220 |
| 3rd vs. 4th viewing: | 5.7 vs. 5.4 | 0.93 | 0.356 |
| Duplexes: | | | |
| 1st vs. 2nd viewing: | 4.7 vs. 5.2 | -2.01 | 0.047 * |
| 1st vs. 3rd viewing: | 4.7 vs. 5.0 | -2.06 | 0.043 * |
| 1st vs. 4th viewing: | 4.7 vs. 5.2 | -2.53 | 0.013 * |
| 2nd vs. 3rd viewing: | 5.2 vs. 5.0 | 0.53 | 0.598 |
| 2nd vs. 4th viewing: | 5.2 vs. 5.2 | -0.43 | 0.669 |
| 3rd vs. 4th viewing: | 5.0 vs. 5.2 | -1.04 | 0.301 |
| Townhouses: | | | |
| 1st vs. 2nd viewing: | 4.0 vs. 4.0 | -0.14 | 0.887 |
| 1st vs. 3rd viewing: | 4.0 vs. 4.2 | -1.21 | 0.231 |
| 1st vs. 4th viewing: | 4.0 vs. 4.1 | -0.03 | 0.980 |
| 2nd vs. 3rd viewing: | 4.0 vs. 4.2 | -0.83 | 0.408 |
| 2nd vs. 4th viewing: | 4.0 vs. 4.1 | 0.07 | 0.943 |
| 3rd vs. 4th viewing: | 4.2 vs. 4.1 | 1.14 | 0.260 |
| Two-story apartments: | | | |
| 1st vs. 2nd viewing: | 3.0 vs. 3.2 | -1.34 | 0.185 |
| 1st vs. 3rd viewing: | 3.0 vs. 3.0 | 0.12 | 0.908 |
| 1st vs. 4th viewing: | 3.0 vs. 3.2 | -0.93 | 0.354 |
| 2nd vs. 3rd viewing: | 3.2 vs. 3.0 | 1.22 | 0.228 |
| 2nd vs. 4th viewing: | 3.2 vs. 3.2 | -0.04 | 0.968 |
| 3rd vs. 4th viewing: | 3.0 vs. 3.2 | -1.20 | 0.235 |

**TABLE A4-1 (CONT.)**

| Dwelling type | Means | t value | 2-tailed prob. |
|---|---|---|---|
| Three-story apartments: | | | |
| 1st vs. 2nd viewing: | 3.4 vs. 3.5 | -0.19 | 0.849 |
| 1st vs. 3rd viewing: | 3.4 vs. 3.6 | -0.77 | 0.446 |
| 1st vs. 4th viewing: | 3.4 vs. 3.6 | -1.01 | 0.314 |
| 2nd vs. 3rd viewing: | 3.5 vs. 3.6 | -0.48 | 0.632 |
| 2nd vs. 4th viewing: | 3.5 vs. 3.6 | -1.17 | 0.247 |
| 3rd vs. 4th viewing: | 3.6 vs. 3.6 | -0.52 | 0.607 |
| Four-story apartments: | | | |
| 1st vs. 2nd viewing: | 2.4 vs. 2.3 | 1.03 | 0.304 |
| 1st vs. 3rd viewing: | 2.4 vs. 2.5 | -0.94 | 0.348 |
| 1st vs. 4th viewing: | 2.4 vs. 2.4 | -0.03 | 0.979 |
| 2nd vs. 3rd viewing: | 2.3 vs. 2.5 | -1.72 | 0.089 |
| 2nd vs. 4th viewing: | 2.3 vs. 2.4 | -0.97 | 0.336 |
| 3rd vs. 4th viewing: | 2.5 vs. 2.4 | 0.76 | 0.451 |

* p<.05

**TABLE A4-2**

**SLIDE VIEWINGS BY GROUP**

First viewing of single-family detached house, disaggregated by group:

| Group No. (Location) | Setting of First Slide Block | Mean Rating | N |
|---|---|---|---|
| 1 (Sacramento) | Butterfield | 6.3 | 21 |
| 2 (Sacramento) | Bradshaw | 4.2 | 22 |
| 3 & 5 (East Bay) | Tennyson | 4.7 | 25 |
| 4 (East Bay) | Union City | 5.9 | 16 |

Overall mean (weighted): 5.3
Overall mean (weighted, minus Group 2): 5.5

First viewing of duplex, disaggregated by group:

| Group No. (Location) | Setting of First Slide Block | Mean Rating | N |
|---|---|---|---|
| 1 (Sacramento) | Butterfield | 5.1 | 21 |
| 2 (Sacramento) | Bradshaw | 3.9 | 22 |
| 3 & 5 (East Bay) | Tennyson | 4.8 | 25 |
| 4 (East Bay) | Union City | 4.9 | 16 |

Overall mean (weighted): 4.7
Overall mean (weighted, minus Group 2): 5.0

## APPENDIX 3-1

## KEY VARIABLES BY CENSUS TRACTS

| 1990 Census Data | Sacramento Census Tracts Butterfield (91.07) | Bradshaw (90.01) | Percent Diff. | East Bay Census Tracts Union City (4403.09) | Tennyson (4376) | Percent Diff. |
|---|---|---|---|---|---|---|
| Median annual household income | $45,953 | $37,087 | 124% | $43,245 | $35,208 | 123% |
| Percentage of households w/children | 39.4 | 39.0 | 101% | 45.6 | 39.3 | 116% |
| Percentage of owner-occ. units | 67.1 | 51.7 | 130% | 53.1 | 62.4 | 85% |
| Median value of owner-occ. units | $134,400 | $114,300 | 118% | $228,300 | $183,800 | 124% |
| Median rent of rental units | $639 | $571 | 112% | $698 | $590 | 118% |
| Median age | 32.2 | 29.7 | 108% | 30.0 | 33.4 | 90% |
| Average travel time to work (in minutes) | 23.3 | 20.7 | 113% | 27.5 | 29.7 | 93% |

Note: The "percent difference" column for each metropolitan area reflects the ratio of the first column divided by the second column. This provides an indicate of how well the listed variables were controlled for within each metropolitan area.

**APPENDIX 3-1 (CONTINUED)**

STANDARDIZED SCORES (Census tract value/County value)

| | Sacramento census tracts | | | East Bay census tracts | | |
|---|---|---|---|---|---|---|
| 1990 Census Data | Butterfield (91.07) | Bradshaw (90.01) | | Union City (4403.09) | Hayward (4376) | |
| Median annual household income | 1.42 | 1.15 | 1.15 | 0.94 | | |
| Percentage of households w/children | 1.16 | 1.15 | 1.35 | 1.16 | | |
| Percentage of owner-occ. units | 1.19 | 0.91 | 1.00 | 1.17 | | |
| Median value of owner-occ. units | 1.04 | 0.88 | | 1.00 | 0.81 | |
| Median rent of rental units | 1.38 | 1.24 | 1.22 | 1.04 | | |
| Median age | 1.01 | 0.93 | | 0.92 | 1.02 | |
| Average travel time to work (in minutes) | 0.97 | 0.86 | 1.07 | 1.15 | | |

Note: The standardized scores were developed by dividing the census tract values for each variable by the value of the corresponding County. This provides a relative measure of each

variable, taking into account such factors as the higher housing prices of the Bay Area.

## APPENDIX 3-2

## PRINTS OF PHOTOSIMULATED SLIDES

This Appendix consists of 34 prints made from the slides used in this study. The first 10 show the original slides of residences and settings used as input to the photosimulation process. The next 24 are the visual images the respondents saw, in print form.

Some detail is lost in converting slides to prints. In particular, important aspects of the slide such as freeway signs and transit vehicles are not easily seen in a 4 x 6 print. However, the prints do illustrate how the buildings and settings were combined in the simulation process, and provide some sense of the images seen by the respondents.

As described in the text, the simulation process permitted modification of the base slides to some degree. In particular, the driveway leading out of the Union City BART station was converted from a one-way to a two-way road, and an additional freeway sign was added to the Tennyson Road/I-880 interchange. Also, the transit vehicle in the Butterfield LRT station slides was not in the original slide, but was scanned in from another slide.

The first six prints show the original dwelling units used in the photosimulation process; the next four prints show the original settings. The final 24 prints present each dwelling-by-setting combination, with the groups shown in the following order: Butterfield, Bradshaw, Union City, Tennyson.

**SINGLE-FAMILY DETACHED HOUSE**

**DUPLEX**

**TOWNHOUSE**

**TWO-STORY APARTMENT**

**THREE-STORY APARTMENT**

**FOUR-STORY APARTMENT**

**BUTTERFIELD LRT STATION**

**BRADSHAW RD/RT 50 INTERCHANGE**

**UNION CITY BART STATION**

**TENNYSON RD/I-880 INTERCHANGE**

**SINGLE-FAMILY DETACHED HOUSE AT BUTTERFIELD**

**DUPLEX AT BUTTERFIELD**

**TOWNHOUSE AT BUTTERFIELD**

**TWO-STORY APARTMENT AT BUTTERFIELD**

**THREE-STORY APARTMENT AT BUTTERFIELD**

**FOUR-STORY APARTMENT AT BUTTERFIELD**

**SINGLE-FAMILY DETACHED HOUSE AT BRADSHAW**

**DUPLEX AT BRADSHAW**

**TOWNHOUSE AT BRADSHAW**

**TWO-STORY APARTMENT AT BRADSHAW**

**THREE-STORY APARTMENT AT BRADSHAW**

**FOUR-STORY APARTMENT AT BRADSHAW**

**SINGLE-FAMILY DETACHED HOUSE AT UNION CITY**

**DUPLEX AT UNION CITY**

**TOWNHOUSE AT UNION CITY**

**TWO-STORY APARTMENT AT UNION CITY**

**THREE-STORY APARTMENT AT UNION CITY**

**FOUR-STORY APARTMENT AT UNION CITY**

**SINGLE-FAMILY DETACHED HOUSE AT TENNYSON**

**DUPLEX AT TENNYSON**

**TOWNHOUSE AT TENNYSON**

**TWO-STORY APARTMENT AT TENNYSON**

**THREE-STORY APARTMENT AT TENNYSON**

## FOUR-STORY APARTMENT AT TENNYSON
**APPENDIX 3-3**

**TELEPHONE INVITATION RESULTS**
**BY CENSUS TRACT**

N (% of total)

| | Butterfield | Bradshaw | Tennyson | Union City |
|---|---|---|---|---|
| Calls That Reached a Person | 90.01 | 91.07 | 4376 | 4403.09 |
| 1) Successful Invitations | 39 (13.0%) | 38 (12.7%) | 38 (13.1%) | 37 (7.9%) |
| 2) Refusals: | | | | |
| a. Straight Refusals | 149 (49.7%) | 174 (58.0%) | 161 (55.7%) | 264 (56.4%) |
| b. Out-of-Towners | 11 (3.7%) | 16 (5.3%) | 10 (3.5%) | 10 (2.1%) |
| c. Transport Disadvantaged | 9 (3.0%) | 1 (0.3%) | 4 (1.4%) | 2 (0.4%) |
| (Total Refusals) | (169)(56.3%) | (191)(63.7%) | (175)(60.6%) | (276)(59.0%) |
| 3) Call Backs | 10 (3.3%) | 13 (4.3%) | 5 (1.7%) | 18 (3.8%) |
| 4) Language Barrier | 4 (1.3%) | 5 (1.7%) | 30 (10.4%) | 35 (7.5%) |
| Total Calls Reaching Person | 222 (74.0%) | 247 (82.3%) | 248 (85.8%) | 366 (78.2%) |
| Calls That Did Not Reach a Person | | | | |
| 5) Disconnected Numbers | 27 (9.0%) | 14 (4.7%) | 17 (5.9%) | 43 (9.2%) |
| 6) New Numbers | 4 (1.3%) | 8 (2.7%) | 0 (0.0%) | 3 (0.6%) |
| 7) Answering Machines | 26 (8.7%) | 17 (5.7%) | 13 (4.5%) | 34 (7.3%) |
| 8) No Answer | 18 (6.0%) | 9 (3.0%) | 8 (2.8%) | 14 (3.0%) |
| 9) Businesses/Modems | 3 (1.0%) | 5 (1.7%) | 3 (1.0%) | 8 (1.7%) |

| | | | | |
|---|---|---|---|---|
| Total Calls Not Reaching Person | 78 (26.0%) | 53 (17.7%) | 41 (14.2%) | 102 (21.8%) |
| TOTAL CALLS | 300 | 300 | 289 | 468 |

**TOTAL RESPONDENTS**

N (% of total)

Calls That Reached a Person

| | |
|---|---|
| 1) Successful Invitations | 152 (11.2%) |
| 2) Refusals: | |
| a. Straight Refusals | 748 (55.1%) |
| b. Out-of-Towners | 47 (3.5%) |
| c. Transport Disadvantaged | 16 (1.2%) |
| (Total Refusals) | (811)(59.8%) |
| 3) Call Backs | 46 (3.4%) |
| 4) Language Barrier | 74 (5.5%) |
| Total Calls Reaching Person | 1083 (79.8%) |

Calls That Did Not Reach a Person

| | |
|---|---|
| 5) Disconnected Numbers | 101 (7.4%) |
| 6) New Numbers | 15 (1.1%) |
| 7) Answering Machines | 90 (6.6%) |
| 8) No Answer | 49 (3.6%) |
| 9) Businesses/Modems | 19 (1.4%) |

| | |
|---|---|
| Total Calls Not Reaching Person | 274 (20.2%) |
| TOTAL CALLS | 1357 |

## APPENDIX 3-4

## SURVEY CALL SHEET

[Phone Number: _____]

Hello, is this (READ PHONE NUMBER)? (IF YES): My name is _____ and I am calling from the University of California at Berkeley. We are conducting a study of people's opinions of different types of housing, and we would like to give someone in your household a chance to participate. I need to speak to the adult in your household who most recently had a birthday.

(IF THAT PERSON IS HOME:)
Hello, my name is _____ and I am calling from the University of California at Berkeley. We are conducting a study of people's opinions of different types of housing, and would appreciate your help. We will be holding group sessions in Hayward in mid-August, at Cal State-Hayward. We would pay you $20 for attending this session, which will take about an hour. You will be shown slides of different types of housing in various settings, and asked for your opinions towards them. You will also be asked to fill out a short questionnaire about types of places you've lived and types of transportation you use. All the information you give us will be confidential.

We have two sessions available: one on Thursday, August 12, at 7:00 PM, and another on Saturday, August 14, at 12:00 noon. Which of these sessions would best fit your schedule?
_____

Thank you for your participation. We will send you a letter confirming this date and time; we will also send a map to Cal State-Hayward. May I have your name and address?
_____
_____

(IF THE PERSON IS NOT HOME:)
Do you know when he/she will be home? _____ And what is his/her name? _____ Thank you; I'll try back at that time.

(IF THE PERSON DOESN'T KNOW THE MOST RECENT BIRTHDAY:)
Then I need to speak with the youngest/oldest man/woman in the household.

## APPENDIX 3-5

## HOUSING QUESTIONNAIRE

1) Are you employed outside the home or do you attend college?
_____ Yes _____ No (IF NO, SKIP TO THE NEXT PAGE, QUESTION 2)

a. How many days/week do you commute to work or school? _____

b. Do you leave for work or school and return home at about the same time for the majority of your commute trips? ____ Yes ____ No
If yes: What time do you usually **leave** for work/school? _____
What time do you usually **return** home from work/school? _____

c. On average, how long is your commute trip, one-way? _____ minutes

d. On average, what distance is your commute trip, one-way? _____ miles

e. Which of the following means of transportation to work/school do you use at least once a week? (Check all that apply)
_____ drive alone (this can include dropping off or picking up children)
_____ carpool
_____ vanpool
_____ rail transit
_____ bus transit
_____ bicycle
_____ walk
_____ other (please specify: _____)

f. How often do you use BART for your commute trip?
_____ at least 4 days a week
_____ 2 - 3 days a week
_____ once a week

_____ less than once a week, but more than once a month
_____ once a month
_____ less than once a month
_____ I never commute by BART

2) How often do you use BART for trips other than commute trips?
_____ at least 4 days a week
_____ 2 -3 days a week
_____ once a week
_____ less than once a week, but more than once a month
_____ once a month
_____ less than once a month
_____ I never use BART for non-commute trips

3) Not counting your current commute (if any), please indicate what types of transportation you have used at least once a week for past commutes to work or school. Indicate only commutes you have made during the past ten years. (Check all that apply)
_____ drive alone
_____ carpool
_____ vanpool
_____ rail transit
_____ bus transit
_____ bicycle
_____ walk
_____ other (please specify: _____)

4) What city do you live in? _____

5) a. What street do you live on? _____
b. What is the nearest cross-street? _____

6) How long have you lived in your current residence? ____ years

7) In what type of residence do you live?
_____ Single family home
_____ Duplex
_____ Apartment building with 3-5 units
_____ Apartment building with 6-10 units
_____ Apartment building with 11 or more units
_____ Townhouse or condominium
_____ Mobile home or trailer
_____ Other (please specify: _____)

8) Do you own or rent your residence?

_____ Own
_____ Rent
_____ Other (please specify: _____)

9) a. If you own your residence, approximately how much are your monthly mortgage and property tax payments? _____

b. If you rent your residence, approximately how much is your monthly rent? _____

10) Please indicate which types of residences you have **ever** lived in, not counting your current residence (check all that apply):

_____ Single family home
_____ Duplex
_____ Apartment building with 3-5 units
_____ Apartment building with 6-10 units
_____ Apartment building with 11 or more units
_____ Townhouse or condominium
_____ Mobile home or trailer
_____ School dormitory
_____ Other (please specify: _____)
_____ I have not lived in another residence.

11) Do you have a driver's license? ___ Yes ___ No (IF NO, SKIP TO QUESTION 13)

12) How often is a car, truck, or van available for your use?

_____ always
_____ usually
_____ sometimes
_____ rarely
_____ never

13) How many cars, trucks, or vans are owned by you or other members of your household? _____

14) What is your occupation? _____

15) Are you: _____ Male _____ Female

16) What is your age? _____

17) a. Not counting yourself, how many other people live in your household?

_____ (IF 0, SKIP TO QUESTION 18)

b. What are their ages? _____

18) What is your annual household income (before taxes)?

____ Less than $10,000
____ $10,000 - $19,999
____ $20,000 - $29,999
____ $30,000 - $39,999
____ $40,000 - $49,999
____ $50,000 - $59,999
____ $60,000 - $74,999
____ $75,000 - $99,999
____ $100,000 - $124,999
____ $125,000 - $149,999
____ $150,000 or above

Note: This questionnaire was given to East Bay respondents. Sacramento respondents were given an identical questionnaire, except for the substitution of "RTD Rail" for "BART" in appropriate questions.

## SATISFACTION RANKINGS

1) Considering all aspects of where you live, how satisfied are you with your current residence?

1---------2---------3---------4---------5---------6---------7---------8---------9

extremely dissatisfied | neither satisfied nor dissatisfied | extremely satisfied

2) (IF YOU HAVE NEVER LIVED IN ANOTHER RESIDENCE, SKIP THIS QUESTION.)

a. Thinking about places you have lived before, what is the most satisfied you have ever been with a residence?

1---------2---------3---------4---------5---------6---------7---------8---------9

extremely dissatisfied | neither satisfied nor dissatisfied | extremely satisfied

b. What is the least satisfied you have ever been with a residence?

1---------2---------3---------4---------5---------6---------7---------8---------9

extremely dissatisfied | neither satisfied nor dissatisfied | extremely satisfied

---

In this section you will be shown slides of some residential developments of different types and densities. For each slide, imagine you were given the opportunity to move into the residential development, and indicate how satisfied you believe you would be living there. Slides will be shown in 4 groups. Each of the 4 groups will have 6 slides. At the end of each group, the slides will be shown again, and you will be asked to indicate which of the residential developments you would most like to live in, and which you would least like to live in.

**SLIDE GROUP A:**

1) How satisfied do you think you would be living in the residences shown in slide 1?

1---------2---------3---------4---------5---------6---------7---------8---------9

extremely dissatisfied | neither satisfied nor dissatisfied | extremely satisfied

2) How satisfied do you think you would be living in the residences shown in slide 2?

1---------2---------3---------4---------5---------6---------7---------8---------9

extremely | neither satisfied | extremely

dissatisfied nor dissatisfied satisfied

3) How satisfied do you think you would be living in the residences shown in slide 3?

1---------2---------3---------4---------5---------6---------7---------8---------9
extremely neither satisfied extremely
dissatisfied nor dissatisfied satisfied

4) How satisfied do you think you would be living in the residences shown in slide 4?

1---------2---------3---------4---------5---------6---------7---------8---------9
extremely neither satisfied extremely
dissatisfied nor dissatisfied satisfied

5) How satisfied do you think you would be living in the residences shown in slide 5?

1---------2---------3---------4---------5---------6---------7---------8---------9
extremely neither satisfied extremely
dissatisfied nor dissatisfied satisfied

6) How satisfied do you think you would be living in the residences shown in slide 6?

1---------2---------3---------4---------5---------6---------7---------8---------9
extremely neither satisfied extremely
dissatisfied nor dissatisfied satisfied

7) Considering all of the slides in Group A, which of the residential developments would you MOST like to live in? _____

Why? _____

_____

_____

8) How much would you be willing to pay per month to own the residential development you chose above?

_____ $450 or less

_____ $451 - $650
_____ $651 - $800
_____ $801 - $900
_____ $901 - $1000
_____ $1001 - $1200
_____ $1201 - $1450
_____ $1451 or more

9) Which of the residential developments would you LEAST like to live in? _____

Why? _____

_____

_____

(Note: The questions for Slide Group A are identical to those for Slide Groups B, C, and D, and are not repeated here.)

**SLIDE GROUP E:**

1) How satisfied do you think you would be living in the residences shown in slide 1, if the cost to purchase a typical unit was $211,000?

1---------2---------3---------4---------5---------6---------7---------8---------9
extremely neither satisfied extremely
dissatisfied nor dissatisfied satisfied

2) How satisfied do you think you would be living in the residences shown in slide 2, if the cost to purchase a typical unit was $205,000?

1---------2---------3---------4---------5---------6---------7---------8---------9
extremely neither satisfied extremely
dissatisfied nor dissatisfied satisfied

3) How satisfied do you think you would be living in the residences shown in slide 3, if the cost to purchase a typical unit was $165,000?

1---------2---------3---------4---------5---------6---------7---------8---------9
extremely dissatisfied | neither satisfied nor dissatisfied | extremely satisfied

4) How satisfied do you think you would be living in the residences shown in slide 4, if the cost to purchase a typical unit was $153,000?

1---------2---------3---------4---------5---------6---------7---------8---------9
extremely dissatisfied | neither satisfied nor dissatisfied | extremely satisfied

5) How satisfied do you think you would be living in the residences shown in slide 5, if the cost to purchase a typical unit was $145,000?

1---------2---------3---------4---------5---------6---------7---------8---------9
extremely dissatisfied | neither satisfied nor dissatisfied | extremely satisfied

6) How satisfied do you think you would be living in the residences shown in slide 6, if the cost to purchase a typical unit was $116,000?

1---------2---------3---------4---------5---------6---------7---------8---------9
extremely dissatisfied | neither satisfied nor dissatisfied | extremely satisfied

7) Considering <u>all</u> of the slides in Group E and the prices of each development, which of the residential developments would you <u>MOST</u> like to live in? _____

Why? _____

_____

_____

8) Which of the residential developments would you <u>LEAST</u> like to live in? _____

Why? _____

_____

_____

Note: The costs presented in this example are for the East Bay version of the questionnaire. As noted in the text, Sacramento housing costs were somewhat lower.

Finally, please take a few minutes to write down the particular features of the residential developments that were most important to you in deciding how satisfied you would be living in each development. Thank you very much for your help!

## APPENDIX 3-6

## COST ESTIMATE CALCULATIONS

As described in Chapter 3, costs of housing units in the simulated residential environments were estimated and provided to respondents to determine the effects of price information on satisfaction measures. This Appendix describes the steps followed in estimating housing costs.

Basic Procedures

Estimates of housing costs were based on several factors:

* The type of dwelling unit (single-family house, duplex, townhouse, or apartment)
* The square footage of the dwelling unit
* The type of exterior wall and siding
* Other miscellaneous features of the dwelling unit (including type of roof, size of garage, etc.)
* The location of the unit (Sacramento or East Bay)
* Cost of land (based on size of lot and land prices)

Information on the first five factors was obtained from the 1993 Means Square Foot Costs Guide, a standard building industry reference. Information on land costs is described below.

Dwelling unit size information was obtained from City Planning or County Assessor's offices, and was combined with square footage costs from the Means Guide. Adjustments were made to account for miscellaneous unit features. This basic 'hard' cost was increased by one-third to account for various 'soft' costs such as site development and preparation, service and infrastructure extension, and development, impact, and planning fees. Location factors from the Means Guide were applied to this overall dwelling unit cost figure, to account for relatively higher housing prices in the Bay Area. Land costs were added in, based on per unit costs and lot size information obtained from City Planning offices. In the case of multi-unit developments, the overall land price was divided among the units. Final per-unit costs were calculated by increasing the dwelling unit + land total by 15% to account for developer profit. Worksheets applying these general procedures to the specific cases are presented below.

Land Cost Estimates

Estimates for land prices were obtained from a survey of building and land costs in Northern California, conducted by Professor John Landis of the Department of City and Regional Planning, University of California, Berkeley. Costs of land were broken down by city and land type; for this study, the relevant categories were Residential and Multi-family land in Hayward and Residential land in Sacramento:

| | Land Price/Acre | | |
|---|---|---|---|
| | Mean | Std Dev | # Cases |
| Hayward Residential | $175,788 | 130,974 | 4 |
| Hayward Multi-family | $781,188 | 791,100 | 2 |
| Sacramento Residential | $34,139 | 27,246 | 5 |

No cases were recorded in Union City; land costs for Union City sites were assumed to be the same as Hayward sites for the estimates developed here. No multi-family cases were recorded in Sacramento; an estimate of multi-family Sacramento land prices per acre was made by multiplying the Sacramento residential price ($34,139) by the ratio of the Hayward multi-family and Hayward residential prices ($781,188/$175,788). This produced an estimated land price/acre for Sacramento multi-family units of $151,711.

**UNIT:** SINGLE-FAMILY HOUSE
**Unit size:** 1,976 sq ft.
**Lot size:** 0.098 acres

**Additional features:** Cedar shake roof, 2-car built-in garage.

**Per-unit costs:** $52.25/sq ft, based on 1 1/2 stories, stucco on woodframe construction (p. 31, Means Guide)

**Land costs:** 0.098 ac * $175,788/ac = $17,227 (Bay Area)
0.098 ac * $34,139/ac = $3,346 (Sacramento)

**Calculations:**

1,976 sq ft * $52.25/sq ft = $103,246
Additional features + 1,976 (cedar shake roof, Means Guide)
- 2,118 (2-car built-in garage, Means Guide)
$103,104 ('hard' costs)
* 1.33 (escalation for 'soft' costs)
$137,472 (basic unit costs)

| Hayward/Union City | | Sacramento | |
|---|---|---|---|
| $137,472 | | $137,472 | |
| * 1.21 | (loc. factor) | * 1.09 | (loc. factor) |
| $166,341 | | $149,844 | |
| + 17,227 | (land cost) | + 3,346 | (land cost) |
| $183,568 | | $153,190 | |
| * 1.15 | (profit) | * 1.15 | (profit) |
| **$211,103** | | **$176,169** | |

**UNIT:** DUPLEX
**Unit size:** 1,465 sq ft.
**Lot size:** 0.08 acres

**Additional features:** Clay tile roof, 2-car attached garage.

**Per-unit costs:** $60.20/sq ft, based on 1 1/2 stories, stucco on woodframe construction (p. 31, Means Guide)

**Land costs:** 0.08 ac * $175,788/ac = $14,063 (Bay Area)
0.08 ac * $34,139/ac = $2,731 (Sacramento)

**Calculations:**

| | | |
|---|---|---|
| 1,465 sq ft * $60.20/sq ft = | $88,193 | |
| Additional features + | 4,761 | (clay tile roof, Means Guide) |
| | + 8,816 | (2-car attached garage, Means Guide) |
| | $101,770 | ('hard' costs) |
| | * 1.33 | (escalation for 'soft' costs) |
| | $135,693 | (basic unit costs) |

| Hayward/Union City | | Sacramento | |
|---|---|---|---|
| $135,693 | | $135,693 | |
| * 1.21 | (loc. factor) | * 1.09 | (loc. factor) |
| $164,189 | | $147,905 | |
| + 14,063 | (land cost) | + 2,731 | (land cost) |
| $178,252 | | $150,636 | |
| * 1.15 | (profit) | * 1.15 | (profit) |
| **$204,990** | | **$173,231** | |

**UNIT:** TOWNHOUSE
**Unit size:** 1,500 sq ft.
**Lot size:** 0.092 acres

**Additional features:** 1-car built-in garage.

**Per-unit costs:** $59.38/sq ft, based on 2 stories, wood siding on woodframe construction (p. 32, Means Guide)

**Land costs:** 0.092 ac * $175,788/ac = $16,172 (Bay Area)
0.092 ac * $34,139/ac = $3,141 (Sacramento)

**Calculations:**

| | | |
|---|---|---|
| 1,500 sq ft * $59.38/sq ft = | $89,070 | |
| | * 0.9 | (adjustment for townhouse) |
| | $80,163 | |
| Additional features | - 1,130 | (built-in garage, Means Guide) |
| | $79,033 | ('hard' costs) |
| | * 1.33 | (escalation for 'soft' costs) |
| | $105,377 | (basic unit costs) |

| Hayward/Union City | Sacramento |
|---|---|
| $105,377 | $105,377 |
| * 1.21 (loc. factor) | * 1.09 (loc. factor) |
| $127,506 | $114,861 |
| + 16,172 (land cost) | + 3,141 (land cost) |
| $143,678 | $118,002 |
| * 1.15 (profit) | * 1.15 (profit) |
| **$165,230** | **$135,702** |

**UNIT:** TWO-STORY APARTMENT
**Unit size:** 990 sq ft. (Total complex size: 53,460 sq ft.)
**Lot size:** 0.043 acres

**Per-unit costs:** $61.20/sq ft, based on total complex size, wood siding on woodframe construction (p. 74, Means Guide)

**Land costs:** 0.043 ac * $781,188/ac = $33,273 (Bay Area)
0.043 ac * $151,711/ac = $6,462 (Sacramento)

**Calculations:**

990 sq ft * $61.20/sq ft = $60,588 ('hard' costs)
* 1.33 (escalation for 'soft' costs)
$80,784 (basic unit costs)

| Hayward/Union City | Sacramento |
|---|---|

| | |
|---|---|
| $80,784 | $80,784 |
| * 1.24 (loc. factor) | * 1.08 (loc. factor) |
| $100,172 | $87,247 |
| + 33,273 (land cost) | + 6,462 (land cost) |
| $133,445 | $93,709 |
| * 1.15 (profit) | * 1.15 (profit) |
| **$153,462** | **$107,765** |

**UNIT:** THREE-STORY APARTMENT
**Unit size:** 933 sq ft. (Total complex size: 333,000 sq ft.)
**Lot size:** 0.04 acres

**Per-unit costs:** $61.20/sq ft, based on total complex size, wood siding on woodframe construction (p. 74, Means Guide)

**Land costs:** 0.04 ac * $781,188/ac = $31,248 (Bay Area)
0.04 ac * $151,711/ac = $6,068 (Sacramento)

**Calculations:**

933 sq ft * $61.20/sq ft = $57,100 ('hard' costs)
* 1.33 (escalation for 'soft' costs)
$76,133 (basic unit costs)

| Hayward/Union City | | Sacramento | |
|---|---|---|---|
| $76,133 | | $76,133 | |
| * 1.24 | (loc. factor) | * 1.08 | (loc. factor) |
| $94,405 | | $82,224 | |
| + 31,248 | (land cost) | + 6,068 | (land cost) |
| $125,653 | | $88,292 | |
| * 1.15 | (profit) | * 1.15 | (profit) |
| **$144,501** | | **$101,536** | |

**UNIT:** FOUR-STORY APARTMENT
**Unit size:** 907 sq ft. (Total complex size: 72,476 sq ft.)
**Lot size:** 0.011 acres

**Per-unit costs:** $61.20/sq ft, based on total complex size, wood siding on woodframe construction (p. 74, Means Guide) *

**Land costs:** 0.011 ac * $781,188/ac = $8,762 (Bay Area)
0.011 ac * $151,711/ac = $1,702 (Sacramento)

**Calculations:**

907 sq ft * $61.20/sq ft = $55,508 ('hard' costs)
* 1.33 (escalation for 'soft' costs)
$74,011 (basic unit costs)

| Hayward/Union City | | Sacramento | |
|---|---|---|---|
| $74,011 | | $74,011 | |
| * 1.24 | (loc. factor) | * 1.08 | (loc. factor) |
| $91,774 | | $79,932 | |
| + 8,762 | (land cost) | + 1,702 | (land cost) |
| $100,536 | | $81,634 | |
| * 1.15 | (profit) | * 1.15 | (profit) |
| **$115,616** | | **$93,879** | |

* Note: Although this complex consisted of 4-story buildings, in appearance and materials it more closely resembled the 1-3 story apartment buildings listed in Means Guide than the 4-7 story buildings. Costs/sq ft were used from the 1-3 story listings.

## APPENDIX 3-7

## GROUP INTERVIEW SCRIPT

"Thank you for coming. I'm John Shaw, a researcher at the University of California at Berkeley working on a study of people's opinions towards different types of housing. This information will hopefully be useful to planners, developers, and urban designers involved with building or revitalizing neighborhoods and communities.

"As part of today's session, you will see slides of different residential developments in a variety of settings. Some of these settings may look familiar to you, and some probably won't. I should point out that all these settings are being used for research purposes only; any developed settings shown here today do not reflect any plans, policies, or intentions on

the part of the owners of any of the properties depicted.

"The session should last about an hour, and consists of two parts. The first is a short questionnaire on types of housing you've lived in and types of transportation you use, along with some background information collected for statistical purposes. (This is a good time for me to mention that all this information is anonymous and confidential.) The second part of the session involves viewing slides of housing, and giving your opinions about them. I'll talk more about that after you fill out these questionnaires. Are there any questions?"

("Housing Questionnaires" distributed.)

"Hang on to your questionnaires - we'll collect everything at the end."

("Satisfaction Rankings" distributed.)

"The second part of this session is for you to provide feedback on slides of various types of housing. We're passing out forms on which you can rate the housing on a 9-point scale. Circling the number '1' means you'd be extremely dissatisfied with the housing, and circling '9' means you'd be extremely satisfied. You can use any number from 1 to 9 to reflect your feelings of satisfaction or dissatisfaction towards a particular residence. If you are right in the middle between dissatisfied and satisfied, you can indicate that by circling the number '5'.

"The first two questions ask you to indicate your satisfaction with your current and past housing. After everybody has had a chance to fill this out, I'll talk about rating the slides you'll be seeing.

"In this section you will be shown slides of some residential developments of different types and densities. For each slide, imagine you were given the opportunity to move into the residential development, and indicate how satisfied you believe you would be living there.

"Slides will be shown in 4 groups. These will be A, B, C, and D. Each of the 4 groups will have 6 slides. At the end of each group, the slides will be shown again, and you

will be asked to indicate which of the residential developments you would most like to live in, and which you would least like to live in.

"Please rate these slides by yourself. It's important we get each person's own opinion, not what 2 people might agree on if they talk about a particular slide. After we're done, of course you can talk about any of the slides you saw. Are there any questions?"

(Before the first set of slides is shown) "The first set of slides, Slide Group A, shows some possible developments around the Butterfield LRT station in Sacramento." [46] (After the first set is shown) "Now I'll go back through the slides in Group A so you can consider which of the developments you would most like to live in, and which you would least like to live in."

(Before the second set of slides is shown) "The next set of slides, Slide Group B, shows some possible developments around the Bradshaw Road interchange with Route 50 in Sacramento." (After the second set is shown) "I'll go back through the slides in Group B again, so you can answer questions 7, 8, and 9."

(Before the third set of slides is shown) "Slide Group C shows some possible developments around the Union City BART station, between Oakland and San Jose." (After the third set is shown) "I'll go back through these slides again."

(Before the fourth set of slides is shown) "Slides in Group D show some possible developments around the Tennyson Road interchange with I-880 in Hayward, south of Oakland." (After the fourth set is shown) "I'll go back through these slides again."

(After everyone has completed the fourth set of slide rankings) "I have one more set of slide ratings for you to consider." ("Slide Group E" distributed.) "This will repeat the set of slides at the Bradshaw Road interchange with Route 50, with some additional cost

---

[46] The slide groups used in this version of the script are in the order shown at the first session in Sacramento. The order of the slide groups was varied at subsequent session, to control for ordering effects.

information for you to consider when making your satisfaction ratings. [47] These will be Slide Group E. As with the other slide groups, I'll go back through Slide Group E after you've made your ratings, so you can indicate which developments you would most and least like to live in."

(After Slide Group E is completed) "Finally, I'd appreciate everyone taking a few minutes to write down the most important features you considered when deciding how satisfied or dissatisfied you'd be in a particular development or setting. These could be specific aspects of the slides themselves, or other things that came to mind as you thought about the developments you saw.

"After you finish, please make sure we have all three sets of your responses, so we can keep them together. Thank you all very much for your help!"

[47] Different sets of slides were shown as Slide Group E at different sessions.

**APPENDIX 4-1 - KEY VARIABLES BY CENSUS TRACTS,**
**COMPARISON OF SAMPLE STATISTICS AND POPULATION PARAMETERS**

| | Sacramento census tracts | | | East Bay census tracts | | |
|---|---|---|---|---|---|---|
| 1990 Census Data | Butterfield (91.07) | | Bradshaw (90.01) | Union (4403.09) | City Hayward (4376) | |
| Median annual household income | $45,000<br>*$45,953* | | $38,750<br>*$37,087* | $43,000<br>*$43,245* | $40,000<br>*$35,208* | |
| Percentage of households w/children | 29.2<br>*39.4* | 21.1 | *39.0* | 42.1<br>*45.6* | 40.0<br>*39.3* | |
| Percentage of owner-occ. units | 91.7<br>*67.1* | 78.9 | *51.7* | 71.4<br>*53.1* | 80.0<br>*62.4* | |
| Median age | 51.5<br>*32.2* | | 39.0<br>*29.7* | 38.0<br>*30.0* | 48.0<br>*33.4* | |
| Average travel time to work (in minutes) | 20.5<br>*23.3* | 25.1<br>*20.7* | | 26.8<br>*27.5* | 20.7<br>*29.7* | |

Note: Sample statistic
*Population parameter*

## APPENDIX 4-2

## HOUSING QUESTIONNAIRE

**Absolute frequencies reported, except as indicated. (Total N= 84)**

1) Are you employed outside the home or do you attend college?
61 Yes 23 No (IF NO, SKIP TO THE NEXT PAGE, QUESTION 2)

a. How many days/week do you commute to work or school? 5.0 (mean and (median)

b. Do you leave for work or school and return home at about the same time for the majority of your commute trips? 51 Yes 10 No

If yes: What time do you usually **leave** for work/school? 7:30am (median) What time do you usually **return** home from work/school? 5:00pm (median)

c. On average, how long is your commute trip, one-way? 23.5 minutes (mean)
20 minutes (mode)

d. On average, what distance is your commute trip, one-way? 13.8 miles (mean) 10 miles (median)

e. Which of the following means of transportation to work/school do you use at least once a week? (Check all that apply)

55 drive alone (this can include dropping off or picking up children)
5 carpool
0 vanpool
9 rail transit **(Note: 45 out of 61 commuters only drove alone)**
1 bus transit
1 bicycle
2 walk
1 other (please specify: _____)

f. How often do you use (RTD Rail/BART) for your commute trip?

5 at least 4 days a week
1 2 - 3 days a week
3 once a week
0 less than once a week, but more than once a month
0 once a month
7 less than once a month
45 I never commute by (RTD Rail/BART)

2) How often do you use (RTD Rail/BART) for trips other than commute trips?

0 at least 4 days a week
0 2 -3 days a week
0 once a week
8 less than once a week, but more than once a month
11 once a month
36 less than once a month
28 I never use (RTD Rail/BART) for non-commute trips

3) Not counting your current commute (if any), please indicate what types of transportation you have used at least once a week for past commutes to work or school. Indicate only commutes you have made during the past ten years. (Check all that apply)

73 drive alone
20 carpool
0 vanpool
17 rail transit **(Note: 37 out of 80 past commuters only drove alone.)**
16 bus transit
19 bicycle
17 walk
1 other (please specify: _____)

4) What city do you live in? No. Sacramento = 24, So. Sacramento =19, Hayward =20, Union City =23

5) a. What street do you live on? _____ b. What is the nearest cross-street? _____

6) How long have you lived in your current residence? 11.4 years (mean), 7 (mode)

7) In what type of residence do you live?

73 Single family home
1 Duplex
0 Apartment building with 3-5 units

0 Apartment building with 6-10 units
4 Apartment building with 11 or more units
4 Townhouse or condominium
2 Mobile home or trailer
0 Other (please specify: _____)

8) Do you own or rent your residence?
68 Own
14 Rent
2 Other (please specify: _____)

9) a. If you own your residence, approximately how much are your monthly mortgage and property tax payments? $669 (mean) $710 (median)

b. If you rent your residence, approximately how much is your monthly rent?
$626 (mean) $705 (mean)

10) Please indicate which types of residences you have **ever** lived in, not counting your current residence (check all that apply):
69 Single family home
36 Duplex
31 Apartment building with 3-5 units
21 Apartment building with 6-10 units
43 Apartment building with 11 or more units
20 Townhouse or condominium
12 Mobile home or trailer
20 School dormitory
8 Other (please specify: _____)
1 I have not lived in another residence.

11) Do you have a driver's license? 82 Yes 2 No (IF NO, SKIP TO QUESTION 13)

12) How often is a car, truck, or van available for your use?
72 always
3 usually
2 sometimes
0 rarely
0 never

13) How many cars, trucks, or vans are owned by you or other members of your

household? 2.3 (mean) 2 (median)

14) What is your occupation?
- 9 Administrative support
- 3 Operators, fabricators, and laborers
- 14 Managerial/professional
- 5 Precision production, craft and repair
- 8 Service
- 12 Technical/sales
- 9 Student
- 5 Miscellaneous
- 16 Retired
- 2 No answer

15) Are you: 47 Male 37 Female

16) What is your age? 44 (mean) 44.5 (median)

17) a. Not counting yourself, how many other people live in your household? 20 (mean and median)

(IF 0, SKIP TO QUESTION 18)

b. What are their ages? _____

18) What is your annual household income (before taxes)?
- 2 Less than $10,000
- 12 $10,000 - $19,999
- 7 $20,000 - $29,999
- 16 $30,000 - $39,999 **Median household income: $42,900**
- 19 $40,000 - $49,999
- 11 $50,000 - $59,999
- 11 $60,000 - $74,999
- 4 $75,000 - $99,999
- 0 $100,000 - $124,999
- 2 $125,000 - $149,999
- 0 $150,000 or above

## APPENDIX 4-3 - ORDERING EFFECTS

As respondents express opinions on repeated viewings of similar slides, it is possible that the order in which the slides are shown influences attitudes and judgments. For instance, a fatigue factor can occur, so ratings of later slides may be lower than those of earlier slides. Or respondents might become desensitized to differences among slides, and their ratings might collapse towards an overall mean. Conversely, repeated viewings might heighten awareness of individual differences within slides, and produce an overall exaggeration of responses - for example, rating single-family dwellings higher or four-story apartments lower than in initial ratings.

To identify possible ordering effects, blocks of slides were shown in varying sequences in each of the five data collection sessions.[48] By showing slides of the four sites

[48] A block consists of each of the six dwelling units placed at the same site; all

in varying order, responses to the specific sequence in which the slides were shown can be averaged across all respondents. The order in which blocks of slides were shown to the respondent groups is presented in Figure 3-6.

The number of respondents in each group is unequal, due to differing numbers of attendees at each of the five data collection sessions.[49] Therefore, the number of people whose first viewing of the detached single-family house was next to the Butterfield light rail station is different than the number who first saw the house near the Bradshaw/Rt 50 interchange, the Union City BART station, or the Tennyson/I-880 interchange. If a simple average was calculated based on mean satisfaction score for each of these groups, it would be most heavily weighted towards the group with the largest number of respondents. To overcome this imbalance, weighting factors were applied to the number of respondents in each group.

Following the weighting of the groups, an overall group mean was calculated for each sequence of presentation of a particular dwelling type. Thus, the mean satisfaction rating of the first viewing of the single-family detached house across all four sites is compared to the mean rating of the second viewing of the single-family detached house across all sites, as well as to the third and fourth viewing of this residence across all sites. The total list of paired comparisons produced through this procedure is presented in Table A4-1.

In general, the results of the table indicate that the order in which the blocks of slides were shown had no bearing on the mean satisfaction rating of the slides. No general ordering effects exist in the data. However, four paired comparisons (out of 36 total) show

---

respondents viewed four blocks of slides, corresponding to the four study sites. Slides within blocks were always shown in the same order: single-family detached house, duplex, townhouse, two-story apartment, three-story apartment, and four-story apartment. Only the order in which the blocks were shown was varied.

[49] Blocks of slides were shown in the same order at Groups 3 and 5; in the analysis of ordering effects, results for these two groups are combined.

significant differences in the mean satisfaction ratings of slides shown in varying sequence. Specifically, the first viewings of the single-family detached house and the duplex produced somewhat lower overall ratings than did subsequent viewings of these same dwelling units.

A disaggregation of these two scores by respondent groups shows that the second Sacramento-area group is almost entirely responsible for the unusually low overall ratings of the first viewing of these two slides (see Table A4-2). What are the characteristics of this group, or the specific order slides were presented to this group, that might have influenced their responses to such an extent? The group members do not differ significantly from the first Sacramento group. However, they did see the slide blocks in a different order. The first block they viewed was of dwelling units placed near the Bradshaw Rd/Rt 50 interchange. It is possible this setting is such an unattractive location for any type of housing that the setting itself was the dominant feature respondents used to determine their satisfaction ratings of the first two slides (the single-family detached house and the duplex). Starting with the third slide, their attention shifted to the variation in dwelling types, and subsequently their ratings were based on a combination of dwelling type and site. This group of respondents did not differ from the other four groups in their ratings of any of the other 22 slides; nor did any other group have such a negative reaction to the detached house and the duplex in the Bradshaw Rd/Rt 50 setting.

With this small exception, no ordering effects were found for any other dwelling type or block of slides. The results of this analysis support the assumption that the order the slides were presented to the respondents did not significantly influence their responses.

## APPENDIX 4-4

## SUPPLEMENTAL DATA ANALYSIS

Several analyses of the satisfaction ratings and "most-liked/least-liked" slides provided little new information, but served to support the results already determined. Brief discussions of these findings are presented below, with supporting data presented in the following tables.

Satisfaction Ratings of Transit and Freeway Settings

Table A4-3 presents the overall sample means for satisfaction with the various building types and densities for the two transit sites (Butterfield LRT and Union City BART). Table A4-4 demonstrates the difference in means between each pair of slides, averaging the scores for the two transit-based sites. The findings are virtually identical to the comparison of means for all slides (shown in Table 4-4); each of the difference of means for the 15 pairs of slides is significant at the .01 level. As with the comparison of means for all slides, the difference between the two-story and three-story apartments is in the opposite direction from all other paired differences.

Table A4-3 also presents the overall sample means for satisfaction with different buildings for the two freeway sites (Bradshaw Rd/Rt 50 interchange and Tennyson Rd/I-880 interchange). Table A4-5 demonstrates the difference in means between each pair of slides, averaging the scores for the two freeway-based sites. The general pattern of relationships among the slides is similar to the pattern found in the transit-based sites. The primary difference is that satisfaction scores for single-family detached houses are virtually identical

to the scores for duplexes; for transit-based slides, this difference is almost a full point (6.2 vs. 5.3). Almost all comparisons are significant at the .01 level. As with the transit-based sites, the difference between two- and three-story apartments is reversed.

Satisfaction Ratings of Sacramento and East Bay Residents

In the process of comparing familiar and unfamiliar sites, respondents were grouped together by location of residence, Sacramento or the East Bay. This is a more generalized comparison of residences than was presented in Table 4-7. Comparisons for these groups are presented in Table A4-6. The categories of "familiar both sites" and "unfamiliar both sites" refer to an average rating across both the transit-based site and the freeway-based site for a particular area. For example, the first line of Table A4-6 indicates Sacramento area respondents' ratings of single-family detached houses at the Butterfield and Bradshaw/Rt 50 sites (averaged to create the "familiar both sites" rating of 5.2) and at the Union City and Tennyson/I-880 sites (averaged to create the "unfamiliar both sites" rating of 5.4). In addition to these ratings based on both transit- and freeway-based sites, Table A4-6 also presents ratings of familiar and unfamiliar transit sites and familiar and unfamiliar freeway sites, for both Sacramento and East Bay respondents.

Table A4-6 essentially repeats the findings of Table 4-7: few significant differences are found, particularly at the .05 level or below, and those that do exist do not follow any particular pattern.[50] Although the increased sample sizes permit more subtle differences to

[50] Three of the five significant differences do show up in one group, that of Sacramento area residents' ratings of familiar and unfamiliar freeways. It is possible that Sacramento residents have a dislike for development around the Bradshaw/Rt 50 interchange, particularly at low densities, while not disliking development around an interchange with which they are not familiar (Tennyson/I-880). However, no similar results were found among East Bay respondents, suggesting this grouping of statistical differences is more likely an anomaly. As noted in the discussion of ordering effects in Appendix 4-3, this result may also be due to a negative response by the Sacramento respondents who viewed the Bradshaw Rd/Rt 50 slides first.

be discerned by statistical tests, such differences are not seen in Table A4-6 to any greater extent than in Table 4-7.[51]

Satisfaction Ratings by Proximity to Site

Table A4-7 shows the differences among the means for the samples broken down by proximity of respondents to the nearest site. The first portion of Table A4-7 shows results for respondents one-quarter to one-half mile from the nearest site. Again, the pattern of differences is similar to previous tables, with differences between means in the usual direction. Fewer comparisons are significant at the .01 level, however, and two comparisons are not significant at the .05 level. The results for respondents one-half to three-quarter mile from the nearest site, shown in the second portion of Table A4-7, are much the same.

Results for the furthest respondents, those three-quarter to one mile from the nearest site, are presented in the third portion of the table. The pattern of differences is similar to those presented before, but somewhat fewer differences are statistically significant. This may be due to a fairly low sample size (18 respondents).

"Most-Liked" and "Least-Liked" Slides

Tables A4-8 and A4-9 present respondents' "most liked" and "least liked" residences, respectively, for the sites nearest their homes. These figures do not differ substantially for selections among the overall sites, presented in Tables 4-22 and 4-23. Breakdowns by transit and freeway sites show no change in preferences for either most liked or least liked sites.

[51] It is interesting to note that, of the 84 paired comparisons made in Tables 4-7 and A4-6 together, 9 were significant at the .10 level, 3 at the .05 level, and 1 at the .01 level. This almost exactly matches the number of "significant" findings that could be expected by chance, based on 84 comparisons and no true differences in the population parameters.

Proximity to site: Table A4-10 presents the most and least-liked choices for each of the three major groups of proximity categories [52]. In general, the patterns described previously apply here: single-family detached houses and duplexes are most preferred, with the four-story and two-story apartments least preferred.[53] Calculations of chi-square show no statistically significant differences of most or least-liked residences among the different proximity groups.

Cost Information

The effects of cost information on satisfaction with various housing densities is presented for the overall sample in Table 4-39, and for breakdowns of the sample into Sacramento and East Bay samples in Table A4-11. The results of these breakdowns mirror the results of the sample as a whole, with most less-dense housing preferred over denser housing.

Differences in satisfaction ratings with and without cost information are presented in Tables A4-12 through A4-14. Table A4-12 shows a breakdown by age, Table A4-13 by income, and Table A4-14 by gender. As indicated by analyses of variance tests, none of the differences in satisfaction across these explanatory variables is significant.

---

[52] See Table 4-2 for a description of the proximity categories.

[53] Among most-liked choices, 8 out of the 51 respondents living over 1/2 mile from the site selected the three-story apartment, compared to only 1 of the 24 respondents living within 1/2 mile; this suggests a slight interaction of proximity to site and negative attitudes towards density (attractive three-story apartments are preferred if they are not located next door). Among least liked choices, the two-story apartments are least liked by 11 out of 56 respondents living within 3/4 mile of the site, but are least liked by only 1 out of 15 of the remaining respondents.

**TABLE A4-3**

**SATISFACTION RATINGS AT TRANSIT- AND FREEWAY-BASED SITES**

| | Transit-based Sites Mean (Std Dev) | Freeway-based Sites Mean (Std Dev) |
|---|---|---|
| Sf detached house | 6.2 (1.3) | 4.8 (1.8) |
| Duplex | 5.3 (1.5) | 4.7 (1.5) |
| Townhouse | 4.4 (1.5) | 3.7 (1.3) |
| 2-story apt. | 3.1 (1.4) | 3.1 (1.3) |
| 3-story apt. | 3.7 (1.7) | 3.4 (1.5) |
| 4-story apt. | 2.4 (1.6) | 2.4 (1.4) |

**TABLE A4-4**

**DIFFERENCES IN MEANS BETWEEN PAIRS OF SLIDES, AVERAGED ACROSS TRANSIT BASED SITES**

**TOTAL SAMPLE (N=84)**

| | Slide #2 | | Slide #3 | | Slide #4 | | Slide #5 | | Slide #6 |
|---|---|---|---|---|---|---|---|---|---|
| Sf detached house | 0.9** | 1.9** | 3.0** | 2.5** | | | 3.8** | | |
| Duplex | ---- | | 0.9** | 2.2** | 1.6** | | 2.9** | | |
| Townhouse | | | ---- | | 1.2** | 0.7** | | 2.0** | |
| 2-story apt | | | | | ---- | | (0.5)** | 0.7** | |
| 3-story apt | | | | | | | ---- | | 1.3** |
| 4-story apt | | | | | | | | | ---- |

* p<.05
** p<.01

**TABLE A4-5**

**DIFFERENCES IN MEANS BETWEEN PAIRS OF SLIDES, AVERAGED ACROSS FREEWAY-BASED SITES**

**TOTAL SAMPLE (N=84)**

| | Slide #2 | Slide #3 | Slide #4 | Slide #5 | Slide #6 |
|---|---|---|---|---|---|
| Sf detached house | 0.0 | 1.0** | 1.7** | 1.4** | 2.4** |
| Duplex | ---- | 1.0** | 1.6** | 1.3** | 2.3** |
| Townhouse | | ---- | 0.6** | 0.4* | 1.4** |
| 2-story apt. | | | ---- | (0.3)* | 0.7** |
| 3-story apt. | | | | ---- | 1.0** |
| 4-story apt. | | | | | ---- |

* p<.05

** p<.01

**TABLE A4-6**

**MEAN SATISFACTION RATINGS, FAMILIAR AND UNFAMILIAR SETTINGS: AREA SAMPLES**

| SAMPLE | SLIDE | FAMILIAR BOTH SITES | UNFAMILIAR BOTH SITES |
|---|---|---|---|
| Sacramento (N=43) | Sf det house | 5.2 (1.5) | 5.4 (1.5) |
| | Duplex | 4.7 (1.4) | 5.0 (1.5) |
| | Townhouse | 3.7 (1.4) | 3.9 (1.3) |
| | 2-story apt | 3.2 (1.3) | 3.1 (1.3) |
| | 3-story apt | 3.6 (1.6) | 3.6 (1.5) |
| | 4-story apt | 2.3 (1.3) | 2.5 (1.3) |

| SAMPLE | SLIDE | FAMILIAR TRANSIT | UNFAMILIAR TRANSIT |
|---|---|---|---|
| Sacramento (N=43) | Sf det house | 6.2 (1.4) | 6.0 (1.5) |
| | Duplex | 5.2 (1.7) | 5.1 (1.6) |

| | | | |
|---|---|---|---|
| | Townhouse | 4.0 (1.4) | 4.2 (1.5) |
| | 2-story apt | 3.1 (1.3) | 3.2 (1.4) |
| | 3-story apt | 3.6 (1.7) | 3.8 (1.7) |
| | 4-story apt | 2.4 (1.4) | 2.5 (1.3) |

| | | | FAMILIAR | |
|---|---|---|---|---|
| UNFAMILIAR | | | | |
| SAMPLE | SLIDE | FREEWAY | FREEWAY | Sacramento |
| | Sf det house | 4.3 (2.0) | 4.8 (1.8) * | |
| (N=43) | Duplex | 4.1 (1.7) | 4.9 (1.6) *** | |
| | Townhouse | 3.4 (1.7) | | 3.7 (1.3) |
| | 2-story apt | 3.3 (1.7) | | 2.0 (1.5) * |
| | 3-story apt | 3.6 (1.8) | | 3.5 (1.7) |
| | 4-story apt | 2.3 (1.5) | | 2.5 (1.4) |

* p<.10
*** p<.01

**TABLE A4-6 (CONT.)**

**MEAN SATISFACTION RATINGS, FAMILIAR AND UNFAMILIAR SETTINGS: AREA SAMPLES**

| | | | FAMILIAR | |
|---|---|---|---|---|
| UNFAMILIAR | | | | |
| SAMPLE | SLIDE | BOTH SITES | BOTH SITES | |
| East Bay | Sf det house | 5.6 (1.5) | | 5.7 (1.5) |
| (N=41) | Duplex | 5.2 (1.4) | 5.2 (1.3) | |
| | Townhouse | 4.4 (1.4) | | 4.3 (1.4) |
| | 2-story apt | 3.1 (1.7) | | 3.1 (1.2) |
| | 3-story apt | 3.4 (1.6) | | 3.6 (1.6) * |
| | 4-story apt | 2.4 (1.7) | | 2.4 (1.6) |

| SAMPLE | UNFAMILIAR SLIDE | FAMILIAR TRANSIT | FAMILIAR TRANSIT |
|---|---|---|---|
| East Bay | Sf det house | 6.1 (1.5) | 6.5 (1.5) |
| (N=41) | Duplex | 5.4 (1.7) | 5.5 (1.5) |
| | Townhouse | 4.7 (1.7) | 4.7 (1.7) |
| | 2-story apt | 3.2 (1.9) | 3.2 (1.6) |
| | 3-story apt | 3.7 (2.0) | 3.8 (1.9) |
| | 4-story apt | 2.5 (2.0) | 2.4 (1.7) |

| SAMPLE | UNFAMILIAR SLIDE | FAMILIAR FREEWAY | FAMILIAR FREEWAY East Bay |
|---|---|---|---|
| | Sf det house | 5.2 (2.0) | 4.9 (2.0) |
| (N=41) | Duplex | 5.0 (1.7) | 4.9 (1.7) |
| | Townhouse | 4.0 (1.6) | 3.9 (1.4) |
| | 2-story apt | 3.0 (1.6) | 3.1 (1.2) |
| | 3-story apt | 3.0 (1.4) | 3.4 (1.6) ** |
| | 4-story apt | 2.3 (1.5) | 2.5 (1.6) |

* p<.10
** p<.05

**TABLE A4-7**

**DIFFERENCES IN MEANS BETWEEN PAIRS OF SLIDES, BY PROXIMITY TO SITE**

A. RESPONDENTS 1/4 TO 1/2 MILE FROM SITE (N=24)

| | Duplex | Townhouse | 2-st apt | 3-st apt | 4-st apt |
|---|---|---|---|---|---|
| Sf detached house | 0.9* | 1.8** | 2.8** | 2.3** | 3.5** |
| Duplex | ---- | 0.9** | 1.9** | 1.4* | 2.6** |
| Townhouse | | ---- | 1.0* | 0.5 | 1.8** |
| 2-story apt | | | ---- | (0.5) | 0.8** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 3-story apt | | | | | | | ---- | | 1.3** | |
| 4-story apt | | | | | | | | | ---- | |

B. RESPONDENTS 1/2 TO 3/4 MILE FROM SITE (N=35)

| | Duplex | Townhouse | | 2-st apt | 3-st apt | 4-st apt | | |
|---|---|---|---|---|---|---|---|---|
| Sf detached house | 0.7* | 1.4** | 2.4** | 2.0** | 3.1** | | | |
| Duplex | ---- | 0.8** | 1.8** | 1.3** | 2.5** | | | |
| Townhouse | | ---- | | 1.0** | 0.6* | | 1.7** | |
| 2-story apt | | | | ---- | | (0.4) | | 0.7** |
| 3-story apt | | | | | | ---- | | 1.1** |
| 4-story apt | | | | | | | | ---- |

* p<.05
** p<.01

**TABLE A4-7 (CONT.)**

C. RESPONDENTS 3/4 TO 1 MILE FROM SITE (N=18)

| | Duplex | Townhouse | 2-st apt | 3-st apt | 4-st apt | |
|---|---|---|---|---|---|---|
| Sf detached house | 0.5 | 1.7** | 2.1** | 1.8* | | 3.2** |
| Duplex | ---- | 1.2** | 1.6** | 1.3* | | 2.7** |
| Townhouse | | ---- | 0.4 | 0.1 | | 1.5** |

| | | | |
|---|---|---|---|
| 2-story apt | ---- | (0.3) | 1.0** |
| 3-story apt | | ---- | 1.4** |
| 4-story apt | | | ---- |

* p<.05
** p<.01

**TABLE A4-8**

**"MOST-LIKED" SLIDES - SITES NEAREST RESPONDENTS' HOMES**

| | Total | Transit Sites | Freeway Sites |
|---|---|---|---|
| Sf detached house | 48 (59%) | 27 (60%) | 21 (57%) |
| Duplex | 20 (24%) | 11 (24%) | 9 (24%) |
| Townhouse | 1 ( 1%) | 1 ( 2%) | 0 ( 0%) |
| Two-story apartment | 2 ( 2%) | 1 ( 2%) | 1 ( 3%) |

| | | | |
|---|---|---|---|
| Three-story apartment | 9 (11%) | 4 ( 9%) | 5 (14%) |
| Four-story apartment | 2 ( 2%) | 1 ( 2%) | 1 ( 3%) |
| Total | 82 (100%) | 45 (100%) | 37 (100%) |
| (No answer) | (2) | (0) | (2) |

**TABLE A4-9**

**"LEAST-LIKED" SLIDES - SITES NEAREST RESPONDENTS' HOMES**

| | Total | Transit Sites | Freeway Sites |
|---|---|---|---|
| Sf detached house | 5 ( 6%) | 2 ( 5%) | 3 ( 8%) |
| Duplex | 1 ( 1%) | 0 ( 0%) | 1 ( 3%) |
| Townhouse | 2 ( 3%) | 1 ( 3%) | 1 ( 3%) |

| | | | |
|---|---|---|---|
| Two-story apartment | 12 (16%) | 8 (20%) | 4 (11%) |
| Three-story apartment | 1 ( 1%) | 0 ( 0%) | 1 ( 3%) |
| Four-story apartment | 56 (73%) | 29 (73%) | 27 (73%) |
| Total | 77 (100%) | 40 (100%) | 37 (100%) |
| (No answer) | (7) | (5) | (2) |

**TABLE A4-10**

**"MOST-LIKED" AND "LEAST-LIKED" SLIDES BY PROXIMITY**

A. RESPONDENTS 1/4 TO 1/2 MILE FROM SITE

| | Most-Liked | Least-Liked |
|---|---|---|
| Sf detached house | 14 (58%) | 1 ( 4%) |
| Duplex | 8 (33%) | 0 ( 0%) |

| | | |
|---|---|---|
| Townhouse | 0 ( 0%) | 1 ( 4%) |
| Two-story apartment | 0 ( 0%) | 4 (17%) |
| Three-story apartment | 1 ( 4%) | 0 ( 0%) |
| Four-story apartment | 1 ( 4%) | 17 (74%) |
| Total | 24 (100%) | 23 (100%) |

B. RESPONDENTS 1/2 TO 3/4 MILE FROM SITE

| | Most-Liked | Least-Liked |
|---|---|---|
| Sf detached house | 22 (63%) | 2 ( 6%) |
| Duplex | 8 (23%) | 1 ( 3%) |
| Townhouse | 1 ( 3%) | 1 ( 3%) |
| Two-story apartment | 0 ( 0%) | 7 (21%) |
| Three-story apartment | 4 (11%) | 1 ( 3%) |
| Four-story apartment | 0 ( 0%) | 21 (64%) |
| Total | 35 (100%) | 33 (100%) |

**TABLE A4-10 (CONT.)**

C. RESPONDENTS 3/4 TO 1 MILE FROM SITE

| | Most-Liked | Least-Liked |
|---|---|---|
| Sf detached house | 7 (44%) | 1 ( 7%) |
| Duplex | 4 (25%) | 0 ( 0%) |

| | | |
|---|---|---|
| Townhouse | 0 ( 0%) | 0 ( 0%) |
| Two-story apartment | 1 ( 6%) | 1 ( 7%) |
| Three-story apartment | 4 (25%) | 0 ( 0%) |
| Four-story apartment | 0 ( 0%) | 13 (87%) |
| Total | 16 (100%) | 15 (100%) |

**TABLE A4-11**

**DIFFERENCES IN MEANS BETWEEN PAIRS OF SLIDES, WITH COST INFORMATION**

**SACRAMENTO SAMPLE (N=43)**

| | Duplex | Townhouse | 2-st apt | 3-st apt | 4-st apt |
|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| Sf detached house | 0.4 | 0.9** | 1.3** | 0.7 | 1.9** | |
| Duplex | ---- | 0.5** | 0.9** | 0.3 | 1.5** | |
| Townhouse | | ---- | | 0.4* | (0.1) | 1.0** |
| 2-story apt | | | | ---- | (0.6)** | 0.5** |
| 3-story apt | | | | | ---- | 1.2** |
| 4-story apt | | | | | | ---- |

**DIFFERENCES IN MEANS BETWEEN PAIRS OF SLIDES, WITH COST INFORMATION**

**EAST BAY SAMPLE (N=41)**

| | Duplex | | Townhouse | | 2-st apt | 3-st apt | 4-st apt | |
|---|---|---|---|---|---|---|---|---|
| Sf detached house | 1.0** | 1.1** | 2.4** | 1.9** | 2.8** | | | |
| Duplex | ---- | | 0.1 | | 1.4** | 0.9* | 1.7** | |
| Townhouse | | | ---- | | 1.3* | 0.9** | | 1.7** |
| 2-story apt | | | | | ---- | (0.5) | 0.4 | |
| 3-story apt | | | | | | ---- | | 0.8** |
| 4-story apt | | | | | | | | ---- |

* p<.05
** p<.01

**TABLE A4-12**

**DIFFERENCE IN SATISFACTION SCORES WITH AND WITHOUT COST INFORMATION, BY AGE**

| | | 18-32 | 33-44 | | 45-59 | 60 + | F value | | Signif. |
|---|---|---|---|---|---|---|---|---|---|
| Single-family house | | -1.29 | -0.81 | | -1.05 | -0.69 | | 0.44 | 0.73 |
| Duplex | -1.57 | -1.14 | | -1.19 | -0.76 | | 0.72 | 0.55 | |
| Townhouse | | -0.52 | 0.10 | -0.45 | -0.40 | | 0.65 | 0.58 | |
| Two-story apt | -0.90 | -0.14 | | -0.19 | -0.10 | 1.40 | 0.25 | | |
| Three-story apt | -0.24 | 0.10 | | -0.10 | -0.26 | 0.26 | 0.85 | | |
| Four-story apt | 0.14 | -0.05 | | 0.10 | 0.15 | 0.09 | 0.97 | | |

**TABLE A4-13**

**DIFFERENCE IN SATISFACTION SCORES WITH AND WITHOUT COST INFORMATION, BY INCOME**

| | Low | Medium | High | F value | Signif. |
|---|---|---|---|---|---|
| Single-family house | -0.95 | -1.01 | -0.89 | 0.03 | 0.97 |
| Duplex | -1.48 | -0.81 | -1.38 | 1.20 | 0.31 |
| Townhouse | 0.05 | -0.24 | -0.70 | 1.40 | 0.25 |
| Two-story apt | -0.19 | -0.37 | -0.41 | 0.14 | 0.87 |
| Three-story apt | 0.24 | -0.26 | -0.23 | 0.87 | 0.42 |
| Four-story apt | 0.10 | 0.20 | -0.07 | 0.30 | 0.74 |

**TABLE A4-14**

**DIFFERENCE IN SATISFACTION SCORES WITH AND WITHOUT COST INFORMATION, BY GENDER**

| | Male | Female | F value | Signif. |
|---|---|---|---|---|
| Single-family house | -0.65 | -1.35 | 3.21 | 0.08 |
| Duplex | -0.85 | -1.57 | 3.44 | 0.07 |
| Townhouse | -0.23 | -0.43 | 0.32 | 0.57 |
| Two-story apt | -0.28 | -0.42 | 0.18 | 0.67 |
| Three-story apt | 0.03 | -0.32 | 1.24 | 0.27 |
| Four-story apt | 0.11 | 0.05 | 0.03 | 0.86 |

## BIBLIOGRAPHY


Aiello, John R. and Baum, Andrew (eds.). Residential Crowding and Design. New York: Plenum Press. 1979.

Alexander, Ernest R. and Reed, K. David. Density Measures and Their Relation to Urban Form. Milwaukee, WI: Center for Architecture and Urban Planning Research, University of Wisconsin-Milwaukee. 1988.

Al-Mosaind, Musaad A.; Dueker, Kenneth J.; and Strathman, James G. "Light-Rail Transit Stations and Property Values: A Hedonic Price Approach," in Transportation Research Record No. 1400. Washington, D.C.: Transportation Research Board. 1993.

Alonso, William. Location and Land Use. Cambridge, MA: Harvard University Press. 1964.

Association of Bay Area Governments. Increasing Transit Ridership and the Efficiency of Land Use While Maximizing Economic Potential: Linking Housing Production and Job Growth in the Bay Area. Working Paper 90-2. Oakland, CA. 1990

Baldassare, Mark. Residential Crowding in Urban America. Berkeley: University of California Press. 1979.

Bernick, Michael and Carroll, Michael. A Study of Housing Built Near Rail Transit Stations: Northern California. Transit/ Residential Access Center, Institute of Urban and Regional Development, University of California at Berkeley. 1991.

Bosselmann, Peter and Craik, Kenneth H. "Perceptual Simulations of Environments," in Methods in Environmental and Behavioral Research, p. 162-190. Robert B. Bechtel, Robert W. Marans, and William Michelson (eds.). New York: Van Nostrand Reinhold. 1987.

Brookshire, David S.; Thayer, Mark A.; Schulze, William D.; and D'Arge, Ralph C. "Valuing Public Goods: A Comparison of Survey and Hedonic Approaches," The American Economic Review. Vol. 72, No. 1, p. 165-177. 1982.

Bureau of the Census. County and City Data Book: 1994. Washington, D.C.: U.S. Government Printing Office. 1994.

Bureau of the Census. 1990 Census of Population and Housing: Social, Economic, and Housing Characteristics - STF 3A (CD-ROM format). Washington, D.C.: U.S. Government Printing Office. 1992.

Bureau of Transportation Statistics. Transportation Statistics Annual Report 1994. Washington, D.C.: U.S. Department of Transportation. 1994.

Campbell, Angus; Converse, Philip E.; and Rodgers, Willard L. The Quality of American Life. New York: Russell Sage Foundation. 1976.

Cervero, Robert. "Light Rail Transit and Urban Development," Journal of the American Planning Association. Vol. 50, No. 2, p. 133-147. 1984.

Craik, Kenneth H. and Feimer, Nickolaus R. "Environmental Assessment," in Handbook of Environmental Psychology, p. 891-918. Daniel Stokols and Irwin Altman (eds.). New York: John Wiley and Sons. 1987.

Cummings, Ronald G.; Brookshire, David S.; and Schulze, William D. Valuing Environmental Goods: An Assessment of the Contingent Valuation Method. Totowa, NJ: Rowman and Allanheld. 1986.

Delsohn, Gary. "The First Pedestrian Pocket," Planning, p. 20-21. December 1989.

Dewees, Donald N. "The Effect of a Subway on Residential Property Values in Toronto," Journal of Urban Economics, Vol. 3, p. 357-369. 1976.

Diamond, Douglas B., Jr. "Income and Residential Location: Muth Revisited," Urban Studies, Vol. 17, p. 1-12. 1980.

Dillman, Joye J. and Dillman, Don A. "Private Outside Space as a Factor in Housing Acceptability," Housing and Society. Vol. 14, No. 1, p. 20-29. 1987.

Dillman, Don A.; Tremblay, Kenneth R., Jr.; and Dillman, Joye J. "Influence of Housing Norms and Personal Characteristics on Stated Housing Preferences," Housing and Society. Vol. 6, No. 1, p. 2-19. 1979.

Doling, J. "The Family Life Cycle and Housing Choice," Urban Studies. Vol. 13, p. 55-58. 1976.

Dowall, David E. and Juhasz, J.B. "Trade-off Surveys in Planning: Theory and Application," Environment and Planning A. Vol 10, p. 125-136. 1978.

Federal Highway Administration. Journey-to-Work Trends in the United States and Its Major Metropolitan Areas, 1960-1990. Washington, D.C.: Office of Highway Information Management, FHA. 1993.

Fischer, Claude S. The Urban Experience. New York: Harcourt Brace Jovanovich. 1976.

Flachsbart, Peter G. "Residential Site Planning and Perceived Densities," Journal of the Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. 2, p. 103-117. November 1979.

Follain, James R. and Malpezzi, Stephen. Dissecting Housing Value and Rent: Estimates of Hedonic Indexes for Thirty-Nine Large SMSAs. Washington, D.C.: The Urban Institute. 1980.

Foote, Nelson N.; Abu-Lughod, Janet; Foley, Mary Mix; and Winnick, Louis. Housing Choices and Housing Constraints. New York: McGraw-Hill. 1960.

Fuerst, J.S. "High-rise Living: What Tenants Say," Journal of Housing, Vol. 42, No. 3, p. 88-90. May - June 1985.

Galster, George C. "Identifying the Correlates of Dwelling Satisfaction: An Empirical Critique," Environment and Behavior, Vol. 19, No. 5, p. 539-568. Sept. 1987.

Galster, George C. and Hesser, Garry W. "Residential Satisfaction: Compositional and Contextual Correlates," Environment and Behavior, Vol. 13, No. 6, p. 735-758. November 1981.

Gaziano, Cecilie. "Variations in Survey Respondent Selection by Telephone," presentation at the 43rd Annual Conference of the American Association for Public Opinion Research, May 1988.

Groves, Robert M. and Kahn, Robert L. Surveys by Telephone: A National Comparison with Personal Interviews. New York: Academic Press. 1979.

Gruber, Kenneth J.; Shelton, Gladys G.; and Godwin, Deborah D. "Housing Satisfaction and Type of Residence," Housing and Society, Vol. 12, No. 2, p. 97-106. 1985.

Hawley, Amos. "Population Density and the City," Demography, Vol. 9, p. 521-529. 1972.

Healey, Joseph F. Statistics, a Tool for Social Research, 2nd ed. Belmont, CA: Wadsworth, Inc. 1990.

Hensher, D.; Brotchie, J.; and Gunn, H. "A Methodology for Investigating the Demand for High-Speed Rail," Fourteenth Australasian Transport Research Forum, Vol. 1, p. 459-476. 1989.

Jackson, Kenneth T. Crabgrass Frontier. New York: Oxford University Press. 1985.

Jones, Peter M.; Koppelman, Frank; and Orfeuil, Jean-Pierre. "Activity Analysis: State-of-the-Art and Future Directions," in Developments in Dynamic and Activity-Based Approaches to Travel Analysis, Peter M. Jones (ed.). Aldershot; Brookfield, USA: Avebury. 1990.

Kain, John F. and Quigley, John M. "Measuring the Value of Housing Quality," Journal of the American Statistical Association, Vol. 65, No. 330, p. 532-548. June 1970.

Kitamura, Ryuichi. "Life-Style and Travel Demand," in A Look Ahead: Year 2020. Washington, D.C.: Transportation Research Board Special Report #220, p. 149-189. 1988.

Knack, Ruth Eckdish. "Tony Nelessen's Do-It-Yourself Neotraditionalism," Planning, Vol. 57, No. 12, p. 18-22. December 1991.

Knight, Robert L. and Trygg, Lisa. "Evidence of Land Use Impacts of Rapid Transit Systems," Transportation. Vol 6, p. 231-247. September 1977.

Kroes, Eric; Sheldon, Robert; and Gore, Christopher. "How Do Rail Passengers Choose When To Travel? A Stated Preference Investigation," in Developments in Dynamic and Activity-Based Approaches to Travel Analysis, p. 171-183. Peter Jones (ed.). Oxford Studies in Transport. 1990.

Krueger, Richard A. Focus Groups: A Practical Guide for Applied Research. Newbury Park, CA: Sage Publications. 1988.

Lam, Julie A. "Type of Structure, Satisfaction, and Propensity to Move," Housing and Society, Vol. 12, No. 1, p. 32-44. 1985.

Lancaster, K.J. "A New Approach to Consumer Theory," Journal of Political Economy, Vol. 74, p. 132-156. 1966.

Lansing, John B.; Marans, Robert W.; and Zehner, Robert B. Planned Residential Environments. Ann Arbor: Survey Research Center, Institute for Social Research, The University of Michigan. 1970.

Lansing, John B.; Mueller, Eva; and Barth, Nancy. Residential Location and Urban Mobility. Ann Arbor: Survey Research Center, Institute for Social Research, The University of Michigan. 1964.

Louviere, Jordan J. "Chairman's Report: Workshop on Stated Preference Methods," in Behavioural Research for Transport Policy, p. 465-475. The 1985 International Conference

on Travel Behaviour. Utrecht, The Netherlands: VNU Science Press. 1986.

Louviere, Jordan J.; Henley, Davis H.; Woodworth, George; Meyer, Robert P.; Levin, Irwin P.; Stoner, James W.; Curry, David; and Anderson, Donald A. Laboratory Simulation Versus Revealed Preference Methods for Estimating Travel Demand Models: An Empirical Comparison. 1981.

MacKenzie, James J.; Dower, Roger C.; and Chen, Donald D.T. The Going Rate: What It Really Costs to Drive. World Resources Institute: Washington, D.C. 1992.

MacLennan, Duncan. "Some Thoughts on the Nature and Purpose of House Price Studies," Urban Studies. Vol. 14, p. 59-71. 1977.

Marans, Robert W. The Determinants of Neighborhood Quality: An Analysis of the 1976 Annual Housing Survey. Ann Arbor: Institute for Social Research, The University of Michigan. 1979.

Marans, Robert W. and Rodgers, Willard. "Toward an Understanding of Community Satisfaction," in Metropolitan America in Contemporary Perspective, p. 299-352. Amos H. Hawley and Vincent P. Rock (eds.). New York: Sage Publications. 1975.

Marcus, Clare Cooper and Sarkissian, Wendy. Housing as if People Mattered. Berkeley: University of California Press. 1986.

McClure, Wendy R. "Using Computer Processed Imagery to Facilitate Design Decision Making on Main Street," APT Bulletin. Vol. 24, Nos. 1-2, p. 74-79. 1992.

McLeod, P.B. "The Demand for Local Amenity: An Hedonic Price Analysis," Environment and Planning A, Vol. 16, p. 389-400. 1984.

Means Square Foot Cost Guide, 14th annual edition. Patricia L. Jackson (ed.). R.S. Means Company, Inc. 1993.

Metropolitan Transportation Commission. Environmental Analysis Sensitivity Test: Alternative Land Use Scenario to the Draft Environmental Impact Report for the Regional Transportation Plan. Oakland, CA. 1991.

Michelson, William. "Most People Don't Want What Architects Want," Transaction, Vol. 5, No. 8, p. 37-43. 1968.

Michelson, William. Environmental Choice, Human Behavior, and Residential Satisfaction. New York: Oxford University Press. 1977.

Mitchell, Robert Cameron and Carson, Richard T. Using Surveys to Value Public Goods: The Contingent Valuation Method. Washington, D.C.: Resources for the Future. 1989.

O'Rourke, Diane and Blair, Johnny. "Improving Random Respondent Selection in Telephone Surveys," Journal of Marketing Research, Vol. 20, No. 4, p. 428-432. 1983.

Perin, Constance. Everything in Its Place: Social Order and Land Use in America. Princeton, NJ: Princeton University Press. 1977.

Popenoe, David. The Suburban Environment. Chicago: The University of Chicago Press. 1977.

Pushkarev, Boris S. and Zupan, Jeffrey M. Public Transportation and Land Use Policy. Bloomington, IN: Indiana University Press. 1977.

Pushkarev, Boris S. and Zupan, Jeffrey M. "Where Transit Works: Urban Densities for Public Transportation," in Urban Transportation: Perspectives and Prospects, p. 341-344. Herbert S. Levinson and Robert Weant (eds.). Westport, CT: Eno Foundation. 1982.

Pushkarev, Boris S.; Zupan, Jeffrey M.; and Cumella, R.S. Urban Rail in America: An Exploration of Criteria for Fixed Guideway Transit. Bloomington, IN: Indiana University Press. 1982.

Quigley, John. Estimates of a More General Model of Consumer Choice in the Housing Market. U.C. Berkeley: Center for Real Estate and Urban Economics, Working Paper 82-42. December 1981.

Quigley, John. Consumer Choice of Dwelling, Neighborhood, and Public Services. U.C. Berkeley: Center for Real Estate and Urban Economics, Working Paper 84-78. April 1984.

Quigley, John M. and Rubinfeld, Daniel L. Unobservables in Consumer Choice: Residential Energy and the Demand for Comfort. Center for Real Estate and Urban Economics, University of California at Berkeley. 1987.

Rapoport, Amos. "Toward A Redefinition of Density," in Crowding in Real Environments, p. 7-32. Susan Saegert (ed.). Beverly Hills, CA: Sage Publications. 1976.

Richardson, Walter J. "Designing High-Density Single-Family Housing: Variations on the Zero-Lot-Line Theme," Urban Land. Vol. 47, No. 2, p. 15-20. 1988.

Robinson, Ira M. "Trade-off Games as a Research Tool for Environmental Design," in Methods in Environmental and Behavioral Research, p. 120-161. Robert B. Bechtel, Robert W. Marans, and William Michelson (eds.). New York: Van Nostrand Reinhold.

1987.

Rosen, Sherwin. "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition," Journal of Political Economy, Vol. 82, No. 1, p. 34-55. 1974.

Rossi, Peter H. and Anderson, Andy B. "The Factorial Survey Approach: An Introduction," in Measuring Social Judgments: The Factorial Survey Approach, p. 15-67. Peter H. Rossi and Steven L. Nock (eds.). Beverly Hills, CA: Sage Publications. 1982.

Sacramento County. Final Public Review Draft Land Use Element of the County of Sacramento General Plan. County of Sacramento Planning and Community Development Department, General and Advance Planning Section. November 1990.

Saegert, Susan (ed.). Crowding in Real Environments. Beverly Hills, CA: Sage Publications, Inc. 1976.

Salmon, Charles T. and Nichols, John S. "The Next-Birthday Method of Respondent Selection," Public Opinion Quarterly. Vol 47, No. 2, p. 270-276. 1983.

Sanoff, Henry and Sawhney, Man. "Residential Livability: A Study of User Attitudes Towards Their Residential Environment," in Environmental Design: Research and Practice, Proceedings of the EDRA 3/AR 8 Conference, UCLA. William J. Mitchell (ed.). 1972.

Shelton, Gladys G.; Gruber, Kenneth J.; and Godwin, Deborah D. The Effect of Housing Type on the Quality of Living. North Carolina A&T State University, Research Bulletin Series Volume 73, No. 3. 1983.

Sheppard, Stephen R. J. Visual Simulation: A User's Guide for Architects, Engineers, and Planners. New York: Van Nostrand Reinhold. 1989.

Shlay, Anne B. and DiGregorio, Denise A. "Same City, Different Worlds: Examining Gender- and Work-Based Differences in Perceptions of Neighborhood Desirability," Urban Affairs Quarterly, Vol. 21, No. 1, p. 66-86. Sept. 1985.

Silverman, Carol J. Neighboring: Private Lives and Public Roles. Working Paper No. 468, Institute of Urban and Regional Development, University of California at Berkeley. 1987.

Spain, Daphne. "The Effect of Changing Neighborhood Composition on Neighborhood Satisfaction," Urban Affairs Quarterly, Vol. 23, No. 4, p. 581-600. June 1988.

Stewart, David W. and Shamdasani, Prem N. Focus Groups: Theory and Practice.

Newbury Park, CA: Sage Publications. 1990.

Stover, Vergil G. and Koepke, Frank J. Transportation and Land Development. Prentice Hall: Englewood Cliffs, NJ. 1988.

Survey Sampling, Inc. The Frame. SSI: Fairfield, CT. March, 1994.

Tanur, Judith M. (ed.) Questions About Questions: Inquiries into the Cognitive Bases of Surveys. New York: Russell Sage Foundation. 1992.

Urban Mass Transportation Administration. The New Suburb. Washington, D.C.: Office of Technical Assistance and Safety, UMTA. 1991.

Uyeki, Eugene S. "Residential Location and Satisfaction with Neighborhood Characteristics," Journal of Urban Affairs, Vol. 7, No. 5, p. 37-50. Fall 1985.

Williams, Alan W. "A Guide to Valuing Transport Externalities By Hedonic Means," Transport Reviews, Vol. 11, No. 4, p. 311-324. 1991.

Wingo, Lowdon, Jr. Transportation and Urban Land. Washington, D.C.: Resources for the Future, Inc. 1961.