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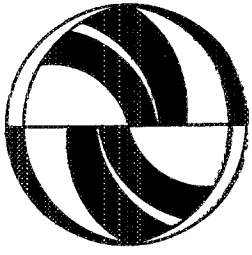https://escholarship.org/uc/item/8qf9116b

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**Publication Date**
1994-09-01

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Working Paper
UCTC No. 247

# An Evaluation of the Market Potential for Transit-Oriented Development Using Visual Simulation Techniques

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*Working Paper*
*September 1994*

University of California Transit Research Program

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Chapter One

Creating Transit Villages:
Issues, Objectives, and Research Approach

## 1.1. Introduction

America's growing dependency on the private automobile is widely cited as a root cause of many of today's urban problems— traffic congestion, air pollution, and faceless urban sprawl. In 1960, 43 million Americans commuted alone to work. By 1990 their numbers had risen to 101 million (U.S. Department of Transportation, 1994). During the 1980s, the national share of drive alone commuters jumped from 64.4 percent to 73.2 (Pisarski, 1992). Nor do these trends appear to be slowing. The latest "State of the Commute" report by the Commuter Transportation Services (1994)— the annual tracking study of commuter behavior in the greater Los Angeles region— shows Southern California's drive-alone rate increased from 77 percent in 1992 to 79 percent in 1993. Similar trends have been reported for the San Francisco Bay Area (RIDES, 1994).

One of many strategies being suggested to help reverse, or at least stave off, the trend toward growing auto-dependency is to promote more intensive development around rail transit stations. Particular emphasis is being placed on clustering more housing around transit stations. In the San Francisco Bay Area, 11 multi-family projects containing over 4,500 units were built within a quarter-mile radius of a Bay Area station between 1988 and 1993 (Bernick, 1993). Nationwide, around 12,000 units were built within a quarter-mile ring of rail stations across ten different metropolitan areas, with nearly 500 units built on land owned by transit authorities (Bernick and Cervero, 1994). Creating more compact yet attractive living environments around stations, proponents argue, will lure more and more households to reside within reasonable proximity of major transit stops and to increasingly give up their cars for transit riding. There is some supportive evidence. Recent research shows residents living near rail stations in California are around five times more likely to commute by rail transit as those living away from rail stations (Cervero, 1993).

Pending state legislation could significantly boost the prospects of transit-based development in California. In early 1994, California State Assemblyman Tom Bates of Oakland introduced AB 3152, the Transit Village Development Act of 1994, that seeks to encourage relatively high-density, mixed-use development, including affordable housing, around rail stations. The bill would allow municipalities to designate a "transit village district," similar to a redevelopment district, which would have special land assemblege and tax increment financing privileges.

While important inroads have been made in attracting new housing projects near rail stations in California and elsewhere in the U.S., much of what has been built to date are isolated stand-alone multi-story apartment structures with 30 to 50 units to the acre (Bernick, 1993). Such environments fall short of

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what is often envisaged by the proponents of transit villages, pedestrian pockets, or other neotraditional neighborhoods. Besides creating residential densities above those found in most American suburbs, all of these initiatives aim to create attractive communities with mixed land uses, prominent public and civic spaces, and pleasant walking environments (Bookout, 1992; Audirac and Shermyen, 1994). Transit village and pedestrian pocket schemes, in particular, rely on placing condominia, blocks of two-story townhouses, and three-story walkups, intermixed with shops and other uses, close enough to stations to support frequent rail services.

Research findings by Pushkarev and Zupan (1977) are widely used as a benchmark for the kinds of residential densities necessary to sustain urban rail transit services in the U.S. Assuming a metropolitan area has a downtown with at least 30 million square feet of commercial and other non-residential floorspace, their work indicates that residential densities of at least 12 dwelling units per acre are necessary to support light-rail transit services operating on 20-minute peak headways (and assuming typical operating, capital, and land acquisition costs). Heavy rail investments, according to the authors, require larger downtowns (with at least 50 million square feet of non-residential space) and minimum residential densities closer to 18 dwelling units per acre. While this study has been criticized for using unrepresentative cost data from the New York metropolitan area and overemphasizing the role of downtowns as employment centers, in the absence of better work, many of the research findings have almost become industry standards, including those related to the minimum-density thresholds necessary to support rail transit investments.

To date, relatively little is known about the market potential of transit village development, in large part because little has been built to date. Transit-oriented projects such as the celebrated Laguna West development south of Sacramento have struggled financially and for the most part incorporate modest transit provisions.[1] Significant obstacles to building transit villages include questionable market viability, a shortage of conventional financing, NIMBY opposition to multi-family housing development (especially in the suburbs), and the existence of multiple landholders near many rail stations (thus impeding land assemblege) (Cervero, Bernick, and Gilbert, 1994). In the absence of many, if any, good examples of transit village development in the U.S., we are left to speculate as to the market potential for such projects as well as how they might impact travel choices and the environment. Europe offers perhaps the best examples of transit-oriented neighborhoods anywhere (Pucher, 1988; Hass-Klau, 1990); however, for historical and cultural reasons, experiences there are not easily transferable to the U.S.

## 1.2. Research Objectives and Approach

Presently, the entire "transit village movement" seems caught in a catch-22: there are few examples, in part, because of questionable market feasibility, and the market potential of transit villages is questionable because there are few examples from which to learn. The main purpose of this research project was to investigate the market potential of the transit village concept. In the absence of good U.S. examples of transit villages, we attempted to simulate them using computer-generated images. After creating a

number of simulated transit village scenarios, we then presented them to the general public as well as a group of the largest Bay Area housing developers; using surveys, we then attempted to elicit views and reactions about the images shown.

Our main objective in conducting this research was to gauge how receptive people were to transit villages that had varying levels of density and amenities, like parks and retail stores. Four scenarios of varying housing densities (12, 24, 36, and 48 dwelling units per acre) were created. As densities increased, so did the amount and quality of neighborhood amenities. In this manner, we attempted to measure the degree to which people might be willing to trade off higher densities in return for more amenities.

Our central hypothesis is that significant numbers of Americans would be willing to live in suburban neighborhoods with the kinds of densities necessary to support rail transit services if these neighborhoods were reasonably attractive and featured parks, small consumer services (e.g., bakery, cleaners), and other amenities. Hawley (1972) and Baldassare (1979) note that the potential benefits of high-density neighborhoods include the opportunity for diversity and stimulation, more conveniences, and improved transportation. While we were unable to postulate *a priori* what density thresholds are acceptable to the general public, we suspected that densities in the range of 20 to 50 dwelling units per acre could be acceptable to many if complemented by appropriate amenities. In most outlying areas, such densities correspond to two- to three-story walkup buildings, possibly with podium parking. Above 50 dwelling units per acre, costs can rise dramatically because of the need for mid-rise structures on strong foundations, elevators, and sometimes structured parking. In many suburban settings, moreover, mid-rise towers built at such densities are politically unacceptable.

Besides testing this "trade-off" theory, we were also interested in exploring what types of amenities are preferred most in transit village environments — e.g., open space and parks, retail shops, access to transit? Additionally, we wanted to investigate who seems most receptive to living in transit villages. We postulated that singles, young adults (saving to eventually buy a single-family home), seniors (including empty-nesters), low-wage earners, and those who work near rail stations would be most willing to reside in a transit-oriented community.

Simulations were designed so that observers could experience "walking through" transit villages with varying levels of density and amenities. Dynamic simulations pose a difficult trade-off in terms of realism versus environmental control. While one sacrifices a certain degree of realism in producing computer-generated images of built environments, at the same time the researcher can control for many factors that might otherwise confound the research — such as keeping architectural styles, building colors, the amount of cloud coverage, and street widths constant across images. The ability to control these other factors was particularly important to our research, since our interest lay in ferreting out the unique and joint influences of neighborhood amenities on attitudes and perceptions. Without introducing such controls, we would not have been able to distinguish the influences of such amenities as open space and retail uses from the effects of building designs, street traffic, and other intervening factors on peoples' attitudes and preferences.

In addition to testing hypotheses about peoples' attitudes to transit village environments, we were also interested in the potential usefulness of computer-generated simulations as a research tool. Is it possible to conduct market research using such technology that yields reasonably valid and reliable findings? We believe the results of this project shed some light on this question. Directions for carrying out future research on transit-oriented development using computer simulations are suggested in the concluding chapter.

## 1.3. Density, Mobility, and Place

In recent years, a number of studies have found population densities to be one of the most important determinants of transit usage. Using 1981 travel data for the Bay Area, Harvey (1990) found a strong negative exponential relationship between residential densities and the amount of vehicular travel— a doubling of densities results in a 30 percent decline in vehicle miles traveled (VMT) per household. Holtzclaw (1990) found a similar relationship across five Bay Area communities with comparable income profiles. Using data from smog check odometer readings and trips logs, Holtzclaw found that residents of a dense part of San Francisco logged, on average, only one-third as many miles on their private vehicles each year as residents of Danville, an East Bay suburb. In a more recent study of 28 California communities, Holtzclaw (1994) found that both automobiles per household and VMT per household fell by one-quarter as densities doubled, and by around 8 percent with a doubling of transit accessibililty. In a similar study of travel in the greater Seattle area, Frank (1994) found that higher population densities were associated with a larger share of shopping trips being made by transit and foot.

In Pushkarev and Zupan's (1977) work, discussed earlier, they suggest that residential densities in the range of 12 to 30 dwelling units (d.u.) per acre can support moderate levels of rail transit services. This is substantially above the 5 d.u. per acre of a typical suburban planned unit development (PUD). Of course, the primary objective of designing communities is not so much to shape travel behavior, much less to lure people to mass transit. Urbanologist have long argued what is most important is to design places at a proper human scale — to impart a sense of identity and belonging to a place. Hans Blumenfeld (1968), with the assurance that comes with long practice, believes he knows what is the "right" residential density — 12 to 60 d.u. per acre. Such a range of densities, he contends, ensures people can easily access places by foot and have frequent face-to-face contact with neighbors without being overawed by a monumental scale. Jane Jacobs (1961) advocates considerably higher densities, more in the 50 to 150 d.u. per acre range, in order to create a sense of urbanity and instill an attachment to place.

Unfortunately, many people equate high density with high-rise buildings. This does not necessarily have to be the case. Le Corbusier's Radiant City, often thought to represent the ultimate high-rise residential city, featured densities of only 120-150 d.u. per acre (Blumenfeld, 1968). Since Le Corbusier's towers were separated by vast expanses of open space, Radiant City covered only 12 percent of the ground, result-

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ing in moderate average densities. Four- to five-story residential buildings can produce average densities above those of Radiant City's — in the 100 to 220 d.u. per acre range (Jensen, 1966).

Built environments are extremely malleable, able to accommodate a variety of spatial organizations and housing types. It is possible to build at 12 d.u. per acre and still accommodate single-family detached units. Ebenezer Howard's garden cities, forerunners of some of today's transit village schemes, were designed largely with single-family units built at 12 units per acre. Row houses (connected single-family homes with zero lot lines) can be developed as high as 36 d.u. per acre. Mixing building types can nudge average densities up to the level where transit trips begin to outnumber automobile trips. For instance, 50 d.u. per acre can be achieved by building a project where half of the units are single-family dwellings at 12 units per acre, 30 percent are row houses at 40 d.u. per acre, and 20 percent are mid-rise apartments at 150 d.u. per acre. Such densities, however, are only feasible, politically speaking, in settings where low-rise development is not already established.

## 1.4. Density and Design

While the mobility benefits of higher residential densities might very well be significant, from a personal standpoint, most Americans see disbenefits in density. Residential preference surveys consistently show that upwards of 95 percent of Americans prefer single-family to multi-family dwellings (Michelson, 1968; Altshuler 1980). To many, density is associated with noise, overcrowdedness, urban blight, and emotional stress. Preference for single-family living also reflects the strong North American value placed on homeownership (Foote et al., 1960). Besides tax advantages and secured tenancy, the ability of an owned, as opposed to rented, residence to be altered to the owner's liking is also important (Michelson, 1977). For families with children, the ability to maintain private and secured outside space is highly valued (Cooper Marcus and Sarkissian, 1986; Dillman and Dillman, 1987).

Only recently have designers begun to recognize that actual and perceived densities can vary considerably. Residential densities as measured in housing units per acre or people per acre might not be a very useful concept in human terms. Rappaport (1975) has argued that high density is associated with crowding and crowding is perceived as negative — "a subjective experience of sensory and social overload." Reversely, low density might also be associated with a negative subjective experience— i.e., excessively low degrees of interaction or isolation. According to Rappaport, density is a perceived experience and should be seen as more than the number of people per unit area or households per acre. Physical and social aspects of the environment are related since both affect an awareness of other people either directly or through artifacts. Environments offer visual cues, and some of these cues indicate dense environments while others tend to indicate low density, irrespective (or at least partly independently) of the actual number of people or housing units per acre. For example, the presence of natural greenery in a residential neighborhood, such as a park at the end of a street, might prompt a visitor's judgment about the area's density to be lower than actual. Likewise, streets lined with trees might be perceived as lower in density than streets without trees.

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Rappaport hypothesized on a number of other variables influencing the perception of density. Residential density will be perceived as "high" when many people are visible on sidewalks. Also, many parked cars or the absence of private gardens and individual entrances will contribute to the perception of high density. Few of Rappaport's variables have been tested empirically. Bergdoll and Williams (1990), in a study of three San Francisco streets of similar measured density (47, 41, 39 d.u. per acre) lined with buildings of identical height but different architectural facade articulation, concluded that facades with greater articulation (i.e., visible roofs, individual bay windows, and recesses) were perceived as lower in density than streets with facades of a uniform appearance.

Bookout and Wentling (1988) contend that a serious challenge to the designers of apartments and mid-to-high-rise complexes is to increase densities while also maintaining quality designs and living environments. In general, they contend, it is possible to trade-off more amenities for higher densities. According to the authors, good quality designs and neighborhood amenities can effectively alter peoples' perceived densities.

Bookout and Wentling maintain the following designs can lead to acceptably higher-density projects:

- replacing row apartments with exterior breezeways and stairs with eight-plex buildings (two-story stacked flats with four ground-level patios and second-level decks)

- designing mid-rise buildings on podiums with below-grade parking

- replacing high-rise slabs with sculptured towers, featuring varied heights, detailed rooflines, and changes in materials and textures

Other ways to "hide" residential densities include attractive landscaping, creation of buffer spaces, varying building heights to break the monotony of structures, maintaining detached units with narrower setbacks, building granny flats and accessory units, and converting spacious single-family homes into duplexes and triplexes.

It is the prospect of reducing the perceived densities of transit-oriented neighborhoods by providing attractive amenities that has motivated this research. The views of one of the Bay Area's largest housing developers, expressed during an interview published in *Urban Land* (Bookout, 1992: 16), is cause for optimism about the prospects of using amenities to compensate for higher densities:

> ... the market is beginning to put more value on the community than on the house itself. This suggests that developers need to do a better job of creating and selling community features — various on-site recreational amenities, a pleasant ambiance (one perhaps harking back to traditional villages), pedestrian-friendly streets, and human building scales.

## 1.5. Prior Research on Neighborhood Preferences

Studies on residential satisfaction and hedonic price modelling provide the best insights to date on factors that shape peoples' attitudes and preferences toward neighborhoods. Several recent research

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projects, moreover, have explicitly used visual simulation techniques to study the prospect for designing transit-oriented communities. These studies are briefly summarized in this section.

*Hedonic Price Models*

Economists maintain that the best barometer of consumer preferences is the marketplace. Whatever homebuyers and renters are willing to pay for a "bundle" of housing attributes, most economists would argue, best reflect what they value most highly. However, as already noted, since there are few examples of transit-oriented communities in the U.S., it is difficult to gauge consumer preferences for this "commodity." A serious shortcoming of revealed preference research is the limited range of alternative choices available to many consumers (Louviere et al., 1981). Where choice sets are limited, which certainly is the case for many prospective homebuyers seeking out neighborhoods, a second-best market research alternative is stated-preference surveys. While stated preferences are always subject to response biases, they offer the advantage of allowing the researcher to present a number of choice options and manipulate variables so as to control for extenuating factors.

Hedonic price modeling embodies revealed preferences by placing a dollar figure on the physical features of housing units and their surroundings, whereas research on residential satisfaction relies on preferences that are revealed through surveys. Several important studies using hedonic price and attitudinal survey methods have illuminated our understanding of those features of neighborhoods that are most highly valued. For example, McLeod (1984) found that amenities accounted for as much as a third of the price of a house in Western Australia. For a good review of this literature, see Shaw (1994).

Several studies, using hedonic price modeling techniques,[2] have found that proximity to rail transit gets capitalized into higher land values. One study concluded that BART had a small but significant positive effect on the price of single-family dwellings (Blayney Associates, 1978). The study found a positive effect on housing prices at 1,000 feet from BART stations of between 0 and 4 percent, which diminished rapidly with increasing distance from stations. In no case did the BART effect extend beyond 5,000 feet. Similar studies of Atlanta's MARTA (Metropolitan Atlanta Rapid Transit Authority) system also concluded that transit station proximity is beneficial to residential values when stations are designed with sensitivity to surrounding neighborhoods (Nelson and McClesky, 1990). The potential negative effects of proximity to rail transit have likewise been studied. Indeed, an opinion survey conducted by Baldassare et al. (1979) found less preference for homes near elevated BART stations. Burkhardt (1976) and Dornbush (1975) also recorded lower values around BART due to such nuisances as noise and vibration, increased automobile traffic, and the perceived accessibility of different social classes and ethnic groups to otherwise homogenous neighborhoods.

A more recent study sheds further light on how proximity to transit gets capitalized into higher land values. Using 1990 sales transaction data, Landis et al. (1994) found for every meter a home is closer to the nearest BART station in Alameda and Contra Costa counties, its selling price increases in the range

of $1.96 to $2.29, all else being equal. Proximity to highways, on the other hand, had a depressing effect on home prices. Interestingly, the researchers found no capitalization effect for homes near three light-rail lines in California. They concluded that the type of rail technology and extensiveness of rail systems have some bearing on home values.

*Residential Satisfaction*

Most relevant to this research are several earlier studies on residential satisfaction that examined attitudes toward neighborhood densities.[3] Lansing et al. (1970) surveyed attitudes of residents from several planned U.S. communities (including Reston, Virginia, and Columbia, Maryland) as well as those from "less-planned" control communities. Residents were most satisfied with low neighborhood densities (under 2.5 dwelling units per acre), although only the highest density (above 12 dwelling units per acre) substantially decreased residents' satisfaction. Residents reacted similarly to townhouses and single-family homes, except at high densities. The authors attributed these results to the overwhelming preference for privacy, quiet, and outdoor space. The densities investigated in our study, it should be noted, are well above those studied by Lansing et al.; perhaps most relevant to our work was the finding that 12 d.u. per acre is a maximum threshold of acceptible densities in suburban areas, which, based on the work of Pushkarev and Zupan (1977), also happens to be the minimum threshold necessary to support rail transit services.

Research by Foot et al. (1960), Baldassare (1979), and others (as cited in Shaw, 1994) consistently show a preference for ownership of detached, single-family living. Moreover, regardless of current living conditions, most residents report general satisfaction with their home and neighborhood. Those less inclined toward single-family residential living include the elderly, singles, and housewives working in the home. Seniors like to live close to other seniors and usually want to be within walking distance of shops (Michelson, 1977). Those without children often rate proximity to social activities higher than those with children.

Not all attitudinal surveys of high-density settings have elicited negative responses, however. Nelessen Associates, Inc. have used a Visual Preference Survey (VPS) as a tool to build community consensus on what kinds of developments are most acceptable. Residents rate between 160 and 240 slides on a scale ranging from -10 to +10. As part of an infill plan for a New Jersey town, residents gave a negative rating to a recently approved multi-family project built according to local zoning requirements, but gave highly positive ratings for several images of higher-density urban townhouses clustered around court-yards (Constantine, 1992). Based on surveys of several thousand people across the U.S., respondents revealed a repeated preference for traditional communities over suburbs:

> Interesting, the long-held American dream of large-lot suburban subdivisions has
> received failing grades when people are asked to rate it along with such alternatives
> as high-density village homes; . . . people prefer to reside in small villages and tradi-
> tional towns, even if it means higher-density living (Constantine, 1992: 13).

Respondents have shown a particularly strong preference toward traditional neighborhood developments. Since our work also relies on visual images as opposed to just written survey queries (used in most residential satisfaction studies), the results from the VPS bode favorably for the hypotheses we set about testing in our research. We also believe they lend credence to the use of visual images as a central tool in our research design.

Shaw (1994) argues that most residential satisfaction studies have not included valid measures of residential density in their model specifications. Housing type has been used as a surrogate for residential density (Michelson, 1977), as has size of community (Campbell et al., 1976) and location of residence in a metropolitan areas (Uyeki, 1985); Shaw (1994) notes that a number of researchers have acknowledged that the absence of explicit measures of density was a shortcoming of their studies on residential satisfaction.

Proximity to transit has received even less attention in past studies on residential satisfaction, ostensibly because of doubts about the importance of this variable. Lansing et al. (1970) found that access to bus transit had little bearing on the attitudes of new-town residents. Because most research on residential satisfaction has focused on suburban areas, where transit services are often meager, these results are perhaps not surprising. It might very well be that transit access has perceived importance only in large metropolitan areas, such as the San Francisco Bay Area where our work was conducted, which have substantial numbers of downtown employees who commute by transit.

## 1.6. Other Attitudinal Surveys on Neighborhood Simulations

Even less work has been conducted to date on the attitudes of Americans to simulated environments, be they transit villages or other settings. Two theses recently completed at the University of California at Berkeley, both chaired by the authors of this report, specifically studied attitudes toward different residential densities. Both used overlays of slides to create photomontages that simulated housing developments near northern California rail stations.

Ketelsen-Johansson (1994) presented front- and rear-lot images for homes in neighborhoods with densities in the range of 10.2 to 36.3 dwellings units per acre to 36 Bay Area residents from several neighborhoods. She presented slide images of neighborhoods of varying densities, both with and without amenities, to discern the importance of such features as lakes, open parks, shops, and transit. Ketelsen-Johansson found that suburban dwellers and home owners were less receptive to increasing densities even after amenities were added. Amenities most strongly preferred were such natural features as lakes, natural views, and hillside landscapes. Proximity to mixed land uses and rail transit were less valued. She found people rated neighborhoods as less desirable as density increased.

In another study of the relationship between residential density and housing satisfaction, Shaw (1994) found that high-density housing was strongly disliked by most of the 84 Bay Area and Sacramento residents who were surveyed. Shaw showed residents images of neighborhoods close to both rail stations and freeway interchanges; housing near transit was generally preferred to housing near freeways. Surpris-

ingly, however, the densest housing was preferred near highways instead of rail stations. Younger and poorer respondents were more favorably inclined towards higher-density housing.

While both of these simulation studies confirmed what others have found, that Americans prefer lower-density neighborhoods, the use of slides to superimpose dense housing projects on images of suburban rail stations probably failed to portray potentially attractive neighborhoods. Photomontage images, for instance, portray natural qualities that are unobtainable in most settings. Also, these studies were not able to satisfactorally control for the influences of other factors that likely influence reactions, such as architectural style or illumination of the scene. Moreover, slide presentations were static, showing single images of a street leading to a transit stop, as opposed to "walking" respondents through a simulated environment. The research that follows aims to overcome these shortcomings.

## 1.7. Report Outline

The remainder of this report consists of four chapters. Chapter Two summarizes the research design used in carrying out this study. Details about the computer-generated simulations, field surveys, sampling approach, and questionnaire design are discussed. Chapter Three presents the results of how 140 residents of the San Francisco Bay Area reacted to the four simulated transit-oriented neighborhoods. Ratings of specific features of each neighborhood are summarized, and the central hypotheses posed by this study are tested. Chapter Four summarizes the attitudinal responses of 24 of the Bay Area's largest housing developers to the same four simulated neighborhoods. Developers' views toward the concept of transit-oriented development as well as the research methodology are also summarized. The concluding chapter summarizes the research findings and suggests directions for future transit village designs as well as future research on the market potential of such built environments.

# NOTES

[1]Laguna West, for instance, is today served solely by bus transit, which operates as typical suburban services with long headways. Although the project was planned to allow an eventual light-rail services, everyone agrees rail will not reach the site until dozens of years in the future, and then it will only skirt the project.

[2]As applied in the housing field, hedonic price models attempt to gauge the relative importance of various attributes of a residential property into components that can be individually measured —e.g., number of bathrooms, square footage, existence of a fireplace, etc. Prices are estimated for each component using multiple regression analysis.

[3]See Shaw (1994) for a good review of previous work on residential satisfaction.

# Chapter Two

# Research Design and Methods

## 2.1. Introduction

Visual simulations of hypothetical neighborhood settings were used to elicit viewer responses to residential density and amenity configurations. This chapter discusses the research design: the creation of visual displays, design of the questionnaire, pretesting, selection of respondents, and in-field presentations.

## 2.2. Simulation Literature

Visual simulation in planning and research has made important advances through recent developments in digital image-recording and three-dimensional computer modeling techniques. Although the technological developments of photorealistic eyelevel scenes generated by computer are a recent accomplishment, earlier experiments with photorealistic eyelevel simulations using traditional cinematographic technologies have successfully validated realistic eyelevel scenes for research and professional planning applications (Bosselmann, 1993; Bosselmann and Craik, 1987). The immediate goal of visual simulations is to produce a high level of realism in the representation of hypothetical environments. Judgments respondents make after viewing a simulated environment should be identical to those they would make after an experience of the same environment in the real world. From viewer to viewer, judgments may differ, but an individual should respond to the simulated experience in much the same way as he or she would to the real-world experience. This comparison of responses to real places and simulated places was the basis of validation research carried out at the Berkeley Simulation Laboratory (Craik and Feimer, 1988). The research took five factors into consideration that influence how an individual forms impressions about an environment. They include (1) the characteristics of the observer, including attitudes toward an environment; (2) the medium chosen for representation of an environment or method of encounter; (3) the response format— that is, the context within which responses are made or impressions are formed; (4) the attributes of an environment; and (5) the process of cognition, including prior familiarity with the environment. These five factors guided the design of visual displays, the questionnaire, and the field presentations for the present study. We were admittedly unable to account for the full influences of these factors on respondents' attitudes towards transit-oriented communities. Such places do not exist in California, and most of our respondents were not familiar with them unless they have visited Europe.

## 2.3. Design of Visual Displays: Constants and Variables

Respondents were expected to make judgments about residential density and the presence or absence of community amenities. We assumed that respondents would accept higher residential densities

if supported by more and varied amenities, such as proximity to transit, commercial retail and services near the station, and a community park or open space. Respondents were expected to judge density and amenities independent of a neighborhood's visual appeal or design. In other words, the visual character of the residential setting should remain constant; only density and amenities should vary. Therefore, in designing the visual displays, we had to show the same architectural quality at all density levels. Careful decisions had to be made regarding many details of the simulated environment, including architectural style, articulation of facades, colors and textures of materials, orientation of entrances and windows, and the landscape design of the private spaces between public streets and building entrances. We decided to render building facades in a contemporary, modern style. Other styles would have been possible design choices, such as post-modern or any other eclectic style. The important decision was not a style *per se*, but a style that would appear plausible at four very different density levels.

Additionally, the design of streets and landscaping remained the same in all simulated images. Buildings were generally of the same height, two to three floors, and identical floor space (1,100 sq. ft. per unit of housing),[1] and were placed at a constant setback line. The buildings faced the street with entrances and windows in the same manner and style. The streets were of identical width, had the same number of trees, planted in identical treewells, had identical sidewalk width with roll-curbs, and the same visible blue sky. Because residential densities varied, so did the frontage length and depth of properties. Lower densities were associated with larger frontage length, possibly space between buildings, and large rear yards. Residences in higher density neighborhoods had shorter frontage lengths, no separation between structures, and smaller rear yards.

In deciding on the densities, we were guided by a study of medium-density housing developments recently completed in the San Francisco Bay Area. Also, the property development division and members of the BART board of directors had expressed density expectations for BART stations yielding up to 50 units per acre. We decided to design four distinct neighborhood scenarios, each with a substantially different density: 12, 24, 36, and 48 dwelling units per acre (dua). Thus, this density range incorporates the minimum density necessary to support rail transit (12 dua), as established by Pushkarev and Zvpan (1977), as well as the upper boundaries (50 dua) that BART hopes to promote around its stations (as well as what can be built without going to four-story structures with elevators and structured parking). One other important constant that had some bearing on design was ownership. We assumed that a successful transit village would need to be home mainly to permanent residents as opposed to more itinerant renters. Thus, all units were designed as if to appeal to potential homeowners.

*Density*

The lowest density, 12 dua, consisted of two-story, free-standing, single-family homes with a 22-ft. frontage length. Each property measured approximately 32'x70' (2,240 sq.ft.). A driveway led to a garage in the rear of each property. The next lowest density, 24 dua, consisted of two-story attached single-family

rowhouses with an 18-ft. frontage length, constructed above individual garages. Each property measured 18'x70' (1,260 sq.ft.). The rowhouse design with individual garages was again used for the 36-dua density, but the frontage length was reduced to 16 feet, resulting in a property of 16'x54' dimensions (864 sq.ft.). The highest density, 48 dua, was designed as a six-unit, three-story condominium with a frontage length of 52 feet placed on a 52'x63' property (3,276 sq.ft., or 546 sq.ft. per unit).[2] The parking concealed towards the front of the building extends under a podium into the rear of the property. Rear-yard space was designed on the roof of the podium.

As mentioned earlier, all four densities face residential streets of identical design and width, 30 feet between curbs, plus five-foot-wide walks on both sides, resulting in a 40' right-of-way with 7-foot-wide setbacks between the right-of-way and the building frontages. All densities were measured from the middle of the right-of-way to the middle of the next right-of-way across city blocks with parallel streets.

*Amenities and Activities*

We assumed in our research that residential amenities such as parks, stores, and services could be designed to compensate for higher densities. Respondents imagining themselves living in the simulated neighborhood, we believed, would find higher densities acceptable if neighborhood amenities were part of the design. Therefore, we decided to show the two higher densities coupled with more amenities than the two lower densities. Upon viewing a model home at the 36- or 48-dua density, the respondents imagining themselves as visitors to the simulated neighborhoods would see a park at the end of the residential street and, upon turning into the next street on their simulated walk towards the BART station, the viewers would first encounter a cafe, then a convenience store, and, upon entering the plaza in front of the BART station, additional commercial space with outdoor seating.

A visitor to the neighborhoods with 12- and 24-dua densities would not see a park at the end of the residential street but instead additional homes facing the adjacent street. He or she would not encounter the cafe at the corner, but only the convenience store; and, upon entering the square at the BART station, the person would see fewer commercial spaces and less outdoor seating. On these alternative walks, a potential visitor would also encounter different activities. Associated with higher densities, 36 and 48 dua, more people would make their way towards the station and more cars would be parked alongside the streets. In the two lower-density communities, a potential visitor would encounter fewer people and fewer cars in the street. For the principal view from one's residence to the end of their local street, we decided to show one car and no pedestrians for the 12-dua density. At 24-dua density, one person would walk in front of the viewer and two cars would be parked along the residential street. At 48 dua, three people would be visible plus three cars. At 48 dua, five people and four cars would appear in the street. Upon entering the station square at the BART station, 17 people would occupy the space in the two higher-density scenarios (36 and 48 dua) and eight people in the 12 and 24 dua ones. Thus, the number of people and parked cars in each viewscape increased with density, though not exactly proportionally. Notably, the number of pedestrians

increased with density to reflect the belief that a transit village environment would encourage more walking and lower automobile dependency.[3] Constant in all density scenarios were two parking structures flanking the station square at the entrance to the BART station, with a train visible in the station and a busstop at the far-right-hand corner of the station square. Also, all four density scenarios had identical apartment structures in the station vicinity.

## 2.4. Computer Modeling and Image Production

We selected the South Hayward BART station as a site for the simulation experiment. Each of the four simulated neigborhoods was designed according to the layout of blocks and streets in the vicinity of this station. The South Hayward station is typical of BART properties where transit-related housing might be considered in the future. A large parking lot is surrounded by predominantly single-family neighborhoods, including some medium-density apartment buildings. In the vicinity of the station, located at a two-block distance, is a commercial strip designed for roadside automobile-oriented retail and services. The station and the BART line are located next to, but independent of, a railroad right-of-way accommodating freight, and Amtrak's commuter passenger service (San Jose-Oakland-Sacramento).

The four community scenarios depicting the four residential densities with associated amenities and activities were modeled using a three-dimensional computer modeling and animation application (3D Studio). The model was designed like a kit of parts with exchangable components depicting the variable factors of our study (i.e., density, amenity, people, and cars), and permanent components depicting the constant factors of the study (i.e., streets, BART station, trees, etc.). The computer-generated kit of parts was created from digitized drawings. Early in the construction of the model, it was possible to animate a "walk" through the computer display, starting with a view out of a second-story rear window into the rear yard, proceeding to the front of the house, looking down into the street, moving downstairs to the front door, looking across the street, turning to the right, walking out of the entrance, moving down the street towards the intersection, turning into the adjacent street, and finally arriving at the BART station. At each of these locations along the walk, we selected "key frames." At this point in the production of images, it would have been possible to create a complete animated walk through each of the four communities at the four different densities and associated amenities. The product of such a simulation would have taken the form of a video tape to be shown at the field presentations. To allow more control over the presentation of images, we decided instead to produce still views, transfer them to photoslides, and use one slide projector for field presentations. As a result of this decision, the "key frames" along each walk were carefully chosen to produce visual continuity from one image to the next. The final number of images totalled nine views per walk, taken at identical locations in each sequence (one sequence for each of the four scenarios). Each view was photorealistically rendered with trees, facade and surface textures, colors, people, and cars. The light sources were set consistently for each sequence, producing realistic shadows and shaded surfaces. Likewise, the angle of view was set consistently at 60°. The images were

stored in separate digital image files and transferred in full color to photoslides via a film recorder and transferred in black and white for printing in this report. They are shown in Figures 2.1 to 2.4 in order of the densities (12, 24, 36, 48 dua) and the view sequences shown (1 through 9). Table 2.1 describes what is shown in each view sequence.

Some of the limitations imposed by our choice of simulation media included the somewhat "artificial" image quality of the rendered views. State-of-the-art computer-generated renderings have a "stark" appearance, partly because everything in the view appears to be brand-new, and partly because of the artificial light quality and reflectivity of surfaces and colors. These concerns are not as apparent in the black and white image reproductions of this report, but they were apparent on the color slides. The "artificial" image quality and the "newness-bias" might very well have influenced viewers' perceptions. The direction of this influence, in favor of the design or against, is unknown.

## 2.5. Questionnaire Design

The design of the questionnaire went through a number of iterations and revisions between the pretest (see Section 2.6) and the final showing. In its final version, the questions were structured into four parts (see Appendix for a copy of the final survey instrument). Each part was introduced briefly by a narrative which was read out to the respondents. Respondents were asked to follow the narrative by reading directly from the questionnaire. The introduction to Part One read as follows:

> ### Transit Housing Survey
> Your contribution today will help us gain insight into the possibility of developing housing near transit stations. We will show you images of four simulated communities near transit stations and ask you to respond to questions about the images. On the next two pages, we would like you to answer a set of general questions.

This introduction was followed by background questions, including questions aimed at understanding respondents' current travel and housing characteristics. At the end of Part One, we asked for household income and respondents' preference ratings regarding walking distances from home to transit, parks, stores, and services. Responses to these questions were later cross-tabulated with ratings for the four simulated neighborhoods to test some of the central hypotheses of this research.

Part Two of the survey process involved showing the four slide sequences and asking respondents to rate the neighborhoods in terms of perceived densities, amenities, and other features. The following was posed: "Based on the images you have seen, how desirable is the neighborhood in terms of:" Listed below this question were rating scales for stores and services, public transportation, public parks, housing density, and architecture. Seven-point rating scales were used, with 0 in the center indicating neutrality or indifference, -3 on the left indicating they viewed the image as highly undesirable, and +3 on the right indicating they considered the image very desirable. Prior to rating, open-ended questions were asked about what respondents liked and disliked about the different neighborhoods. After the rating, respondents were asked to estimate the value of the homes shown.[4] Finally, the last question asked for an overall

16

# Figure 2.1
## 12 Units per Acre Density

5

1

2

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4

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7

8

9
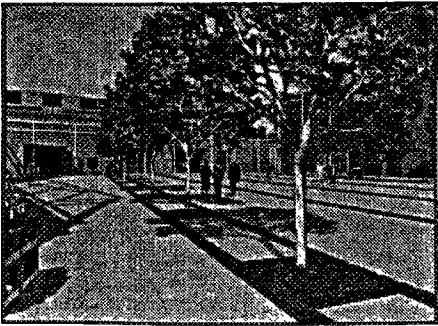
**Figure 2.2**
**24 Units per Acre Density**

1

2

3

4
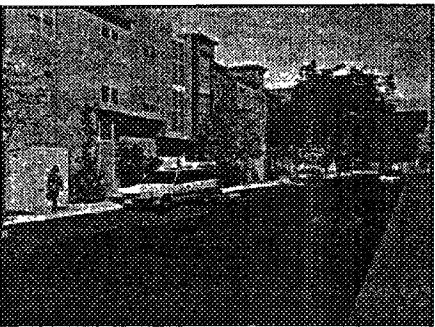
5

6
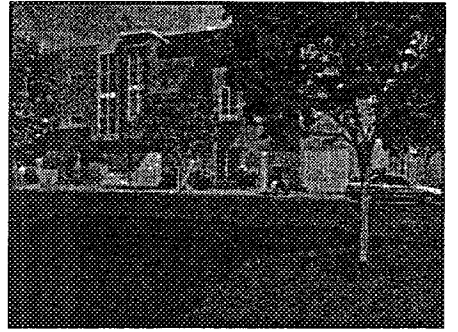
7
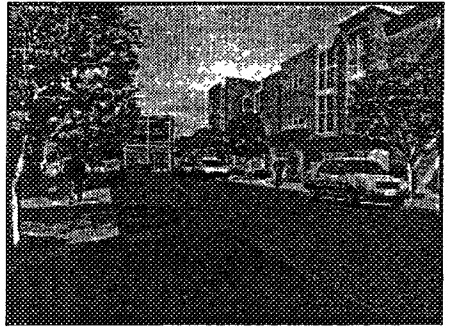
8
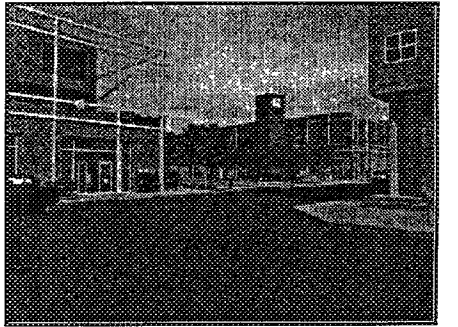
9
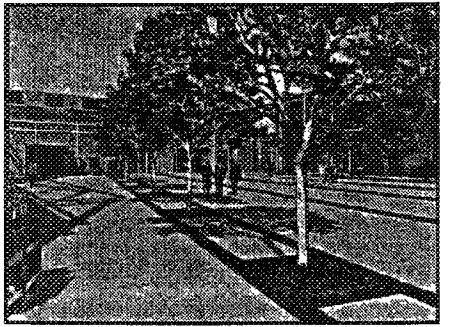
## Figure 2.3
## 36 Units per Acre Density

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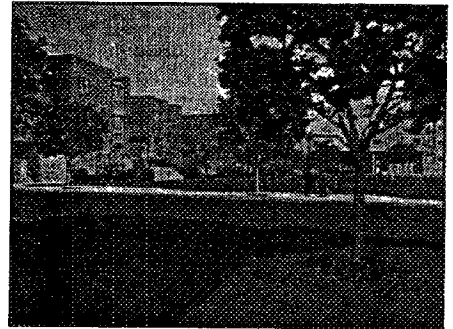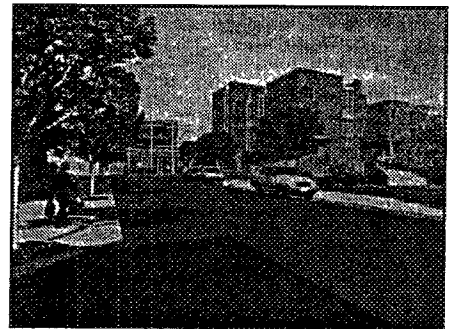
9
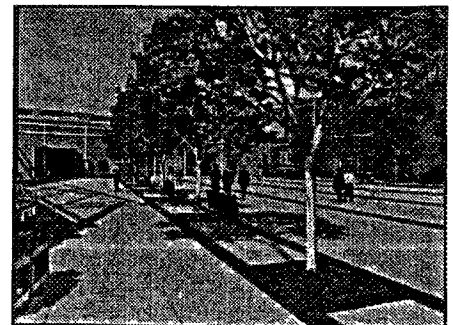
**Figure 2.4**
**48 Units per Acre Density**

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2
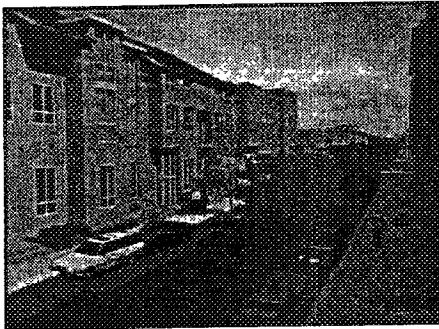
3

4

5
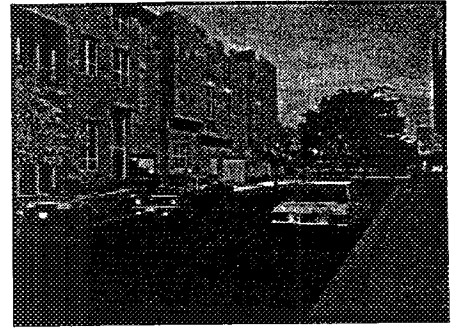
6
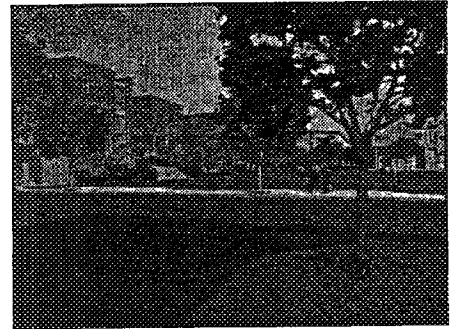
7
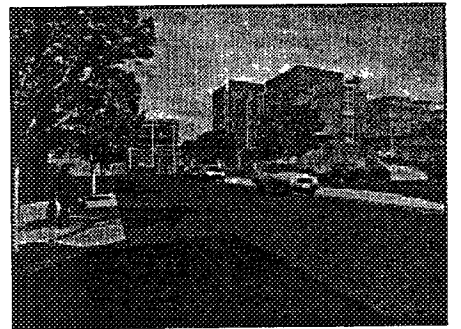
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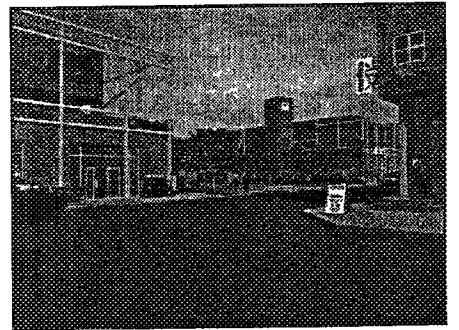
9
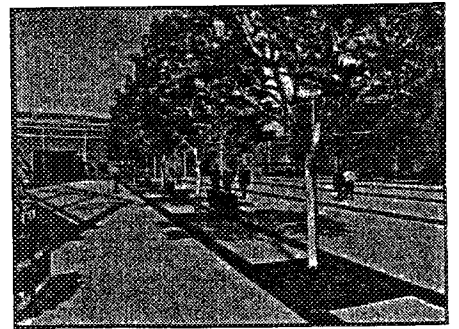
# Table 2.1

## Simulated View Sequences for Four Neighborhood Scenarios

### Density Low, 12 dua, Amenity Low

- View from an upstairs window into the rear yard (VW1,12)*
- View from upstairs, front of the house down into residential street (VW2,12)
- View from the front-door across the street (VW3,12)
- View down residential street (VW4,12)
- View midblock local street (VW5,12)
- View at the end of local street across intersection (VW6,12)
- View down adjacent street (VW7,12)
- View of the station square (VW8, low dens. 2)
- View of the BART entrance standing in the square (VW9, low dens. 2)

### Density Medium, 24 dua, Amenity Low

- View from an upstairs window into the rear yard (VW1,24)
- View from upstairs, front of the house down into residential street (VW2,24)
- View from the front-door across the street (VW3,24)
- View down residential street (VW4,24)
- View midblock local street (VW5,24)
- View at the end of local street across intersection (VW6,24)
- View down adjacent street (VW7,24)
- View of the station square (VW8, low dens. 2)
- View of the BART entrance standing in the square (VW9, low dens. 2)

### Density High, 36 dua, Amenity High

- View from an upstairs window into the rear yard (VW1,36)
- View from upstairs, front of the house down into residential street (VW2,36)
- View from the front-door across the street (VW3,36)
- View down residential street (VW4,36)
- View midblock local street (VW5,36)
- View at the end of local street across intersection (VW6,park)
- View down adjacent street (VW7,park)
- View of the station square (VW8, high dens. 2)
- View of the BART entrance standing in the square (VW9, high dens. 2)

### Highest Density, 48 dua, Amenity High

- View from an upstairs window into the rear yard (VW1,48)
- View from upstairs, front of the house down into residential street (VW2,48)
- View from the front-door across the street (VW3,48)
- View down residential street (VW4,48)
- View midblock local street (VW5,48)
- View at the end of local street across intersection (VW6,park)
- View down adjacent street (VW7,park)
- View of the station square (VW8, high dens. 2)
- View of the BART entrance standing in the square (VW9, high dens. 2)

*This code signifies the view number (VW) and density or dominant image of each slide. Thus, (VW1,12) specifies the first view for the 12 dua neighborhood. (VW7,1park) signifies the seventh view of the sequence, which contained a park. This slide was shown for both the 36 and 48 dua scenarios.

rating of the neighborhood. Prior to these questions and ratings, the respondents were given an introduction which was read out to them. The text of the introduction to Part Two read as follows:

---

### INTRODUCTION TO SLIDE VIEWING

Shortly you will see a simulated sequence of images depicting the experience of visiting and potentially living in a Bay Area community. There will be four sequences, each depicting a somewhat different neighborhood. We will show you each sequence twice. During the first showing you should concentrate on the images, imagining yourself in the places shown. Then, we will show you the same sequence again at a slower pace. You should watch the images very carefully. During the second showing of each sequence, you are to answer questions about some of the details you have seen.

The four residential communities do not actually exist. They are simulated using advanced computing techniques. Also, they appear as if they were brand new, recently completed. As you view the sequences, image yourself visiting the neighborhood with the purpose of possibly purchasing a home for yourself or your family. The houses in each sequence are of identical size, approximately 1,100 square feet, with two bedrooms and one and half baths. Each unit has a garage space for one car. Consider that the neighborhood lies in a part of the San Francisco Bay Area similar to where you presently live and near a rail station like BART.

---

Thus, the respondents saw each slide sequence twice, and responded to questions on each sequence after the second showing. They then proceeded on to the next neighborhood sequence until all four sequences were shown. The slide sequences were shown in random order; a different random order was used for each field presentation in order to remove any biasing influence of sequencing.[5]

Part Three asked for a rank ordering of all four slide sequences. The introduction read out to the respondents read as follows:

---

### FOUR SEQUENCES TOGETHER

Now you will see all four sequences again and we would like you to compare and rank them, from best to worst. Each sequence will be shown in exactly the same order as it was shown earlier, except it will be shortened to only four images. One sequence will be shown after the other until all four sequences are shown. After all four have been shown twice, we will stop the projector and you will answer the remaining question. Please watch carefully.

---

The respondents were asked to rank the four communities shown in the four slide sequences from most liked to least liked. They were asked why they liked their first choice best, and what would have to be changed to make their least favorite choice more acceptable. Finally, they were asked to rank-order the four communities according to density. As mentioned in the introduction to Part Three of the survey, the slide sequences were shown in the same order as they had been shown in the previous two, but were shortened from nine to four representative slides for each seqeunce.

Part Four consisted of a respondent debriefing. The purpose of the debriefing was to verbally inform the participants about specific factors that distinguished the four neighborhoods. The intent of this was to determine whether this information had any bearing on respondent rankings. The introduction read to the participants went as follows:

FINAL RANKING

We appreciate your participation thus far. We would like to take a minute to draw your attention to some specific details of the images shown. Each slide sequence has varying densities and community amenities, yet several things in the images remain the same. We have assumed in our study that people would approve of living in higher density if there were more amenities such as a park or open space, convenience stores, and access to rail transportation.

Items that remain the same are road widths, architectural style, building colors, the tree-lined streets, the blue sky, the parking garage near the BART station, the bus near the plaza and the BART station itself. Also consistent are the apartment buildings that are located at the end of the residential streets. Things that increase with increasing density are the amount of open space, convenience stores, cafes and benches in the plaza. Other things that change are the number of people and automobiles that would accompany the changing housing density levels. Now that you know about these changes, do they influence your perception of the communities? The sequences will be shown slowly one last time, using only four representative slides for each sequence, so that you may rank the communities again. (Please do not change your ranking on the previous page. Just rank the communities one last time on this page.)

Two questions followed the showing of the four sequences, and respondents were asked to make a final rank ordering. They were then invited to make open-ended comments. Answering all questions including slide viewing time took 35 to 45 minutes to complete.

## 2.6. Pretest

A first draft of the questionnaire was pretested with a group of 26 graduate students and faculty members from the College of Environmental Design, University of California at Berkeley. Acknowledging that this group would be more perceptive and critical toward the images shown than the general public, we used our colleagues and students as a "sounding board" to revise the research design so as to increase the internal and external validity of the study. The format of the slide presentation and the questionnaire was similar to the final version; however, some important changes to the final format were made as a result of the pretest experience. A number of viewers responded negatively to the pace of the slide sequences. Some could not distinguish the differences between sequences at all. Others could distinguish, for different reasons, the four neighborhoods from one another because of different backyard dimensions, presence and absence of a park, and facade spacing. Few respondents at the pretest saw any difference in the number of stores and services associated with the four densities. We thus changed the last two images of each sequence, clarifying the view of stores and services at the BART station. We concluded that the narration of the slide sequences had to be made clearer, the pacing slower, and that a repeated showing was necessary prior to rating each sequence. Also we decided to create a composite slide showing all four representative views of each sequence. This last slide followed the second showing of each sequence and stayed on the screen during the time participants filled in answers to rating questions, thus allowing them to double-check images they saw earlier. Figures 2.5 to 2.8 show the composite images.

Respondents at the pretest commented on the architecture, some finding the appearance "artificial," the colors "wrong," "too dominating." Several respondents, though, liked the "urban" quality and, generally, many respondents liked the landscaping. Respondents had minor suggestions with regard to the wording of the questions, and these suggestions were incorporated into the final version of the question-

Figure 2.5. Summary Images Shown for the 12 Dwelling Units per Acre Neighborhood
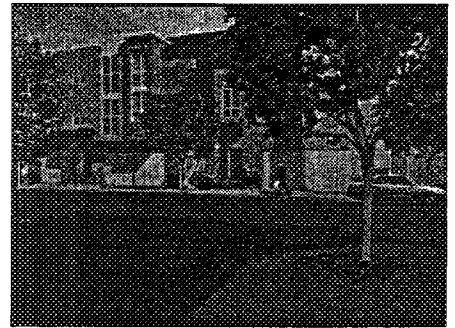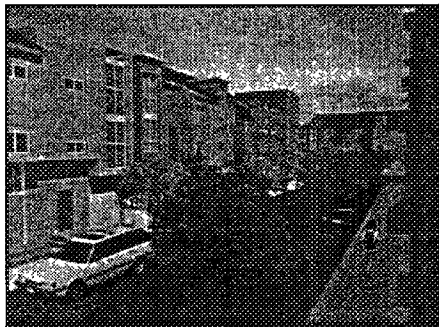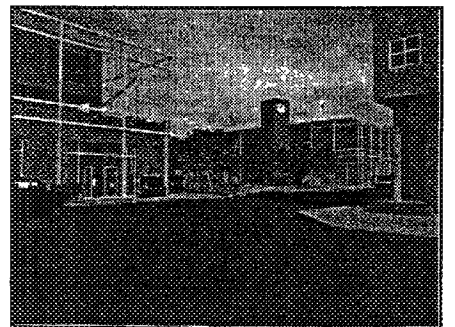


Figure 2.6. Summary Images Shown for the 24 Dwelling Units per Acre Neighborhood

**1** 

**6** 
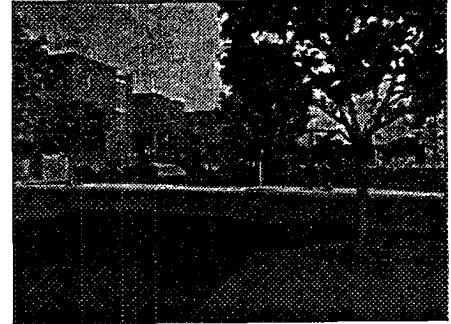
**2** 

**8** 

Figure 2.7. Summary Images Shown for the 36 Dwelling Units per Acre Neighborhood

**1** 

**6** 

**2** 

**8** 
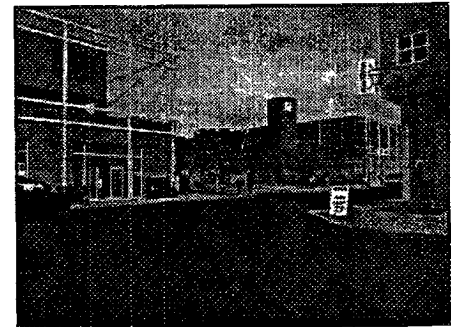
Figure 2.8. Summary Images Shown for the 48 Dwelling Units per Acre Neighborhood

naire. Upon analyzing the results of the pretest, most respondents ranked the 12 and 36 dua neighborhoods as more desirable than the 24 and 48 dua ones.

## 2.7. Sampling Locations and Respondent Selection

We scheduled eight field presentations in neighborhood/cities with different existing densities and levels of urbanization: urban (San Francisco, Berkeley), older suburb (Hayward, Ashland, and El Cerrito), new suburb (Dublin and Walnut Creek), plus one presentation to a group of the Bay Area's largest housing developers and BART property managers.

Each solicitation approach had its strengths and weaknesses. A combination of newspaper ads, telephone solicitations, and passer-by solicitations were used in recruiting survey participants. All participants received $20 for their time and effort. The newspaper ads, combined with screening those who telephoned a number in response to our ads, were successful in bringing our work to the attention of many Bay Area residents and attracting a relatively large response; however, some respondents seemed attracted more by the $20 offer for participating than by an interest in transit-based housing or by a desire to explore possible options for purchasing a new home.[6] Telephone solicitation using randomly selected numbers for predetermined area prefix codes had a low success rate.[7] For the Berkeley field presentation, over 600 numbers for prefixes in the city of Berkeley, Albany, and Emeryville were dialed; three persons showed up at the meeting, though some additional potential respondents came late and had to be turned away. The most successful method was direct passer-by solicitation. We handed out fliers to pedestrians in the vicinity of the sampling location, between one-and-a-half hours and 15 minutes prior to the appointed survey time. Fliers invited people to participate in a research survey to be held nearby. The flier noted the address of the sampling location, time of the meeting, and the promise to pay $20 upon completion of the one-hour participation.[8] Collectively, these solicitation approaches provided us with 170 participants for the seven sites at which the general public was surveyed.[9]

## 2.8. Field Presentation

The field presentations took place in community centers (El Cerrito, Walnut Creek), a high school (Hayward), university classroom (Berkeley), the office of the American Architecture Association (San Francisco), and city hall (Dublin). One field presentation was scheduled in Ashland, an unincorporated community near Hayward. Here we were invited to make a presentation to community representatives at their regular meeting. Unlike the other field presentations, the participants of this meeting did not receive reimbursement, nor did the developers at the meeting scheduled at BART headquarters.

Table 2.2 identifies the date of each field presentation, along with the number of participants at each site and the order in which the slide images were shown. All field presentations were conducted during the daylight period of a spring weekend day, to increase the chances of recruiting participants, except the presentation to the Ashland neighborhood association (on a Thursday evening) and Bay Area

# Table 2.2

## Dates of Field Presentation, Number of Respondents, and Order of Slide Sequences Shown

| Location | Date (Day of Week) | No. of Respondents | Slide Order* |
|----------|--------------------|--------------------|--------------|
| Dublin | 4/23/94 (Saturday) | 5 | 2,3,4,1 |
| Berkeley | 5/7/94 (Saturday) | 48 | 2,1,3,4 |
| Oakland | 5/12/94 (Thursday) | 12 | 3,4,1,2 |
| Walnut Creek | 5/14/94 (Saturday) | 25 | 3,1,4,2 |
| Hayward | 5/21/94 (Saturday) | 19 | 4,1,2,3 |
| El Cerrito | 5/22/94 (Saturday) | 19 | 4,1,3,2 |
| Oakland (Developers) | 5/24/94 (Tuesday) | 17 | 3,2,4,1 |
| San Francisco | 5/28/94 (Saturday) | 31 | 4,3,1,2 |

*Where 1 = 12dua, 2 = 24dua, 3 = 36dua, 4 = 48dua)

developers (at a Tuesday breakfast gathering).[10] Once they arrived at a site, participants were invited to enter the room of the slide showing. Participants sat in chairs that faced a large slide screen. After handing out questionnaires and sharpened pencils to all participants, we thanked people for attending, briefly stated the purpose of the gathering, and proceeded with the field presentation. If at any point participants had a question during the presentation, they were asked to raise their hand, at which time one of the four to five researchers running each field presentation would assist them with their question. In this way, other participants would not be disrupted by the questions of others. Upon the completion of the field presentation, participants were asked to turn in their completed questionnaires and sign an attendance form, at which time they received an envelope with the $20 payment and our verbal thanks.

## 2.9. Conclusion on Research Design

This research was designed to elicit responses from the general public as well as developers toward simulated transit-oriented neighborhoods. In particular, the research was designed to control for many potential confounding factors so that the central question posed by this research could be tested: will people accept densities sufficient to support rail transit services if they are given basic community amenities in return? The research design chosen for addressing this question is, to the best of our knowledge, original and is thus, in and of itself, of interest in terms of how well it addresses the questions posed. Thus, in addition to testing hypotheses and defining potential markets of transit village dwellers, we were also interested in assessing the utility of the simulation models and research methods chosen. The next two chapters specifically address these questions.

# NOTES

[1] A 1,100 sq.ft. unit typically corresponds to a unit with two bedrooms, 1-1/2 bathrooms, a living room, and small dining room. Such unit sizes are common for condominium and apartment complexes, and are normally home to families of limited size.

[2] Lot sizes decreased proportionally with density —from 2,240 sq.ft. per unit (at 12 dua) to 546 sq.ft. per unit (48 dua). Multiplying by dwelling units per acre, each acre of land contained the following total lot areas under each scenario: 12 dua —26,880 sq.ft. (12x2,240), 24 dua —30,240 sq.ft.; 36 dua —31,104 sq.ft.; and 48 dua —26,208 sq.ft. (48x546).

[3] In order to reduce any possible biasing effect, the back sides of most pedestrians were shown so as not to reveal the age, race, or perhaps social status of people. Also, the vehicles shown were usually late-model mid-size sedans in the mid-price range. No trucks, pickups, or motorcycles were shown in any of the images.

[4] Respondents were asked to estimate the value of each home assuming that it was located in the neighborhood where they currently live. This was done to control for the effects of land values on the perceived value of the housing units observed, typically the most expensive component of a home purchase, in the Bay Area at least. Thus, relative differences in housing values across the four neighborhood scenarios reflected perceived differences in the value of improvements on land, controlling for land values.

[5] We suspected that ratings might tend to be higher for the early sequences because of the novelty factor. They might tend to fall for latter sequences because some respondents might begin to tire from viewing many images. Random ordering of sequences reduces the likelihood of such biases. The most straightforward sequencing would have been to show neighborhoods in the order of the lowest to the highest densities. This would have likely biased responses in favor of the 12 dua and 24 dua neighborhoods.

[6] Paid newspaper ads were placed in the classified section (under the "Announcements" heading) of the *San Francisco Chronicle, Oakland Tribune, Bay Guardian*, and *East Bay Express* (the latter two being free publications). Announcements appeared for five consecutive days, between three to ten days before the field presentation. Advertisements informed readers of a housing survey at a general location for a specified time and date, and the offer of $20 per participant. Ads contained a phone number that interested individuals could telephone to sign up for the field presentation and find out a specific address. The phone number had a recorded message about the survey, and requested the names and phone numbers of potential participants. We returned all telephone calls to discuss the survey further with interested parties. This approach allowed us to screen individuals to ensure they were above 18 years of age, lived full-time in the Bay Area, potentially might be in a position to purchase a home, and were not from a group (e.g., young singles) who were already overrepresented in the survey. Advertisements were placed for field presentations in Dublin, Berkeley, and Walnut Creek. They were discontinued for the other sites because of some concern over the non-representativeness of some participants —mainly the attraction of disproportionate numbers of unemployed individuals and the homeless. It became clear to us that those reading the classified ad sections of major newspapers and reponding to $20 offers under the "Announcement" headings did not represent a typical cross-section of Bay Area residents. Since we hoped respondents would represent potential homebuyers, this biasing factor was of particular concern. We thus discontinued advertising as a recruiting device.

[7] In all, over 1,300 telephone solicitations were made; however, fewer than 3 percent of those called expressed an interest in participating, and even fewer attended the field presentations. Using a random dialing system, telephone solicitors first mentioned that they were from the University of California at Berkeley and were conducting a study on the potential for constructing more housing and developing better neighborhoods near BART stations. Around half of those called expressed disinterest at that point, at which the caller thanked them for their time. Next, people were informed that a survey on attitudes to possible computer-generated neighborhoods around BART would be conducted at a specified location, date, and time. They were then invited to participate, and informed the survey would take less than an hour of their time and they would receive $20 for participating. Most of those still on the line turned down the offer, typically because they were too busy or had prior commitments. If a non-residential number was dialed, the solicitor stated he or she had reached a wrong number, and the next randomly chosen number was then dialed. If the solicitor was unsure whether the person answering the phone was 18 years of age or more, they politely asked whether this was the case. Children were asked to give the phone to one of their parents or any other adult present. While some have noted that women tend to answer tele-

phones disproportionately more than men and other possible biasing effects (see Shaw, 1994, for further discussions on possible biases in telephone solicitations), we did not adjust for such factors because of the exceedingly low success rate in recruiting participants. Because of this low success rate, telephone solicitations were attempted only for field presentations conducted at Berkeley, Walnut Creek, and Hayward.

[8]Direct in-field solicitation proved the most successful recruiting approach because those who were approached were already in the vicinity, and thus would not face the burden of scheduling ahead for the field survey and traveling to the site. While virtually everyone who passed by one of the researchers handing out fliers received an invitation, this approach did allow some degree of screening, if only subtly. In particular, we were aware of the fact that certain cohorts had been underrepresented in previous field tests, and thus we made a particular effort to recruit such individuals (e.g., middle-aged couples). This generally involved making a particularly strong plea to such individuals to participate, emphasizing the importance of building more transit-based housing for the betterment of the region. Field solicitations were used at all sites; however, they were relied on most heavily for Walnut Creek, Hayward, El Cerrito, Berkeley, and San Francisco. In the cases of Walnut Creek and Hayward, we were fortunate that Farmers' Markets were held within a mile of each survey site just an hour or so before our presentations, providing a large pool of potential participants.

[9]At several survey sites, interested participants had to be turned away because they arrived too late. Ten minutes after the beginning of the field presentation was designated the cutoff time for allowing people to participate. In all, over 30 individuals were turned away because of late arrival. Additionally, in the case of the Berkeley field presentation, around a dozen individuals were turned away because there were no seats left inside the room where the survey was being conducted.

[10]The weather was generally good on all survey days, except for the April 23 presentation at Dublin, when an unusually heavy rain showered the area before and during the 1:00-2:00 p.m. field presentation. We believe the low number of participants at the Dublin site was due, in large part, to inclement weather conditions.

Chapter Three

Attitudes of the General Public
to Alternative Simulated Transit Neighborhoods:
Survey Results

## 3.1. Background on Survey Respondents

As discussed in the previous chapter, the simulated transit neighborhoods were presented to 170 adults who were recruited among the general population of the San Francisco Bay Area and then asked to complete a questionnaire eliciting information on how they felt about the images shown. While obtaining a true cross-section of Bay Area residents who are willing to invest an hour or so (usually of a weekend) viewing slide images was found to be exceedingly difficult, an effort was made to stage the formal viewing of the slides in parts of the Bay Area that would hopefully increase the odds of obtaining a more representative sample of the population. In that the research focused on developing transit-oriented neighborhoods in settings similar to suburban areas served by BART, we mainly recruited participants from the East Bay, where BART-served suburbs are located — namely, Hayward and El Cerrito (older suburbs) and Dublin and Walnut Creek (newer suburbs). However, in recognition of opportunities for redeveloping some existing inner-city neighborhoods into more transit-village-like areas, we also presented slides and compiled survey responses in two built-up, urban settings: San Francisco and Berkeley. Thus, the targeted sampling frame consisted mainly of adult residents of more suburban-like areas of the East Bay, with a smaller subset of city-dwellers drawn from Berkeley, San Francisco, and elsewhere.

This chapter summarizes the survey results among the 170 adults (age 18 and above) who viewed the images and completed questionnaires — how they rated and ranked the neighborhoods and the neighborhoods' physical attributes. This initial section presents background characteristics of the individuals who were surveyed, comparing these to 1990 census population statistics for the three BART-served counties combined: Alameda, Contra Costa, and San Francisco.

*Demographic Profile*

The two main characteristics of respondents recorded in the surveys were their ages and annual incomes. The mean age of respondents was 37.8 years; this is fairly close to the average age for residents 18 years and above of 41.2 years for Alameda, Contra Costa, and San Francisco counties combined. Around 30 percent of the respondents were between 18 and 28 years of age, and 6.3 percent were over 65.

The mean annual income of respondents was around $18,500, with considerable variation. Over half earned less than $21,000 per year, and 6.2 percent made over $60,000 annually.[1] Since income data were compiled only for respondents themselves as opposed to all household members, it was not possible

to compare these data to census statistics on annual household income. However, it appears that many respondents were positioned toward the low end of the Bay Area's earnings scale. The relatively large share of low-income respondents could reflect the fact that some were attracted to the $20 payment to participants.

*Household Characteristics*

The average size of households that respondents lived in was 2.79 persons (standard deviation = 1.65). This is fairly close to the 1990 average household size of 2.61 (std. dev. = 1.46) for the three BART-served counties. On average, survey respondents had 1.43 vehicles available for use by household members (std. dev. = 1.35).[2] This is slightly below the average of 1.51 for the BART-served counties (std. dev. = 1.08). Also, 22.6 percent of respondents had no vehicle available to them, compared to 15.8 percent for the three BART-served counties. These statistics on vehicle availability seem consistent with the finding that many survey respondents earned modest incomes.[3]

Around 60 percent of the respondents identified themselves as single — either living alone, with other singles, or raising children by themselves (Figure 3.1). This share is slightly above the 53 percent of adults from the three BART-served counties who were single in 1990.[4] Around one in five of the respondents were married or lived with a partner, but had no children. This is less than the 26 percent of households in the three BART-served counties classified in 1990 as couples without children. Only 12 percent of the survey respondents lived in what might be called a "traditional" household— a couple with children. This is considerably below the 21 percent of households in the BART-served counties that were traditional. In total, then, 20 percent of the respondents currently live in households with children, compared to 28 percent of adults from the three BART-served counties. Lastly, 7 percent of the respon-



Single: Roommates 32%

Single: Live Alone 20%

Single: Children 8%

Retired 6%

Empty-Nesters 1%

Couple: Children 12%

Couple: No Children 21%
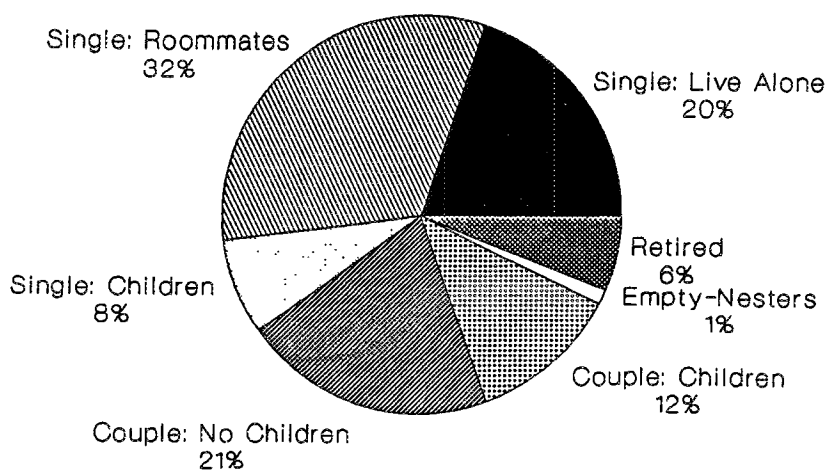
**Figure 3.1. Type of Household**

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dents identified themselves as being retired or an empty-nester.[5] In all, compared to the region at large, respondents tended to be from smaller households, usually without children. Since such households are considered to be good candidates for transit-oriented residences, the survey responses which follow, we believe, are particularly well-suited for gauging the market potential of various types of transit-oriented neighborhoods.

*Type of Residence*

Survey respondents currently live in a wide range of housing types (Figure 3.2). Only 37 percent of the respondents live in single-family homes, compared to 46 percent of households in the three BART-served counties in 1990. Comparable shares of apartment and condominium dwellers were found in both groups — 51 percent of respondents and 51 percent of residents of the three BART-served counties. The biggest difference was in the share living in "other" types of residences (group quarters like dormitories as well as, we suspect, homeless) — 12 percent of respondents versus just 3 percent of all residents in Alameda, Contra Costa, and San Francisco counties. These breakdowns are consistent with the finding that relatively large shares of survey respondents were single.[6]
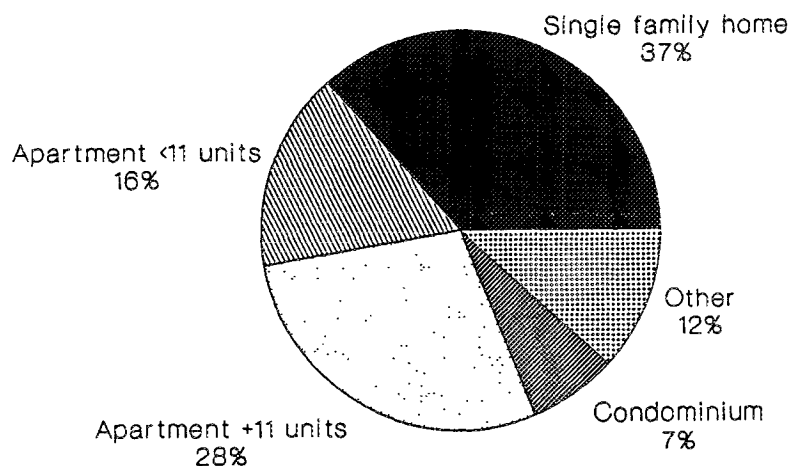


Figure 3.2. Type of Residence

*Commuting Modes*

Since this research concentrated on transit-oriented development, we were also interested in knowing how respondents currently commute to work. Among those with jobs, Table 3.1 shows that the survey respondents are far more reliant on urban transit and other non-auto modes for getting to work than other resident-workers of the three BART-served counties. Three out of ten of the respondents commute to work by BART or bus, over twice the share of all resident-workers of the three counties.[7] Also quite noticeable is the high share of survey respondents who walk or cycle to work. These modal

## Table 3.1

## Work Trip Modal Splits: Survey Respondents and Workers in Three Counties

| Percent Commuting by: | Respondents | Workers Residing in Alameda, Contra Costa, and San Francisco Counties, 1990 |
|---|---|---|
| Drive-Alone Vehicle | 43.8 | 60.5 |
| Carpool/Vanpool | 4.6 | 12.7 |
| Bus Transit | 13.8 | 9.5 |
| BART/Rail | 16.2 | 5.6 |
| Walk | 13.1 | 4.9 |
| Bicycle | 4.6 | 0.9 |
| Other | 3.8 | 5.9 |

Sources: Survey and Metropolitan Transportation Commission (1993).

split results reflect, we believe, some degree of self-selection among the respondents. That is, those who currently rely heavily on BART and other alternative modes might very well have been most interested in the possibilities of transit-oriented development and thus might have been more inclined to participate in the survey, regardless how much we tried to control for such factors. More likely, however, the higher degree of transit-dependency reflected the fact that a disproportionately large share of respondents were from low-income households and were attracted to the survey because of the chance to pick up $20.

The penchant for non-auto commuting among survey respondents is underscored by Figure 3.3, which compares actual commuting modes to how respondents said they would prefer to commute. Over one-quarter would prefer to walk to work and around one out of five would like to take BART to work. A fair number also would like to bike to work. Since these are the very modes of commuting that a transit village is suppose to promote, it again appears that those who responded to our survey are potentially good candidates for living in a transit-oriented neighborhood.

### Summary on Respondent Background

Overall, we believe that the 170 Bay Area adults who responded to our survey make up a good cross-section of potential residents of transit-oriented neighborhoods. Many are single, currently live in apartments, condos, and group quarters, currently commute by non-auto modes, and like to walk and bicycle. While we did not compile complete data on individuals' household incomes, occupations and employment status, and other personal attributes, we suspect that a larger share are from lower-income households than the Bay Area average. The annual earnings of participants themselves were fairly low —most below $21,000 per year. Because the respondents come from the very sorts of households that are
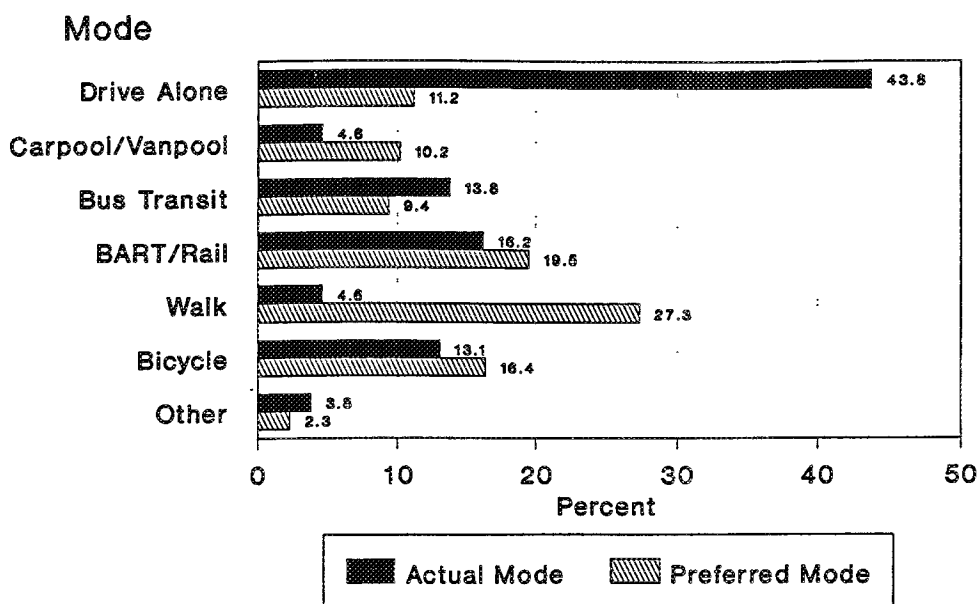
## Mode



Figure 3.3. Actual and Preferred Modes of Commuting

considered to be the best candidates for transit-oriented housing (e.g., singles, beginning stages of life-cycle, modest earnings), we believe they represent a good sample for studying the reactions of potential residents to various types of transit-oriented communities. It is to this question that we now turn.

## 3.2. Overall Neighborhood Ratings

*Desirability Rating*

After viewing the nine slides for each simulated neighborhood, survey participants were asked to rate each neighborhood on a -3 to +3 scale in terms of "overall desirability," with -3 representing highly undesirable, +3 representing highly desirable, and 0 signifying indifference or neutrality. Figure 3.4 presents the average rating of the four simulated neighborhoods. The figure shows that, while none of the neighborhoods were viewed as overwhelmingly more desirable than the others, the lowest-density neighborhood was generally preferred over all others among the 170 Bay Area adults who were surveyed. Important to this research, however, was the finding that "desirability" did not fall off as residential densities increased. In fact, the least desired neighborhood had the second lowest densities — 24 d.u. per acre. It was preferred, on average, even less than the neighborhood which was twice as dense.

The biggest fall-off in desirability was between the neighborhoods with 12 and 24 d.u. per acre, suggesting that the prospect of living in a neighborhood of attached housing 2.5 stories high but without a local park or much in the way of commercial shops is widely disliked (particularly in comparison to semi-

## Neighborhood (DU/acre)
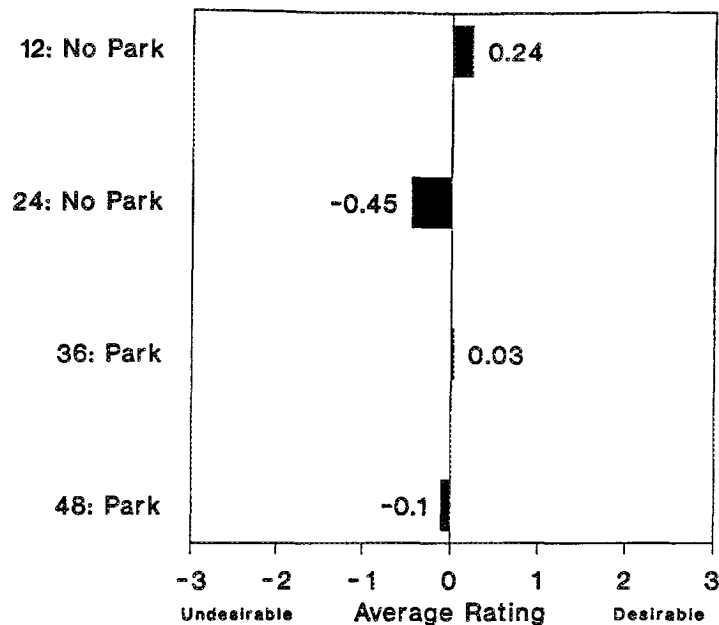


Figure 3.4. Overall Desirability Rating

detached 2-story dwellings at 12 units per acre). Perhaps most telling was the finding that the 36 d.u. per acre neighborhood had the second-highest average rating. Even though, on balance, respondents were fairly neutral toward this simulated neighborhood of rowhouses, they clearly preferred it over the one whose densities were a third less. While the 36 d.u. per acre neighborhood had more retail activities (in addition to traffic and street life), it was the addition of a central neighborhood park that seems to have made the big difference. These additional amenities seemed insufficient to compensate for the higher average densities of 48 d.u. per acre, however — that is, the general public seemed more receptive to more moderate densities of 36 d.u. per acre as long as there was the presence of a significant green space within the neighborhood. Still, having a nice neighborhood park at 48 dwelling units per acre was preferred over a setting with half the density but no park — or perhaps more accurately, it was disliked less.

In order to conduct statistical tests on how significant differences were in overall desirabililty ratings, matched-pair comparisons were drawn. Taking differences in ratings for neighborhood pairs for each respondent effectively removed the influence of all factors other than the variable of interest— desirability rating. Table 3.2 shows that ratings were significantly different for all neighborhood pairs at a .05 probability level except for two: 12 vs. 36 dua and 36 vs. 48 dua. Thus, while respondents preferred living in a 12 versus 36 dua neighborhood, differences were not statistically significant. Nor were they between the two highest-density neighborhoods. The largest and most statistically significant difference in ratings was between the two lowest-density neighborhoods.

## Table 3.2

### Matched-Pair Comparisons of Overall Neighborhood Desirability Ratings[1]

| Neighborhood Comparisons (Dwelling Units per Acre) | Group Mean | Paired Comparison Results | | |
| --- | --- | --- | --- | --- |
| | | Paired Difference | t-value | Significance |
| 12 du/acre vs. | .223 | .687 | 6.24 | .000 |
| 24 du/acre | -.446 | | | |
| 12 du/acre vs. | .253 | .223 | 1.77 | .079 |
| 36 du/acre | .030 | | | |
| 12 du/acre vs. | .247 | .343 | 2.52 | .013 |
| 48 du/acre | -.096 | | | |
| 24 du/acre vs. | -.421 | .460 | 4.40 | .000 |
| 36 du/acre | .049 | | | |
| 24 du/acre vs. | -.443 | .327 | 2.63 | .009 |
| 48 du/acre | -.115 | | | |
| 36 du/acre vs. | .037 | .122 | 1.27 | .205 |
| 48 du/acre | -.085 | | | |

Note:
   [1]Group Means for neighborhoods vary slightly over group comparisons because of differences in sample sizes. Listwise deletions for missing values altered sample sizes.

In general, these findings seem to corroborate a central hypothesis of this research: the general public seems willing to accept higher densities in a transit-oriented neighborhood as long as various amenities, most notably a neighborhood park, are provided. Overall, as was expected, peoples' preferences of neighborhoods fell as densities increased — that is, among the two simulated neighborhoods without a park, they generally preferred the lowest-density one (12 d.u. per acre), and among the two neighborhoods with a park the lowest-density one (36 d.u. per acre) was also liked most. However, the finding that significant neighborhood amenities can compensate for higher densities, at least in terms of responses to simulated environments, is an important one, and bodes positively for the prospects of creating successful transit villages. At 36 d.u. per acre, rail transit can begin to attract upwards of half of all those commuting to destinations served by rail (Pushkarev and Zupan, 1977; Cervero, 1993).

*Rating of Simulated Versus Existing Neighborhood*

As discussed in Chapter Two, one difficulty in eliciting valid responses on how people perceive different neighborhoods is that perceptions can change markedly depending on where the neighborhoods are located. What might be acceptable in a built-up urban area might be loathed in a newly suburbanizing setting, or vice-versa. As any real estate agent knows, it is location and overall neighborhood quality that are usually most important to a prospective homebuyer— hence, the "location, location, location"

adage. We attempted to control for the effects of location by asking respondents to consider that each of the simulated neighborhoods was in a location similar to where they currently reside, though with a nearby BART station (even if they live nowhere near BART). In this way, ratings of each neighborhood were for the same assumed location.

Figure 3.5 shows respondents' rating of simulated neighborhoods relative to their rating of where they currently live, averaged across all respondents. This indicator was based on subtracting the rating of where they live from their rating of each simulated neighborhood. Values can range from -6 (if they rated a simulated neighborhood as a -3 and their current neighborhood as a +3) and +6 (if vice-versa).[8] Figure 3.5 shows that, on average, the respondents preferred where they currently live to all four of the

Neighborhood (DU/acre)

12: No Park    -0.52

24: No Park    -1.22

36: Park    -0.72

48: Park    -0.88

-3    -2    -1    0    1    2    3
Undesirable    Average Rating    Desirable

Range: -6 (Lowest) to +6 (Highest)
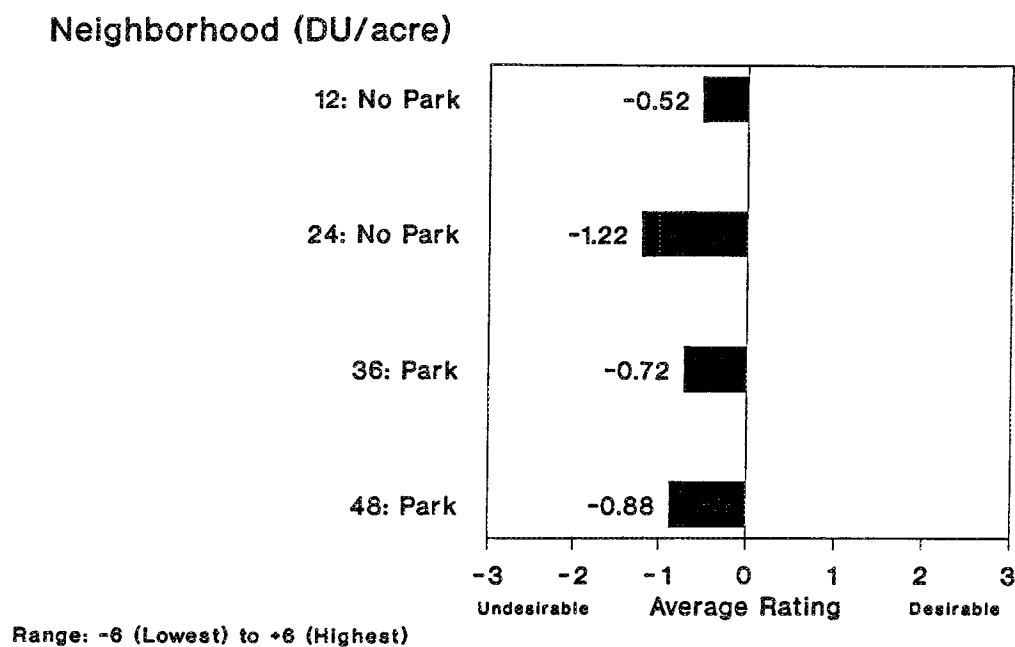
Figure 3.5. Overall Desirability Rating,
Relative to Rating of Existing Neighborhood

simulated neighborhoods. The resulting relationships were similar to those discussed for Figure 3.4. The neighborhood "least disliked" relative to where respondents currently reside was the lowest-density one. The higher-density neighborhoods with a park were also preferred, on average, less than where respondents currently live. Only the 24 d.u. per acre neighborhood had a average score that was more than one below peoples' rating of their present neighborhood.

Overall, these results probably reflect the fact that respondents were reacting to neighborhoods with densities that are higher than where they currently live. Despite the prospect of being closer to BART and having various neighborhood amenities, those surveyed seem to like single-family living over multi-family environments. This is consistent with a recent Building Industry of Northern California

(1993) survey of over a thousand Bay Area residents (in all counties except San Francisco) that found 82 percent of respondents preferred a single-family home over all other housing types. It is a fundamental rule, according to one California developer, that "as density goes up, the general interest from the consumer goes down" (Bookout, 1992: 15).

*Ratings by Respondent "Attentiveness"*

Levels of attentiveness seemed to vary among the 170 individuals who responded to the survey. In the course of presenting the slides and eliciting responses, we noticed that some participants seemed really interested in our research, concentrating on the details of what was being presented, while others could have cared less, seemingly only interesting in picking up $20 and exiting the premises as fast as they could. Some participants did not seem to have the stamina or interest in concentrating on details of simulated neighborhoods for upwards to 45 minutes, and it is likely that their responses reflected this disinterest. We noticed that some rated almost all neighborhoods the same, evidently too tired or disinterested to discriminate among the images shown.

One way we tried to distinguish between those who were concentrating on the images and those who were not was to ask respondents to identify which neighborhood had the least density, the second lowest, the next to highest, and the highest density. Several respondents actually got it exactly wrong, rating the least dense neighborhood as the densest, and vice-versa. Figure 3.6 presents the average "overall desirability" ratings of two subsets of respondents: (1) those who correctly identified the relative densities of all four neighborhoods, and (2) those who got at least two of the relative neighborhood density rank
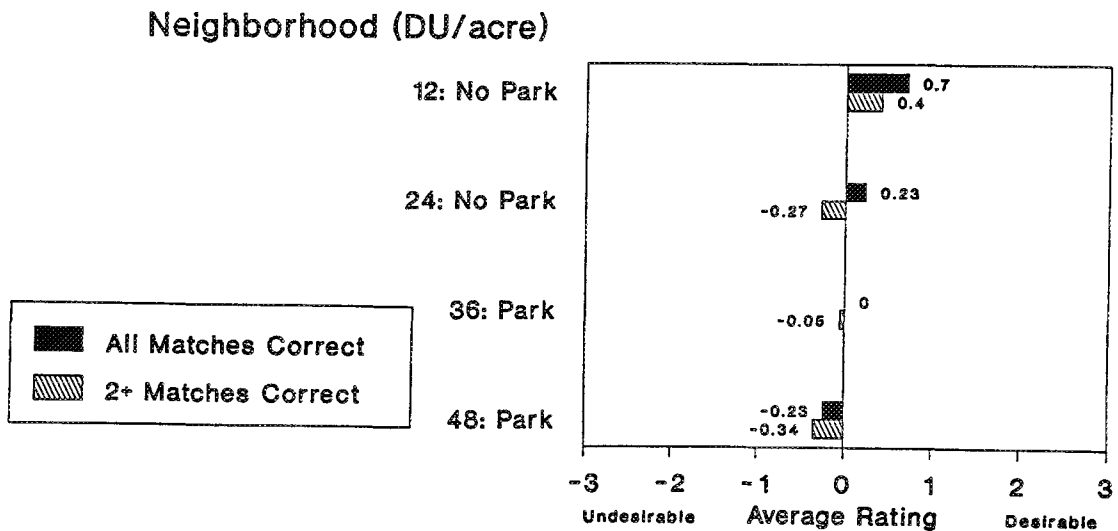


Figure 3.6. Overall Desirability Rating: Respondents

ings correct. The first group, which comprised 19 percent of the respondents, can be considered the most "attentive" respondents, and, we suspect, probably those who were less motivated by the honorarium and more interested in the research topic. The second grouping aims to weed out those respondents who, for what ever reason, did not either seem to understand what was going on, who were not very attentive, or who were unable to discriminate between the places shown. Fortunately, a strong majority of respondents, 64 percent in all, fell into this second grouping of what we will call "reasonably attentive" respondents.

Among those "most attentive," Figure 3.6 shows that desirability ratings fell consistently with neighborhood densities. Those who were most perceptive as to relative densities liked the lowest-density neighborhood the best and the highest-density neighborhood the least. The addition of a park and other amenities appears to have had little bearing on the attitudes of these more astute observers. It was among the "reasonably attentive" respondents that the addition of a neighborhood park and retail services seems to have had a positive cognitive influence. The "reasonably attentive" subgroup generally preferred the 36 d.u. per acre neighborhood over the 24 d.u. per acre one. On average, however, they liked the highest density one the least.

Overall, attitudinal responses did seem to vary among participants depending on their level of attentiveness. In general, respondents seem to be more sensitive to density as their level of attentiveness increased. Put another way, those who were most perceptive seemed less willing to trade-off higher densities for more neighborhood amenities. This does not imply that those who are most likely to live in transit-oriented neighborhoods are the most "perceptive," and thus are less interested in amenities than in lower average densities. Quite likely, potential residents of transit villages will include both those who are "attentive" and those who are less so. Thus, Figure 3.6 should be interpreted more as a control for the effects of the research method itself than any kind of refined analysis of peoples' attitudes to the simulated neighborhoods. In terms of the general public's overall attitudes toward different transit-oriented neighborhoods, we believe the findings summarized in Figures 3.4 and 3.5 are most relevant.

## 3.3. Rating of Neighborhood Attributes

In addition to the "overall desirability" ratings, respondents were asked to rate the desirability of each simulated neighborhood in terms of five specific attributes: stores and services; public transportation; public parks; housing density; and buildings and architecture. These results are summarized in this section.

*Stores and Services*

In the four simulations, the amount and character of stores and services systematically changed with densities. The two lowest-density neighborhoods contained only a convenience store on the corner closest to the BART station. At 36 d.u. per acre, a bakery and outdoor cafe were prominently added, as were more commercial stalls and outdoor seating at the plaza leading to the BART station.

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Figure 3.7 suggests that having in-neighborhood stores and services was desired among respondents; however, the pattern of responses was not simple. The 36 d.u. per acre neighborhood was, on average, rated highest in terms of stores and services, followed closely by the highest-density neighborhood. Least liked was the 24 d.u. per acre neighborhood, even though it had more stores and services than the lowest-density one. Overall, having local stores and services seems to have a positive influence on how people perceive different transit-oriented neighborhoods.

## Neighborhood (DU/acre)

| | |
|---|---|
| 12: No Park | 0.21 |
| 24: No Park | -0.04 |
| 36: Park | 0.79 |
| 48: Park | 0.7 |

-3    -2    -1    0    1    2    3

Undesirable    **Average Rating**    Desirable
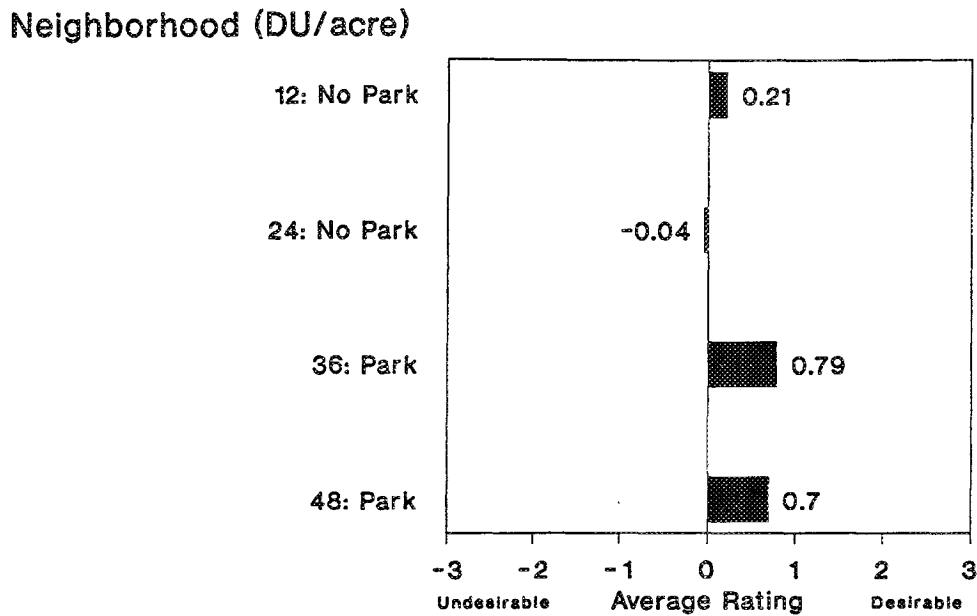
Figure 3.7. Desirability of Neighborhood: Stores and Services

*Public Transportation*

Of all the physical features of the simulated neighborhoods shown, having easy access to BART was consistently liked the most. Figure 3.8 shows there was little variation in how neighborhoods were perceived in terms of public transportation services— on average, all received "desirability scores" in the 1.80-1.90 range. Since public transportation services were constant across neighborhoods (i.e., all had a train station with integrated bus connections), these results were not entirely unexpected.

*Public Parks*

The neighborhood attribute that perhaps changed the most, visually, was the presence or absence of a public park. Figure 3.9 reveals that the two higher-density neighborhoods with public parks were, on average, preferred in terms of their open space features. Most preferred for its parks was the second-highest-density neighborhood, even though it had the same level of amenities (e.g., benches, play areas) as

## Neighborhood (DU/acre)
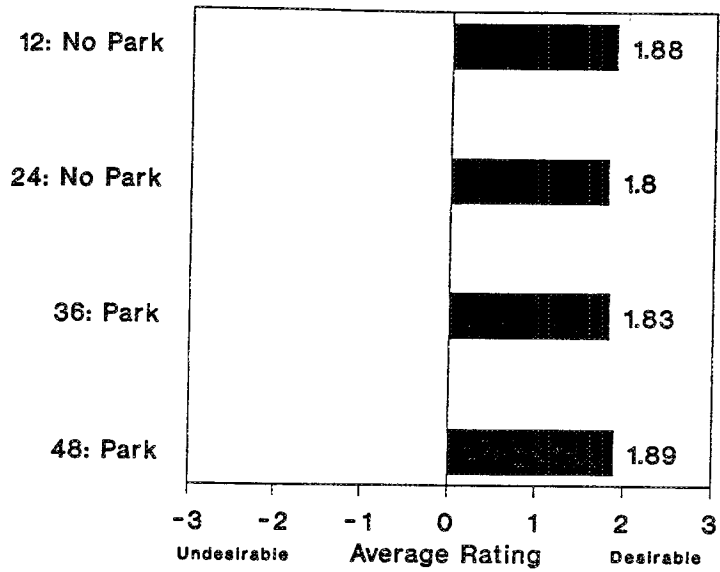


Figure 3.8. Desirability of Neighborhood: Public Transportation

## Neighborhood (DU/acre)
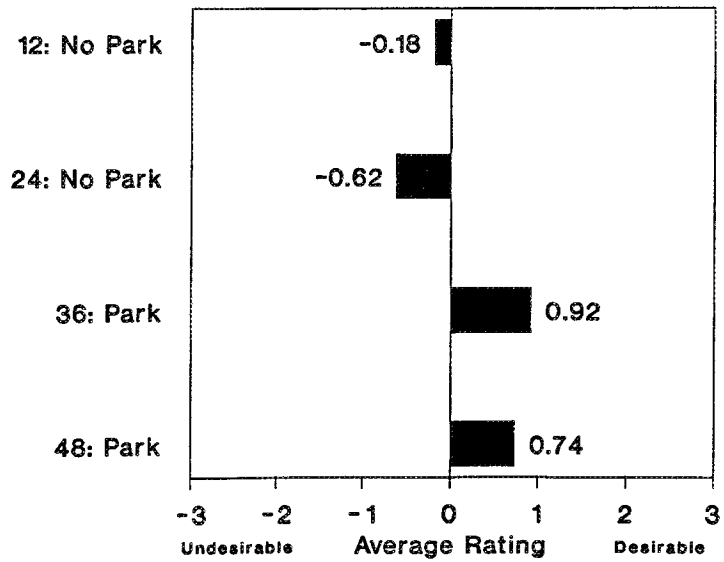


Figure 3.9. Desirability of Neighborhood: Public Parks

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the highest-density one. Also, among the two lower-density neighborhoods without central parks, the 12 d.u. per acre neighborhood was preferred over the 24 d.u. per acre one, even though both had comparable amounts of public open space (though the 12 d.u. per acre neighborhood had more rear-area private garden space). These findings suggest that the respondents like having a neighborhood park, though only to a point. While a public park is clearly perceived as a positive amenity, this is likely so only up to a certain density threshold — evidently around 36 d.u. per acre. Also, the presence of a neighborhood park with more activities (e.g., children playing, sports) and people (including strangers) might very well be perceived by some as a neighborhood disamenity in fairly dense settings — perhaps partly explaining why the 48 d.u. per acre neighborhood was generally preferred less than the 36 d.u. per acre one in terms of its open space features. Another possible explanation is the size of rear lots. In the images, the 36 d.u. per acre condominiums had a small rear-area private yard. At 48 d.u. per acre, the rear-yard area was shared by residents, except for small individual decks and balcony spaces.

*Housing Densities*

Figure 3.10 shows that the three most dense neighborhoods were generally disliked in terms of their residential densities, while respondents were generally neutral toward the densities of the least dense (12 d.u. per acre) one (the only one with detached residences). Interestingly, however, the 24 d.u. per acre neighborhood was generally liked least in terms of its density, while the density of the 48 d.u. per acre neighborhood was actually preferred over those of the two lower-density ones. These findings under-score the fact that perceived and actual densities can vary quite a bit. Thus, the 2.5-story rowhouses with 18-ft. frontages and bigger backyards are viewed by many as "more crowded-feeling" than rowhouses with smaller frontages and backyards but a large neighborhood park. Given that the 24 and 48 d.u. per acre neighborhoods had similar average scores, there seems to be a threshold above which people perceive densi-ties to be in a similar mid-to-high range. This potentially provides designers a fair amount of latitude in creating built environments that are dense enough to justify high levels of transit service, yet not perceived as being high-rise in character. Additionally, the fact that people seemed fairly indifferent toward the densities of the 12 d.u. per acre neighborhood, even though these densities are much higher than the median net densities of around 7 d.u. per acre found in the East Bay, suggests that at least some of the populous would accept infill development and other efforts to create more transit-serviceable densities.

*Buildings and Architecture*

The average ratings of simulated neighborhoods in terms of buildings and architecture were simi-lar to the density ratings. Figure 3.11 shows that respondents were generally indifferent to the design of housing in the 12 d.u. per acre neighborhood but generally disliked the architecture of the higher-density ones. The general consistency of these findings suggest that negative responses toward the "desirability" of neighborhoods might have been based on how people perceived the design of buildings and neighbor-

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## Neighborhood (DU/acre)



|  | | | | | | | |
|---|---|---|---|---|---|---|---|
| 12: No Park | | | | 0.1 | | | |
| 24: No Park | -1.21 | | | | | | |
| 36: Park | -1.07 | | | | | | |
| 48: Park | -0.97 | | | | | | |

| -3 | -2 | -1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| Undesirable | | | Average Rating | | | Desirable |
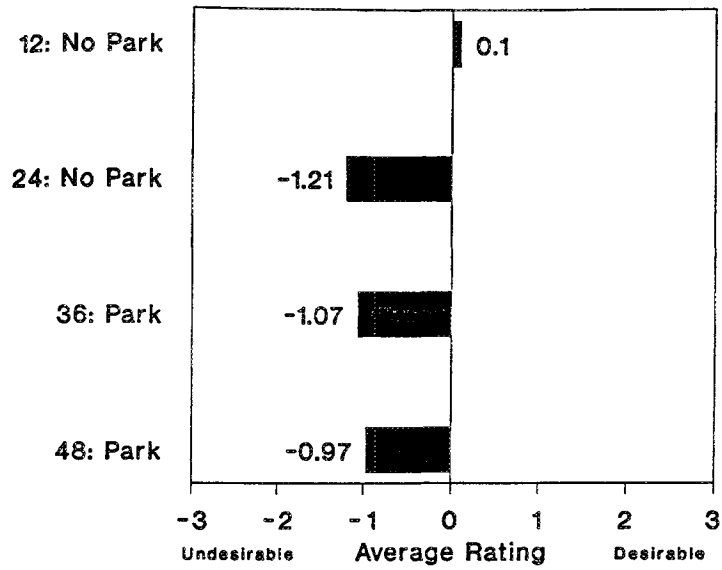
Figure 3.10. Desirability of Neighborhood: Housing Density

## Neighborhood (DU/acre)



|  | | | | | | | |
|---|---|---|---|---|---|---|---|
| 12: No Park | | | | 0.08 | | | |
| 24: No Park | -0.66 | | | | | | |
| 36: Park | -0.69 | | | | | | |
| 48: Park | -0.74 | | | | | | |

| -3 | -2 | -1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| Undesirable | | | Average Rating | | | Desirable |
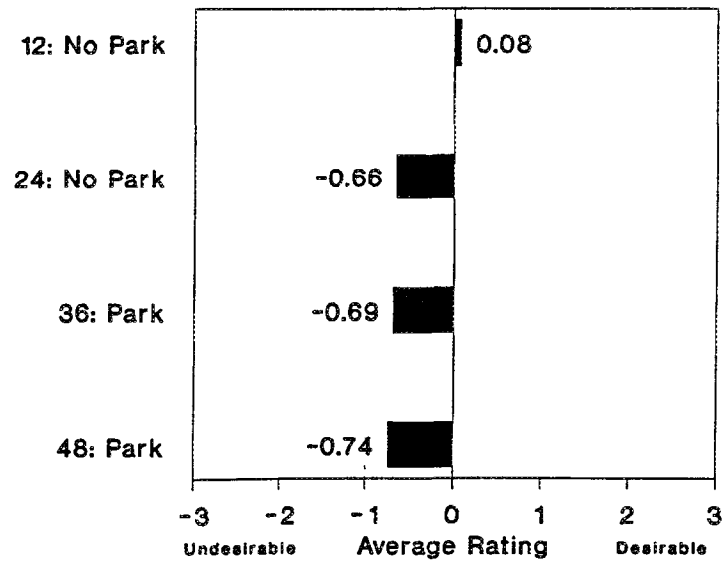
Figure 3.11. Desirability of Neighborhood: Buildings and Architecture

43

hood density in combination. Unlike the density attribute, however, the degree to which respondents disliked the buildings and architecture increased as density rose.

It might have been interesting to see how people reacted to neighborhoods if the "quality" of architecture increased with density; however, this is obviously a highly subjective matter, not to mention the fact that building architecture would no longer have been a control variable. As noted in Chapter Two, we purposely chose to simulate housing with standard designs so that respondents would concentrate less on design details and hopefully more on the overall characteristics of the neighborhoods shown. We might have been able to elicit more positive responses to higher-density neighborhoods if the architecture of buildings was more visually pleasing as density rose; however, as already noted, this would have confounded the research design. [10]

*Overall Attribute Ratings*

Collectively, these findings on the ratings of specific attributes of simulated neighborhoods indicate that respondents liked them only in terms of their access to BART and, in the case of the two highest-density neighborhoods, their park features and local stores and services. In terms of other features—housing density and architecture — respondents were generally indifferent to the 12 d.u. per acre neighborhood and disliked the three higher-density ones. The second-lowest density neighborhood (24 d.u. per acre) was, on average, least preferred in terms of four of the five physical attributes: stores and services, public transportation, public parks, and housing densities. The second-highest density neighborhood (36 d.u. per acre) was liked most in terms of the two features that varied most: stores and services, and public parks. It is for these reasons that the 36 d.u. per acre neighborhood was the second most preferred and the 24 d.u. per acre neighborhood was generally liked least. In short, the presence of retail services and public parks seems to more than compensate for increases in densities in the mid-density range of 24 to 36 d.u. per acre. At lower density ranges, however, they do not appear to be sufficient to compensate for the higher perceived densities.

## 3.4. Neighborhood Rankings

The statistics just presented are based on how respondents rated each simulated neighborhood individually. In addition, respondents were asked to rank-order neighborhoods after viewing four images of each neighborhood group in quick succession, two times. The ranking statistics presented next were expected to reinforce the rating statistics just presented, as well as to strengthen the research design through triangulation. Additionally, respondents were asked to rank the neighborhoods twice: an initial ranking (which actually followed the individual ratings of neighborhoods) and a second ranking after they were told specifically what distinguished the neighborhoods. The intent of the second ranking was to ferret out how perceptions changed once respondents were informed about the changes introduced.

*Initial Rankings*

Consistent with the earlier findings, the lowest-density neighborhood was initially ranked as being the most preferred. As shown in Table 3.3, however, rankings of the other three neighborhoods did not follow a straightforward pattern. For instance, the 48 d.u. per acre neighborhood was actually ranked as "most liked" by around one of five respondents (the second-highest share for "most liked"), yet nearly 40 percent of respondents liked it the least (the highest share for "least liked").

---

## Table 3.3

## Relative Ranking of Neighborhoods: General Public, Initial Rankings

| Neighborhood (DU/acre) | Percent of Respondents Who Like the Community | | | |
| | Most | Second-Best | Third | Least |
|---|---|---|---|---|
| 12: No Park | 58.2 | 14.9 | 14.4 | 13.7 |
| 24: No Park | 4.8 | 31.1 | 31.3 | 33.5 |
| 36: Park | 17.6 | 29.8 | 38.1 | 13.7 |
| 48: Park | 19.4 | 24.2 | 16.3 | 39.1 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |

---

In terms of the statistical mode, the relationship was fairly tidy — rankings were inversely related to densities. That is, the neighborhood liked the most had the lowest density, the neighborhood with the most "second-best" rankings had the second-lowest density (24 d.u. per acre), the neighborhood with the most third-place rankings had the next-to-highest density (36 d.u. per acre), and the neighborhood liked the least was the densest (48 d.u. per acre).

Even though the 24 d.u. per acre neighborhood had the most second-best rankings, it received the fewest first-place rankings. Moreover, one-third of respondents ranked it as the worst neighborhood— more than twice as many who ranked the 36 d.u. per acre neighborhood as the worst.

Figure 3.12 suggests that in terms of the extremes of rankings, the 12 d.u. per acre neighborhood was clearly most preferred, and the 24 d.u. and 48 d.u. per acre neighborhoods were generally liked the least. The 36 d.u. per acre neighborhood fell more in the middle of these extremes— neither strongly liked or disliked. From this, we might infer that a moderately dense neighborhood without a large park (24 d.u. per acre) or a very dense neighborhood with a park (48 d.u. per acre) were disliked by many. The neighborhood which fell in between these two in terms of density and park features (i.e., the one with 36 d.u. per acre) provoked less of a strong reaction— it was generally liked more and disliked less than these other two neighborhoods.

## Neighborhood (DU/acre)
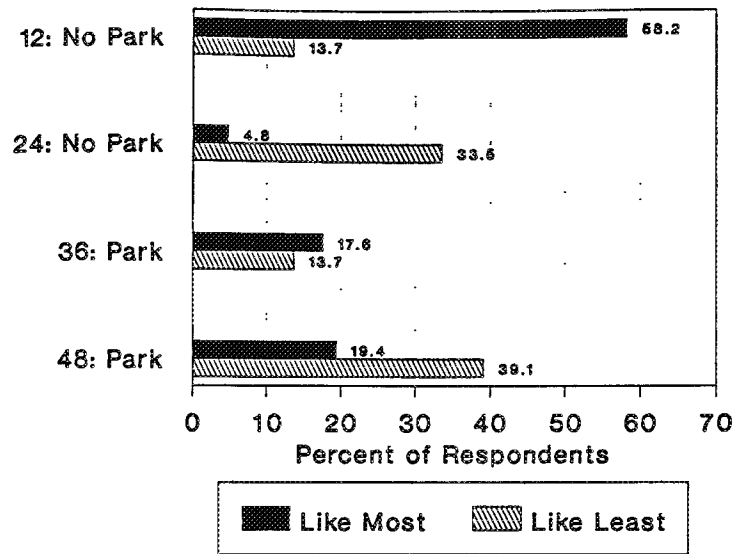


Figure 3.12. Ranking of Neighborhoods: Initial Rank

*Second Rankings*

Comparisons of Table 3.4 with Table 3.3, and Figure 3.13 with Figure 3.12, reveal that describing how neighborhoods differed did not change the opinions of participants very much. In general, this information improved the rankings of the two highest-density neighborhoods slightly, and accordingly lowered those of the two lowest-density neighborhoods just a bit. This finding suggests that most respondents had already noticed specific features that distinguished neighborhoods and thus were not influenced by verbal descriptions of these differences. For those who did not initially notice some of the differences, it appears that many stuck with their initial subjective rankings regardless.

### Table 3.4

### Relative Ranking of Neighborhoods: General Public, Second Ranking

| Neighborhood (DU/acre) | Percent of Respondents Who Like the Community | | | |
| --- | --- | --- | --- | --- |
| | Most | Second-Best | Third | Least |
| 12: No Park | 53.1 | 14.2 | 16.8 | 16.1 |
| 24: No Park | 6.2 | 27.8 | 31.7 | 34.8 |
| 36: Park | 19.8 | 33.3 | 35.4 | 12.4 |
| 48: Park | 21.0 | 24.7 | 16.1 | 36.6 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |

## Neighborhood (DU/acre)



| | |
|---|---|
| **12: No Park** | 53.1 / 16.1 |
| **24: No Park** | 6.2 / 34.8 |
| **36: Park** | 19.8 / 12.4 |
| **48: Park** | 21 / 36.6 |

Percent of Respondents

■ Like Most    ▨ Like Least
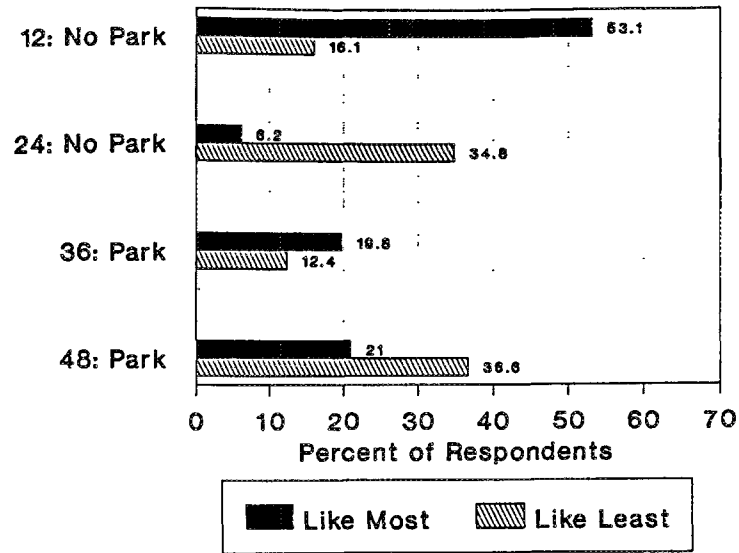
**Figure 3.13. Ranking of Neighborhoods: Second Rank**

### Rankings by Respondent "Attentiveness"

Among the 19 percent of respondents who correctly identified the densities of all four neighborhoods ("most attentive"), Figure 3.14 shows that, as was found for all respondents, rankings were generally inversely related to neighborhood density. However, density was clearly of much greater concern to this group — larger shares of the "most attentive" respondents liked the lowest-density neighborhood the most and the highest-density neighborhood the least. The relationship was similar for the "reasonably attentive" group (who correctly identified densities for at least two of the neighborhoods). However, density did not appear to have as strong a bearing on the rankings of this group.[11] Overall, density seems to have mattered most to the most attentive, and we might infer the most educated, respondents, while other factors like amenities seems to have influenced the rankings of the other participants.

## 3.5. Associations Between Neighborhood Ratings and Respondent Characteristics

In this section, the association between neighborhood ratings and various characteristics of respondents (e.g., household type, respondent age) are explored. For each grouping of respondents, the share who liked and disliked the lowest-density (12 d.u. per acre) and highest-density (48 d.u. per acre) neighborhoods are presented. Respondents were considered to "like" the neighborhood if they rated it in the +1 to +3 range and to "dislike" it if they rated it between -1 and -3.[12] To keep the analysis fairly straight
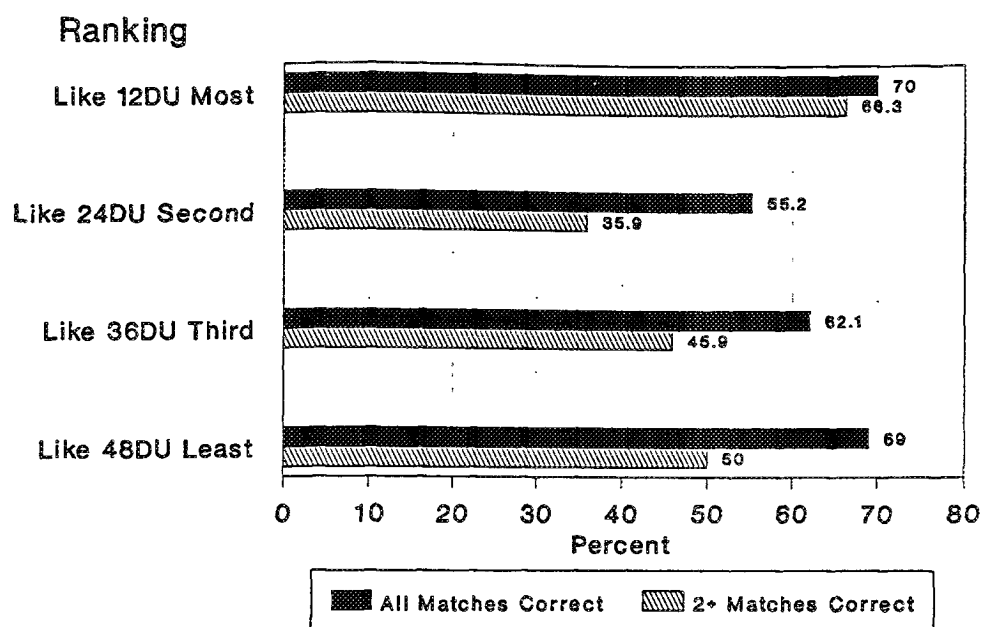
## Ranking



Figure 3.14. Ranking of Neighborhoods:
Respondents Who Matched Neighborhoods With Densities

forward, we opted to explore these associations only for the two neighborhoods that were most dissimi-lar —i.e., 12 d.u. per acre/no park and 48 d.u. per acre/park.[13]

*Ratings and Household Type*

A simple hypothesis might be that singles are more accepting of higher-density neighborhoods, and that those with children prefer lower-density settings. Figures 3.15 and 3.16 reveal that these hypotheses do not seem to hold, and suggest that the relationship between neighborhood rating and the respondents' household type was anything but simple. Couples without children tended to like the lowest-density neighborhood the most and the highest-density one the least. About a third of single parents liked both neighborhoods, though an even larger share (53.9 percent) disliked the 48 d.u. per acre neighborhood. For most other groups, ratings were similar for both neighborhoods. This included couples with child-ren, around 55-60 percent of whom liked both neighborhoods. Retirees and empty-nesters seemed fairly neutral to both types of neighborhoods— half rated both a zero in terms of "overall desirability." Over-all, being single or having children did not seem to strongly influence preferences toward different types of transit villages, at least among those we surveyed.[14]

*Ratings and Housing Type*

We might expect those currently living in low-density settings to be most critical of the simulated neighborhoods (since all have densities well above those found in single-family neighborhoods), while

## Household Type

**Lowest Density Neighborhood**

| Household Type | Disliked | Liked |
|---|---|---|
| Single: No Children | 34.1 | 62.9 |
| Single: Children | 38.5 | 30.8 |
| Couple: No Children | 39.4 | 46.8 |
| Couple: Children | 30 | 66 |
| Retired/Empty Nester | 16.7 | 33.3 |
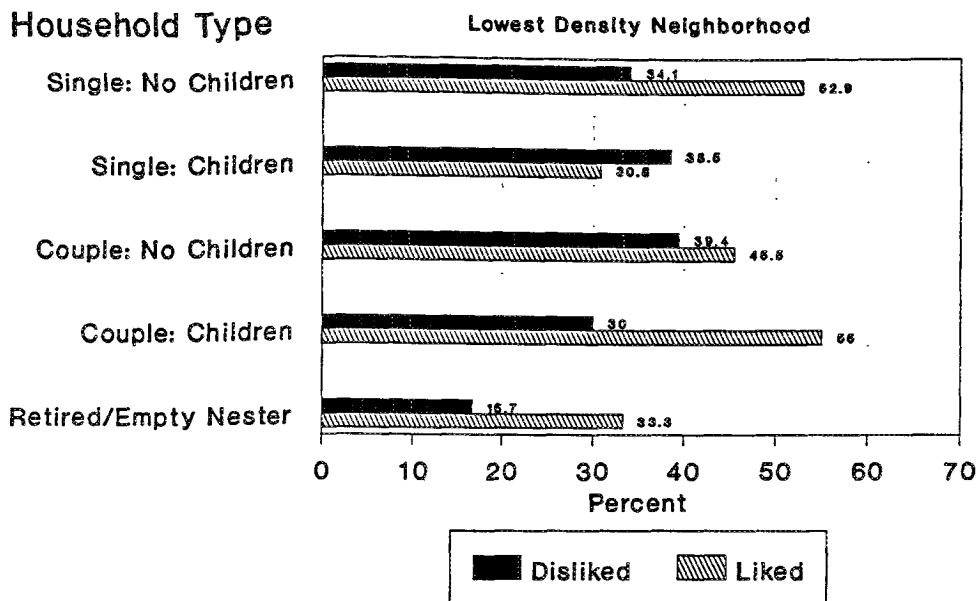
**Disliked** **Liked**

• 12 DU/acre

Figure 3.15. Percent Who Liked/Disliked the Lowest-Density Neighborhood,*
by Household Type



## Household Type

**Highest Density Neighborhood**

| Household Type | Disliked | Liked |
|---|---|---|
| Single: No Children | 37.6 | 46.4 |
| Single: Children | 53.9 | 30.8 |
| Couple: No Children | 60 | 32.3 |
| Couple: Children | 31.6 | 57.9 |
| Retired/Empty Nester | 16.7 | 33.3 |
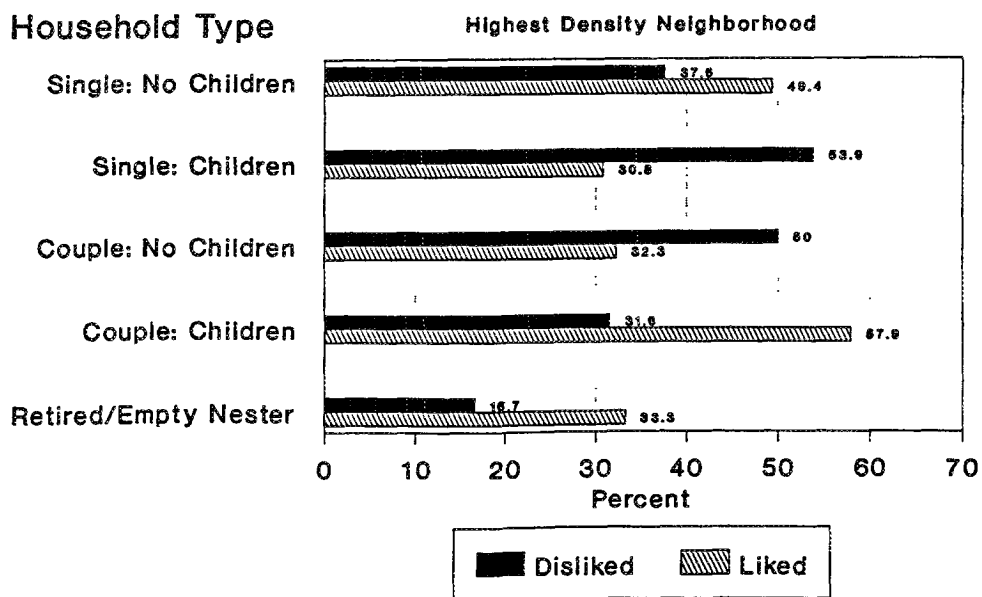
**Disliked** **Liked**

• 48 DU/acre

Figure 3.16. Percent Who Liked/Disliked the Highest-Density Neighborhood,*
by Household Type

49

those residing in fairly dense apartments would be most accepting of the places shown. Figures 3.17 and 3.18 suggest that this hypothesis generally holds. Those presently living in single-family homes did not appear to be particularly fond of either the lowest- or highest-density neighborhood; interestingly, however, larger shares (63.1 percent) of single-family home dwellers disliked the 12 d.u. neighborhood than 48 d.u. per acre neighborhood (46 percent).

As expected, respondents who seemed most receptive to both neighborhoods were those living in apartment complexes with eleven or more units; on average, this group liked the densest neighborhood more than the least dense one. On the other hand, those currently living in smaller apartment complexes (duplexes, triplexes, garden apartments with ten or fewer units) generally preferred the lowest-density neighborhood most.

*Ratings and Income*

We hypothesize that those earning higher incomes generally prefer lower-density neighborhoods, while those drawing relatively low incomes would be more accepting of denser transit-oriented neighborhoods. While relationships were not simple, Figures 3.19 and 3.20 suggest that this hypothesis does not generally hold. For the 12 d.u. per acre neighborhood, the share who liked the neighborhood generally fell as income rose, while the share who disliked the neighborhood rose with income. Still, more respon-



Housing Type — Lowest Density Neighborhood

Single family home — Disliked 63.1, Liked 40.4
Condominium — Disliked 29.9, Liked 41.6
Apartment <11 units — Disliked 22.2, Liked 65.6
Apartment +11 units — Disliked 30.4, Liked 68.7
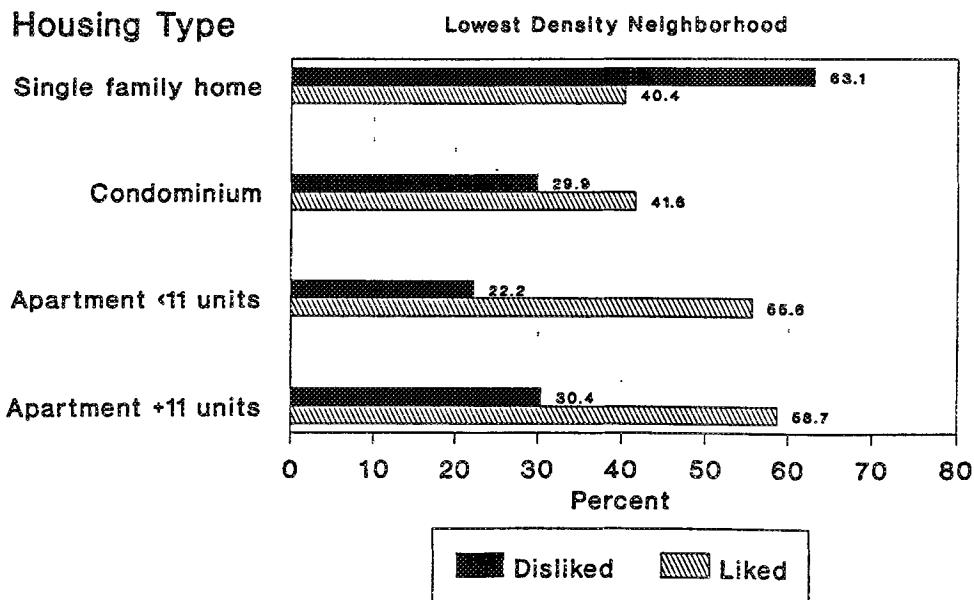
Disliked    Liked

• 12 DU/acre

Figure 3.17. Percent Who Liked/Disliked the Lowest-Density Neighborhood,*
by Housing Type

## Housing Type

### Highest Density Neighborhood



Single family home — 46 (Disliked), 41 (Liked)

Condominium — 41.7 (Disliked), 41.6 (Liked)

Apartment <11 units — 48.1 (Disliked), 37 (Liked)

Apartment +11 units — 21.2 (Disliked), 61.7 (Liked)

Percent
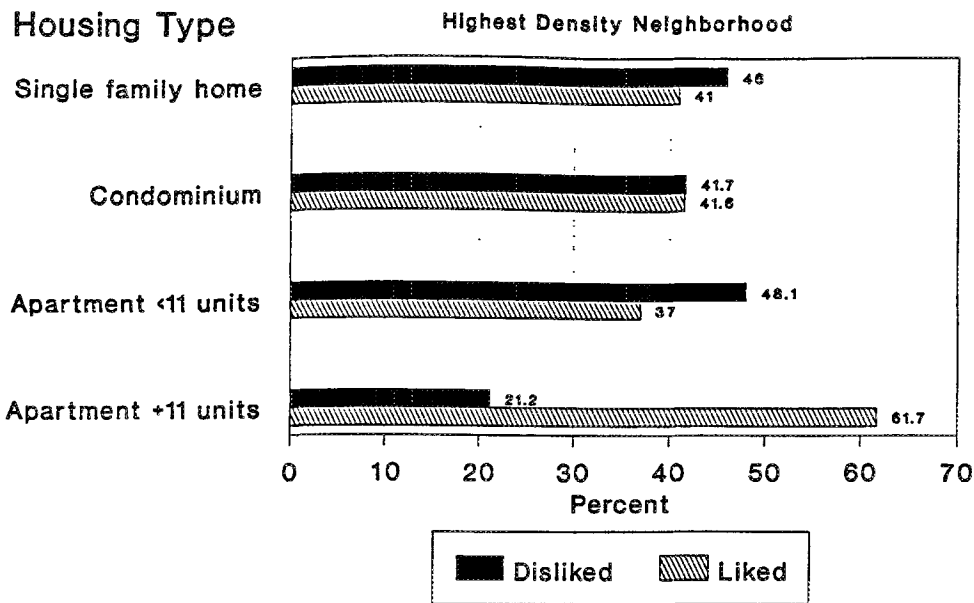
■ Disliked  ▨ Liked

* 48 DU/acre

**Figure 3.18. Percent Who Liked/Disliked the Highest-Density Neighborhood,\*
by Housing Type**

---

## Annual Household Income

### Lowest Density Neighborhood



< $21,000 — 32.6 (Disliked), 61.8 (Liked)

$21,000 - $28,000 — 19 (Disliked), 67.1 (Liked)

$28,000 - $40,000 — 37 (Disliked), 61.9 (Liked)

$40,000 - $60,000 — 38.1 (Disliked), 47.8 (Liked)

> $60,000 — 60 (Disliked), 30 (Liked)

Percent
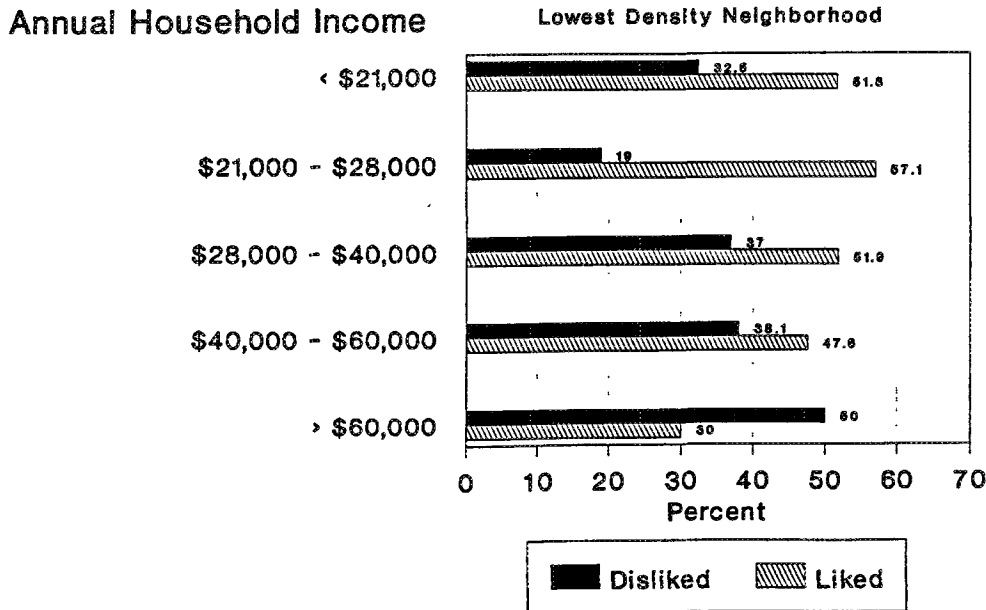
■ Disliked  ▨ Liked

* 12 DU/acre

**Figure 3.19. Percent Who Liked/Disliked the Lowest-Density Neighborhood,\*
by HH Income**

51

## Annual Household Income

Highest Density Neighborhood



| Annual Household Income | |
|---|---|
| ‹ $21,000 | 44.6 / 41 |
| $21,000 - $28,000 | 40.9 / 40.9 |
| $28,000 - $40,000 | 25.5 / 63 |
| $40,000 - $60,000 | 40 / 46 |
| › $60,000 | 40 / 40 |

0   10   20   30   40   50   60   70
Percent
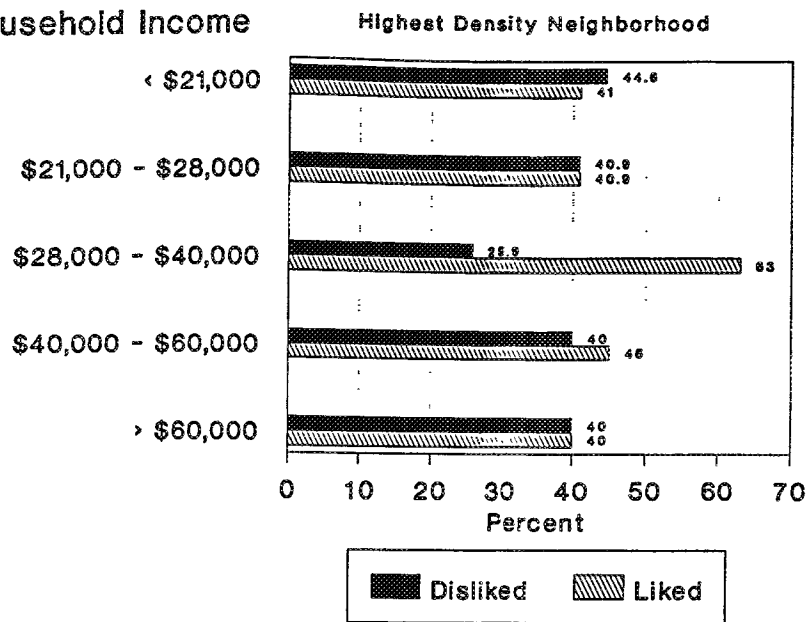
■ Disliked   ▨ Liked

• 48 DU/acre

Figure 3.20.  Percent Who Liked/Disliked the Highest-Density Neighborhood,*
by HH Income

dents with annual incomes below $60,000 liked than disliked the lowest-density neighborhood. Those in the highest-income brackets were most critical of the 12 d.u. per acre neighborhood.

As revealed in Figure 3.20, the relationship between income and preference was a bit more muddled for the highest-density neighborhood. Those in the middle income range ($28,000-$40,000) were most receptive toward the densest neighborhood. For other income groups, comparable shares liked and disliked the densest neighborhood.[15]

Simple correlations revealed that desirability ratings were negatively associated with income for all neighborhoods except the densest — that is, richer people tended to rate all of the neighborhoods lowest except the 48 d.u. per acre one. None of the correlations were statistically significant at the .05 level, however.[16]

### Ratings and Respondent Age

Figures 3.21 and 3.22 reveal that the youngest respondents were most accepting of both the 12 and 48 d.u. per acre neighborhoods — higher shares liked and lower shares disliked both neighborhoods than any other age group. Seniors generally expressed the strongest dislike toward the densest neighborhood, while those in the upper-middle age group (41-65) were least receptive toward the lowest-density neighborhood. Those in the early- to mid-lifecycle stage (28-40), the group most closely associated with child-rearing, also tended to prefer lower-density neighborhoods. Simple correlations further revealed

## Age Group

**Lowest Density Neighborhood**
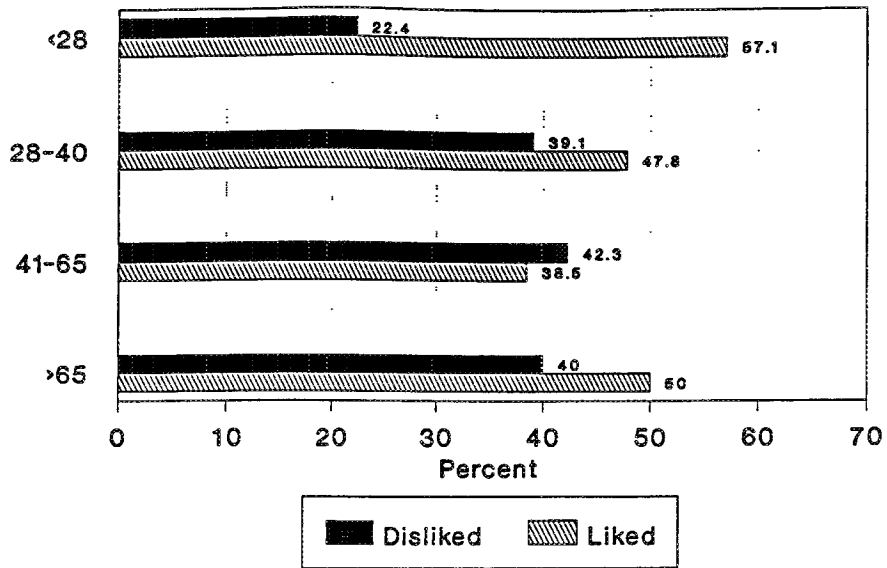


* 12 DU/acre

**Figure 3.21.** Percent Who Liked/Disliked the Lowest-Density Neighborhood,*
by Age

## Age Group

**Highest Density Neighborhood**
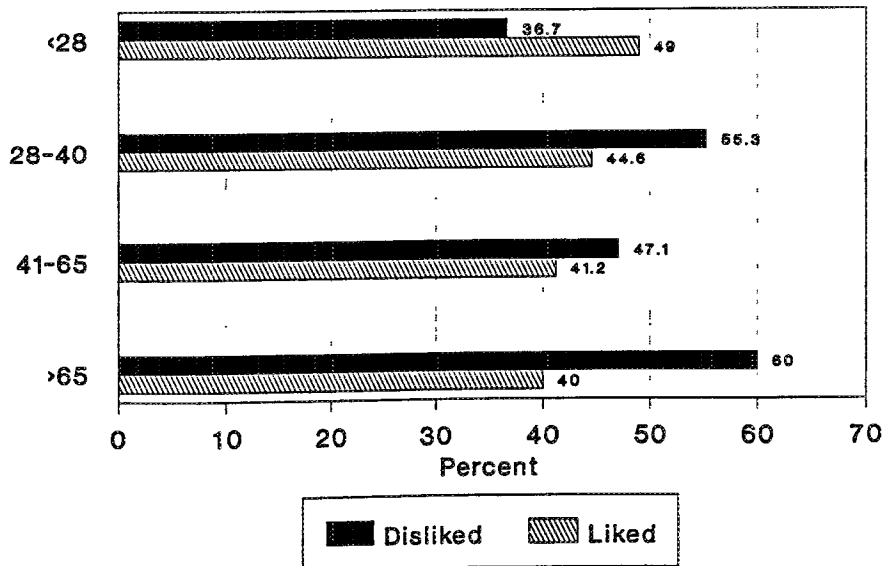


* 48 DU/acre

**Figure 3.22.** Percent Who Liked/Disliked the Highest-Density Neighborhood,*
by Age

53

the negative relationship between age and desirability rating — for all four neighborhoods, ratings tended to fall as age rose. [17]  Overall, these findings suggest that denser transit-oriented neighborhoods with parks, services, and other amenities seem most acceptable to young (and ostensibly single) households.

*Ratings and Commute Modes*

We might expect that those who commute most often by transit, foot, and bicycle would be most receptive to denser, transit-oriented neighborhoods.  Figures 3.23 and 3.24 reveal that this hypothesis finds some support, though the relationship between preferences and commuting modes was not particularly strong.  Among transit commuters, pedestrians, and cyclists, more people liked than disliked both the 12 and 48 d.u. per acre neighborhoods.  Among automobile commuters, there tended to be a stronger preference toward the lowest density neighborhood.

*Ratings and Area of Residence*

The geographic location of respondents' current residence was also thought to have some bearing on neighborhood ratings.  We assumed that those who currently reside in denser urban settings well-served by transit, such as San Francisco and Oakland, would be most receptive to a denser, transit-oriented neighborhood, and that those from more suburban settings would be the least receptive.

Figures 3.25 and 3.26 reveal little support for this hypothesis.  Larger shares of San Franciscans and those residing along the densest corridor of the East Bay (Oakland-Richmond, including Berkeley) preferred the lowest-density than the highest-density neighborhood.  Survey respondents from southern Alameda County (San Leandro-Hayward-Fremont), an area characterized by more mature suburbs, expressed even stronger preference for the 12 d.u. per acre neighborhood and stronger dislike for the densest one.  Surprising, however, was the tendency for respondents from the relatively new, low-density suburbs of eastern Alameda and Contra Costa counties (e.g., Walnut Creek, Dublin) to like the highest-density neighborhood more than the lower-density one.  The uniqueness of their preferences stands out even more when neighborhood rankings are compared, as shown in Figure 3.27.  Among respondents from eastern suburbs, around two-thirds ranked the 48 d.u. per acre neighborhood the highest; among respondents from other areas, 60 percent or more ranked the lowest-density neighborhood the highest.[18] We are hard-pressed to explain why so many of the respondents from the eastern suburbs liked the densest neighborhood, and can only surmise that factors other than existing residential location influenced these respondents' ratings and rankings.  One such factor could be the presence of a large fully-developed park in the center of the 48 d.u. per acre neighborhood, which might have favorably impressed many participants from the eastern suburbs.

Commute Mode                 Lowest Density Neighborhood



Automobile          40.3
                    45.2

Bus/Rail Transit    33.3
                    48.7

Walk/Bike/Other     40.7
                    48.1

0   10   20   30   40   50   60
            Percent
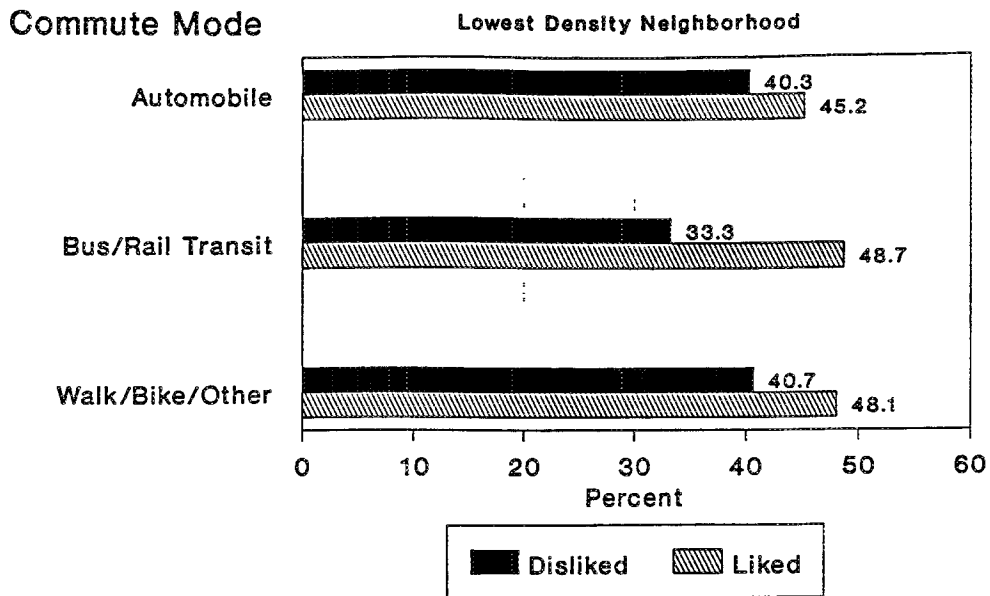
■ Disliked    ░ Liked

* 12 DU/acre

Figure 3.23.  Percent Who Liked/Disliked the Lowest-Density Neighborhood,*
by Commute Mode

Commute Mode                 Highest Density Neighborhood



Automobile          44.3
                    39.3

Bus/Rail Transit    28.2
                    48.7

Walk/Bike/Other     39.3
                    42.9

0   10   20   30   40   50   60
            Percent
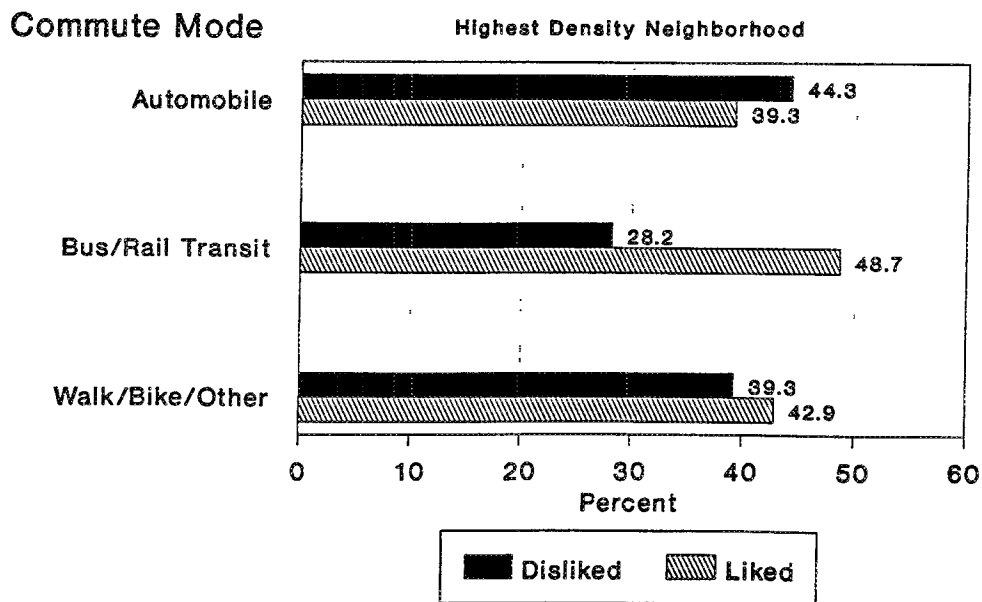
■ Disliked    ░ Liked

* 48 DU/acre

Figure 3.24.  Percent Who Liked/Disliked the Highest-Density Neighborhood,*
by Commute Mode

55

## Area of Residence

**Lowest Density Neighborhood**

San Francisco

Oakland-Richmond

So. Alameda County

Eastern Suburbs

Other Bay Area

36.7 46.6

26.3 66

29.6 66.6

66.6 20.6

26 62.6

0  10  20  30  40  50  60  70  80

Percent
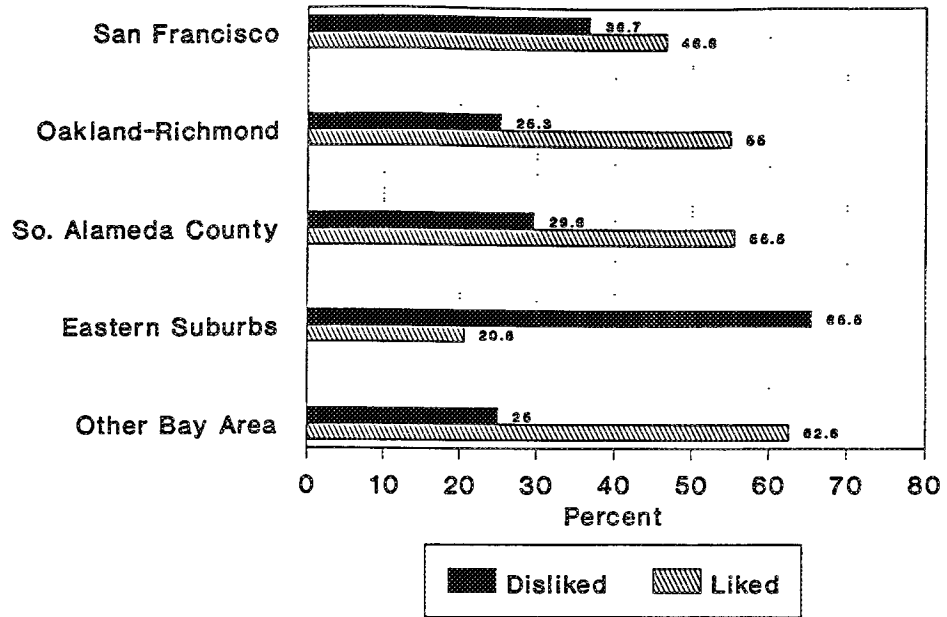
■ Disliked   ▨ Liked

* 12 DU/acre

Figure 3.25.  Percent Who Liked/Disliked the Lowest-Density Neighborhood,*
by Residential Area

## Area of Residence

**Highest Density Neighborhood**

San Francisco

Oakland-Richmond

So. Alameda County

Eastern Suburbs

Other Bay Area

38.7 38.7

42.3 49.3

46.2 38.6

37.9 44.7

28.6 42.9

0  10  20  30  40  50  60

Percent
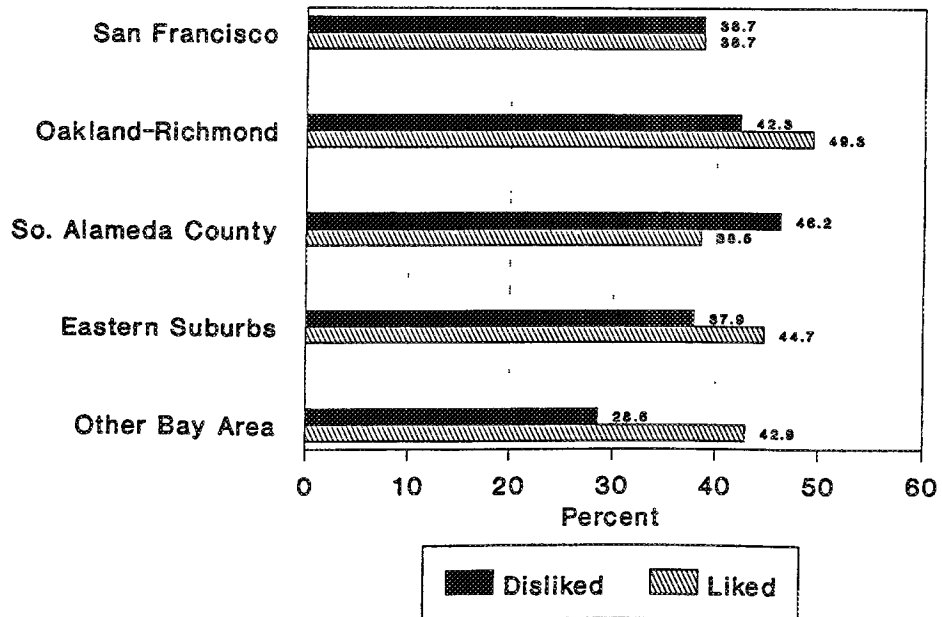
■ Disliked   ▨ Liked

* 48 DU/acre

Figure 3.26.  Percent Who Liked/Disliked the Highest-Density Neighborhood,*
by Residential Area

56

## Area of Residence



| | |
|---|---|
| San Francisco | 87.7 / 12.8 |
| Oakland-Richmond | 80.3 / 7.4 |
| So. Alameda County | 73.1 / 7.7 |
| Eastern Suburbs | 27.6 / 65.5 |
| Other Bay Area | 62.5 / 26 |

Percent That Rank:

■ 12 DU/acre highest    ▨ 48 DU/acre highest

Figure 3.27. Ranking by Respondent's Residential Area

### Ratings and Area of Employment

One might also expect that those who work in cities that are well-served by BART would be more receptive to denser, transit-oriented neighborhoods. Living in a transit village means they could easily commute to work by rail. Figures 3.28 and 3.29 reveal that no strong pattern was found. Among those working in San Francisco, arguably the Bay Area's most walkable and transit-oriented city, there appeared to be a slight preference for the 12 d.u. per acre neighborhood. Those working in other BART-served cities were even less receptive to the 48 d.u. per acre neighborhood. Among those working at a location beyond walking distance of a BART station (more than two miles away), there seemed to be slightly more receptivity to the denser neighborhood. Overall, however, employment location appeared to have little influence on respondents' ratings.

### Summary: Associations with Ratings

Several of our assumptions about who would be most receptive towards living in a denser, transit-oriented neighborhood were confirmed; however, several were not. Our survey results suggest that the strongest market potential for transit-based housing in the San Francisco Bay Area is among young adults with moderate incomes who currently reside in large apartment complexes. Those who currently commute to work by transit or some other non-auto mode also seem slightly more accepting of denser neighborhoods.

## Area of Employment

**Lowest Density Neighborhood**

| Area of Employment | Disliked | Liked |
|---|---|---|
| San Francisco | 30.4 | 60.8 |
| Other BART Cities | 40.3 | 42.8 |
| 2-5 Miles From BART | 38.5 | 53.9 |
| > 5 Miles From BART | 25 | 50 |

Percent: 0 10 20 30 40 50 60 70
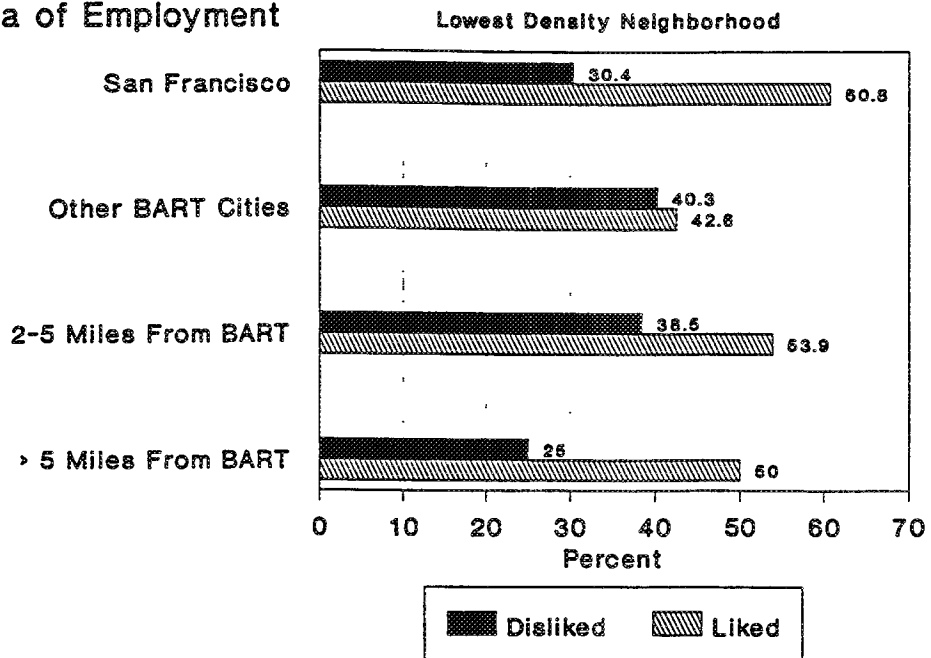
Disliked ▮  Liked ▨

*12 DU/acre

Figure 3.28.  Percent Who Liked/Disliked the Lowest-Density Neighborhood,*
by Employment Area

## Area of Employment

**Highest Density Neighborhood**

| Area of Employment | Disliked | Liked |
|---|---|---|
| San Francisco | 37.5 | 50 |
| Other BART Cities | 44.6 | 38.3 |
| 2-5 Miles From BART | 46.2 | 53.8 |
| > 5 Miles From BART | 36.4 | 45.5 |

Percent: 0 10 20 30 40 50 60 70
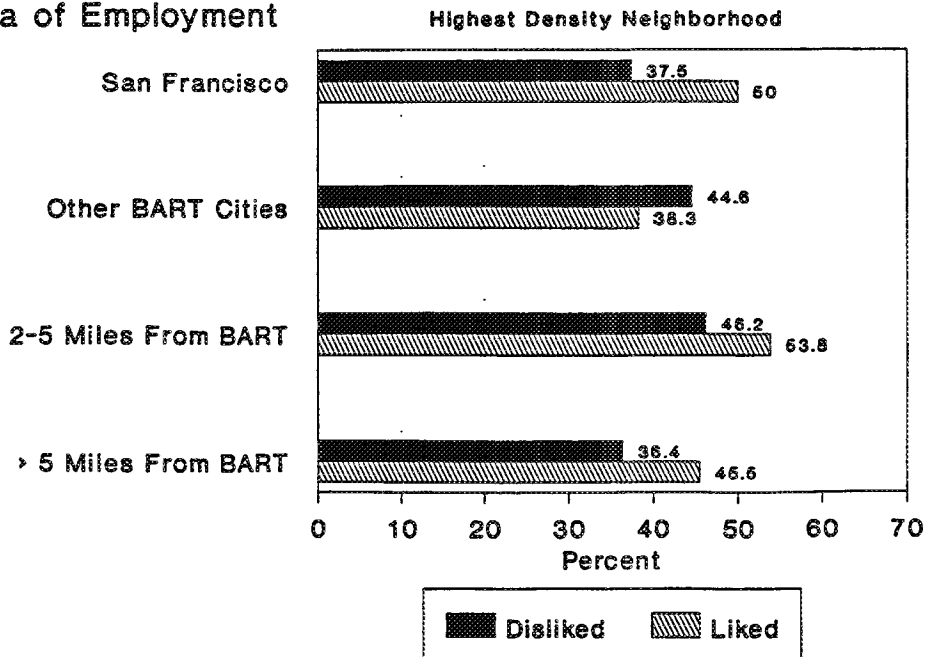
Disliked ▮  Liked ▨

*48 DU/acre

Figure 3.29.  Percent Who Liked/Disliked the Highest-Density Neighborhood,*
by Employment Area

58

No strong or meaningful associations were found between where people currently live or work and neighborhood preference. Surprisingly, those currently living in parts of the Bay Area with the lowest residential densities were more accepting of the 48 d.u. per acre neighborhood than those from San Francisco, Oakland, or Berkeley, the region's densest cities. Nor did income or age strongly influence preferences, outside of the moderate-income group and the youngest respondents being most receptive to the densest neighborhood. The highest-income group actually expressed the strongest dislike toward the 12 d.u. per acre neighborhood while the lowest-income respondents liked it the most.[19] Those in the mid and latter stages of lifecycle generally preferred the lowest-density neighborhoods; however, the degree to which they disliked the higher-density one varied.

Perhaps most surprising was the finding that existing household type had no clear bearing on neighborhood preferences. Couples with children generally liked both the lower-density and higher-density neighborhood, while single parents liked neither. (This could reflect the fact that single parents often feel greater child-rearing responsibilities since they are largely on their own, and thus are perhaps more sensitive toward living in a single-family neighborhood that is perceived as being safe.) Many singles without children were accepting of both types of neighborhoods, while childless couples generally favored the lowest-density one. Thus the presence or absence of children in a household had no strong influence on preferences. It was not clearly childless households that were most receptive toward the 48 d.u. per acre neighborhood — couples with children, for instance, generally liked it. Those in the 28-40 age group, normally associated with the child-rearing stage of lifecycle, however, expressed a clear preference for the lower-density neighbood without a park. While these findings might not appear totally consistent, it could be that some in this lower-middle age group currently do not have children but perhaps anticipate having kids one day and thus would prefer to buy into a lower-density neighborhood.

No clear insights could be gained on the residential preferences of one other group thought to represent a potential market niche of transit village residents — seniors. Retirees and empty-nesters were generally neutral towards both the 12 and 48 d.u. per acre neighborhoods— half gave both a zero score on the "overall desirability" rating. However, among those who were 65 years of age or more, many of whom we expect would be retired and empty-nesters, there tended to be a slight preference for the lower-density neighborhood.

## 3.6. Neighborhood Amenities and Ratings

Since respondents rated neighborhoods in terms of "overall desirability" as well as specific attributes (e.g., stores and services) on a -3 to +3 scale, it was possible to explore whether these ordinal ratings were correlated for different types of neighborhoods. For instance, is the influence of stores, parks, and public transportation on the "overall desirability" rating different for a lower-density than a higher-density neighborhood? Which factors most strongly influenced the rating of neighborhoods in terms of "overall desirability"? These questions were addressed by cross-tabulating the ratings of each attribute

with the "overall desirability" rating for the 12 d.u. and 48 d.u. per acre neighborhoods, and then generating Kendall Tau-B statistics.[20] High, positive Tau-B statistics signified a strong association between the overall rating of a neighborhood and a specific attribute of that neighborhood.

Table 3.5 indicates that, as expected, the existence of stores, public parks, and public transit had a stronger positive influence on the ratings of the 48 d.u. per acre neighborhod than the 12 d.u. per acre one. In terms of stores and services, comparisons of the Kendall Tau-B statistics suggest that stores and services shown in the slide images had roughly three times the influence on the desirability rating of the 48 d.u. per acre neighborhood as the 12 d.u. per acre one. Among those who rated the highest density neighborhood as being very desirable (score = +3), 73.1 percent felt that having stores and services within a neighborhood was very desirable (score = +3).

---

## Table 3.5

### Correlations of Desirability of Neighborhood Amenities and Rating of Neighborhoods in Terms of Those Amenities: Kendall Tau-B Correlations[1]

| | Rating of desirability of neighborhood in terms of stores and services | |
| --- | --- | --- |
| | 12 dua: No Park | 48 dua: Park |
| Importance of stores and services within walking distance | .087 | .251 |

| | Rating of desirability of neighborhood in terms of public parks | |
| --- | --- | --- |
| | 12 dua: No Park | 48 dua: Park |
| Importance of public parks within walking distance | -.032 | .136 |

| | Rating of desirability of neighborhood in terms of public transportation | |
| --- | --- | --- |
| | 12 dua: No Park | 48 dua: Park |
| Importance of public transportation within walking distance | .202 | .256 |

[1]Kendall's Tau-B is a non-parametric measure of correlation for ordinal variables that takes ties into account. For square tables, it ranges from -1 to +1.

---

Having a park in the neighborhood also seems to have positively influenced the desirability rating of the densest neighborhood, while the absence of a park lowered the desirability rating of the 12 d.u. per acre neighborhood, though only slightly. Of those who gave the 48 d.u. per acre neighborhood a +3 score for overall desirability, 68.8 percent had identified having a park within walking distance of their home as a very desirable feature of a neighborhood (score = +3).

Lastly, the close proximity of a BART station was viewed as a positive feature of both the lowest- and highest-density neighborhoods. Being close to a rail station seems to have had a slightly stronger positive influence on the desirability rating of the 48 d.u. per acre neighborhood, however.

Comparisons of Tau statistics indicate that for the densest neighborhood, the presence of stores and services as well as a BART station were the most important factors in influencing desirability ratings. Having a large neighborhood park was also viewed positively; however, not as much as having stores and a BART station nearby. From the Tau statistics, one could infer that the presence of stores and rail transit had about twice the influence on the positive ratings of the 48 d.u. per acre neighborhood as the presence of a park.

For the 12 d.u. per acre neighborhood, the presence of BART had a fairly strong positive influence on the desirability rating, besides ostensibly the relatively low density of the neighborhood itself.[21] Having a small amount of stores and services close to the BART station was generally viewed as a positive feature of the 12 d.u. per acre neighborhood, though only modestly so. The absence of a public park tended to lower the desirability rating of the 12 d.u. per acre neighborhood, though only slightly. Overall, having a fully developed central park in the densest neighborhood is perceived more positively than is not having such a park in a 12 d.u. per acre neighborhood perceived negatively. Put more simply, having a park matters more in a dense place than does not having a park in a less dense one.

## 3.7. Summary and Conclusion

Among the 170 Bay Area residents surveyed who represented the "general public," there was a general preference for the lower-density transit villages. However, "desirability" ratings did not regularly fall off as residential densities rose. In fact, the 36 d.u. per acre neighborhood had the second-highest average rating in terms of "overall desirability." The least desired neighborhood had the second-lowest densities —24 d.u. per acre. In general, the survey results corroborate a central hypothesis of this research: people are willing to accept higher densites in a transit-oriented neighborhood as long as various amenities, like a neighborhood park and stores, are provided. Controlling for the presence or absence of a park revealed that density certainly had a strong bearing on preferences — among the two simulated neighborhoods without a park, respondents generally preferred the lowest-density one (12 d.u. per acre), and among the two neighborhoods with a park the lowest-density one (36 d.u. per acre) was also liked most. The general finding that significant neighborhood amenities can compensate for higher densities, at least in terms of responses to simulated environments, bodes favorably for the prospects of creating successful transit villages.

Among the neighborhood features shown, having a BART station close by was consistently liked the most. Having stores and shops was particularly important for those who liked the denser neighborhoods. Having a central park increased the average ratings of the densest neighborhoods, and not have a park slightly lowered the ratings of the less dense ones. Most preferred for its parks was the second-highest density neighborhood, even though it had the same level of amenities (e.g., benches, play areas) as the

highest-density one. While a public park was clearly perceived as a positive amenity, the ability to compensate for density seemed to hold only up to a certain density threshold— around 36 dwelling units per acre.

The three most dense neighborhoods were generally disliked in terms of their residential densities. The 24 d.u. per acre neighborhood was liked least for its density. This finding underscores the fact that perceived and actual densities can vary quite a bit, and that neighborhood amenities can help offset some of the "negatives" associated with higher densities. Overall, respondents disliked the architecture and buildings of the three densest neighborhoods, and were fairly indifferent toward the designs and density of the 12 d.u. per acre neighborhood.

In terms of the demographic characteristics of respondents, those who were most receptive toward the higher-density transit neighborhoods were young adults with moderate incomes who currently reside in large apartment complexes. Those who currently commute to work by transit or some other non-auto mode were also slightly more accepting of denser neighborhoods.

No strong or meaningful associations were found between where people currently live or work and neighborhood preference. Nor did income or age strongly influence preferences, outside of the moderate-income group and the youngest respondents being most receptive to the densest neighborhood. Perhaps most surprising was the finding that existing household type had no clear bearing on neighborhood preferences. The presence or absence of children in a household had no strong influence on preferences. Also, retirees and empty-nesters were generally neutral towards both the 12 and 48 d.u. per acre neighborhoods — half gave both a zero score on the "overall desirability" rating.

# NOTES

[1] The income distributions were: <$21,000 —50.6 percent; $21-$28,000 —14 percent; $28-$40,000 —16.5 percent; $40-$60,000 —17.8 percent; $60-$80,000 —3.7 percent; and >$80,000 —2.4 percent.

[2] Vehicles were defined as autos, trucks, and vans; several participants asked about motorcycles, which they were told should be excluded from the definition of vehicles.

[3] The survey also showed that 58.2 percent of the respondents had a vehicle available every day. Also, 22.9 percent never had a vehicle available.

[4] All census statistics presented in this section were obtained from the 1990 U.S. Bureau of Census, Summary Tape File 3A, for Alameda, Contra Costa, and San Francisco Counties, combined.

[5] Retired individuals and empty-nesters could be living either as a single or with someone else as a couple. Thus, the household types shown in Figure 3.1 are not necessarily mutually exclusive. The types shown are the ones that respondents identified themselves as most closely belonging to. Comparable census data (on whether residents are retired or empty-nesters) were not available.

[6] From the survey, the mean mortgage payment was $669 per month (std. dev. = $469) for single-family homes and condominiums. Because of the Bay Area's expensive housing market, this is probably less than the regional average. The average rent was $579 per month (std. dev. = $415), which is likely more consistent with the regional average.

[7] A number of respondents were regular BART users —18 percent indicated they patronize BART around once a day, and 21.6 percent stated they ride BART around once or twice a week. Around one of ten respondents (9.6 percent) indicated they never use BART.

[8] Thus, if someone rated where they currently live as highly desirable (+3) and a simulated neighborhood as highly undesirable (-3), the resulting value would be -3 - (+3), or -6.

[9] This result could also be an artifact of the research design, reflecting the fact that the lowest-density neighborhood happened to be 12 d.u. per acre, and some respondents were possibly willing to give it a higher score relative to the higher-density ones.

[10] This point was made by several developers who viewed the simulated neighborhoods at a separate showing, as discussed in Chapter Four.

[11] For instance, 13 percent of the "reasonably attentive" respondents liked the 36 d.u. per acre neighborhood the most, compared to 5.4 percent who preferred the 24 d.u. per acre neighborhood. And for the same group, 28.3 percent liked the 24 d.u. per acre neighborhood the least, compared to 9.8 percent who liked the 36 d.u. per acre neighborhood the least.

[12] Zero, or neutral, ratings were excluded from the analyses presented in this section.

[13] Associations were also explored for the 24 and 36 d.u. per acre neighborhoods; however, the relationships found generally followed a pattern similar to those of the other two neighborhoods. In order to make the findings more transparent and limit the amount of statistics, we present only the findings for the two most dissimilar neighborhoods.

[14] Several other statistical findings lend perhaps a bit of credence to the hypotheses posed. For singles without children, 22.4 percent liked the 48 d.u. acre neighborhood the most. For singles with children, one-half liked the 24 d.u. per acre neighborhood (without a park) the least. Couples without children also liked the 24 d.u. per acre neighborhood the least.

[15] Analyses were also carried out between two household income groups: those with annual incomes below and above $21,000. This simple dichotomy allowed preferences between "low-income" and "other income" groups to be compared. Using this dichotomy, the lowest-density neighborhood was liked more by the "other income" group; however, the highest-density neighborhood was also most acceptable to the "other income" group. In general, respondents from low-income households seemed more indifferent toward both types of neighborhoods.

[16] The Pearson product-moment correlations between income and overall desirability rating for each neighborhood (with significance levels in brackets) were: 12 d.u. per acre — -.099 (.212); 24 d.u. per acre — -.124 (.116); 36 d.u. per acre — -.102 (.195); and 48 d.u. per acre — .067 (.400).

[17]The Pearson product-moment correlations beetween age and overall desirability for each neighborhood (with significance levels in brackets) were: 12 d.u. per acre — -.150 (.046); 24 d.u. per acre — -.154 (.055); 36 d.u. per acre — -.098 (.223); and 48 d.u. per acre — -.080 (.321). The negative association between age and rating fell as the density of a neighborhood increased.

[18]Only 6.9 percent of respondents from eastern suburbs ranked the 48 d.u. per acre neighborhood the lowest; 41.4 percent, however, ranked the 12 d.u. per acre neighborhod the lowest.

[19]The finding that low-income people from dense neighborhoods in San Francisco, Oakland, and Berkeley were most impressed by the 12 d.u. per acre neighborhood and generally did not like the 48 d.u. per acre neighborhood could reflect the aspirations of these individuals to one day filter upwards through the housing market. That is, many likely live in dense urban settings that they perhaps associate with other problems, such as crime and poor quality schools, and aspire to one day move away from. The 12 d.u. per acre neighborhood might represent the biggest change in the current living situation of many of these individuals, and thus they could have been more predisposed towards liking such lower-density neighborhoods.

[20]Because 7x7 symmetrical matrices were generated, the Tau-B measure of association was used.

[21]Kendall Tau-B correlations were also measured for other neighborhood attributes, including density and building architecture; however, most correlations were close to zero for both neighborhoods, and thus are not presented in this section. Despite the absence of strong statistical correlations, we believe that the factor that most strongly influenced the rating of the 12 d.u. per acre neighborhood was the relatively low density, including the existence of a back yard in the images shown for this neighborhood.

# Chapter Four

## Attitudes of Housing Developers
## to Alternative Simulated Transit Neighborhoods:
## Survey Results

## 4.1. Background on Developer Surveys

The same slide images were shown to a group of the Bay Area's largest residential developers at a morning gathering held at the BART headquarters in Oakland on May 24, 1994. BART co-sponsored the breakfast meeting and assisted in soliciting developer interest. Developers received a formal invitation by mail from BART officials. Nearly everyone who was sent an invitation attended the gathering or sent a senior staff member in their place. After initial introductions by BART officials, we discussed the purpose of the research —to study peoples' reactions to different transit-oriented residential neighborhoods and explore the degree to which they are willing to accept higher blended densities in return for more neighborhood amenities like parks and retail shops. The same slide presentation was then shown and the survey was administered among the developers. Developers were asked to complete the questionnaires based on their own tastes and preference as opposed to what they perceived the general public to like most. Of course, the two are likely inseparable — that is, the views of developers are no doubt colored by their overall perceptions of market preferences.

Upon completing the slide show, the preliminary results from the general public survey responses were presented. This was followed by an open discussion of the research methodology itself as well as the general concept of promoting denser housing development near rail transit stations.

In all, 24 developers attended the gathering, viewed the slide sequences, and completed the questionnaire. [1] All of the Bay Area's major housing developers were represented at the meeting, including several which have recently built new housing projects near BART or Santa Clara County light rail stations.

## 4.2. Neighborhood Ratings

In general, the 24 developers rated the four transit-oriented neighborhoods quite similarly to how the general public rated them. Figure 4.1 shows the average "overall desirability" ratings by the developers, compared to those of the general public (presented in Chapter Three). Both groups liked the 12 d.u. per acre neighborhood the most and the other neighborhoods less so. As with the general public, developers, on average, rated the 24 d.u. per acre neighborhood the lowest. The 36 d.u. per acre neighborhood with a park had the second-highest average rating. Compared to the general public, developers generally liked the 36 d.u. per acre neighborhood more, and disliked the 24 d.u. per acre neighborhood less. We might

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## Neighborhood (DU/acre)
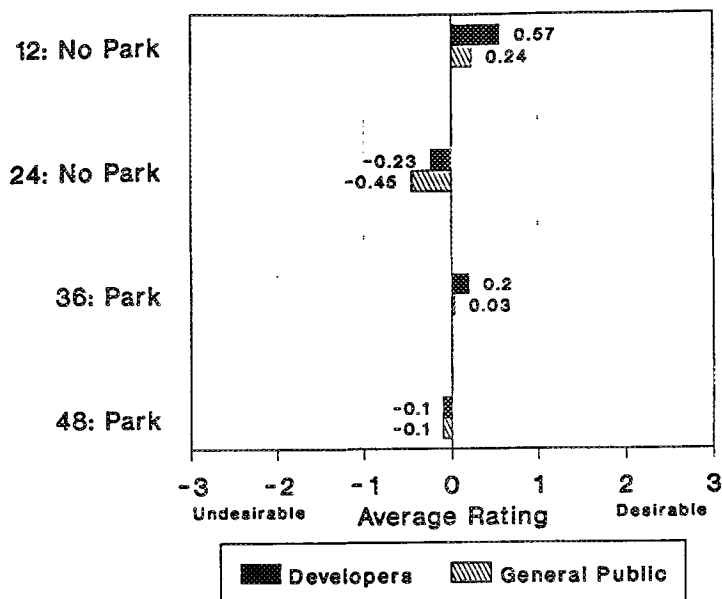


Figure 4.1. Overall Desirability Rating: Developers

infer that even with the "trained eyes" of developers, higher-density neighborhoods can be viewed as desirable (and potentially more marketable) when complemented by various amenities.

Developers' ratings of specific features of neighborhoods— e.g., stores, public parks, architecture, etc. —were also very similar to the general public's. The 36 d.u. per acre neighborhood received the highest ratings in terms of its stores, services, and parks, even though it had identical shops, consumer services, and open-space amenities as the 48 d.u. per acre neighborhood. All neighborhoods were liked for their public transit provisions, with the lowest-density neighborhood receiving the highest rating. The only neighborhood to receive a positive rating for housing density by developers was the 12 d.u. per acre one. However, the densities of the 36 d.u. per acre neighborhood were generally preferred over those of the 24 d.u. per acre one. So was the architecture and building design. Only the lowest-density neighborhood received a positive average rating for building design. The highest-density neighborhood was viewed as the least pleasant architecturally.

Overall, developers seemed to prefer the 36 d.u. per acre neighborhood over the 24 d.u. per acre one because of the presence of a park and more consumer-oriented services. This could suggest that the Bay Area developers are more inclined to build mixed-use transit-oriented projects than residential-only ones even if it means substantially higher densities.

## 4.3. Neighborhood Rankings

The initial rankings of the four neighborhoods when shown together twice in sequence are summarized in Figure 4.2. Comparisons with Figure 3.12 in Chapter Three reveal developers' rankings were very similar to those of the general public. Overwhelmingly, the 12 d.u. per acre neighborhood was liked most and the 48 d.u. per acre neighborhood was liked least. Second in preference was the 36 d.u. per acre neighborhood. The 24 d.u. per acre neighborhood received the fewest number of first-place rankings.[2]

### Neighborhood (DU/acre)
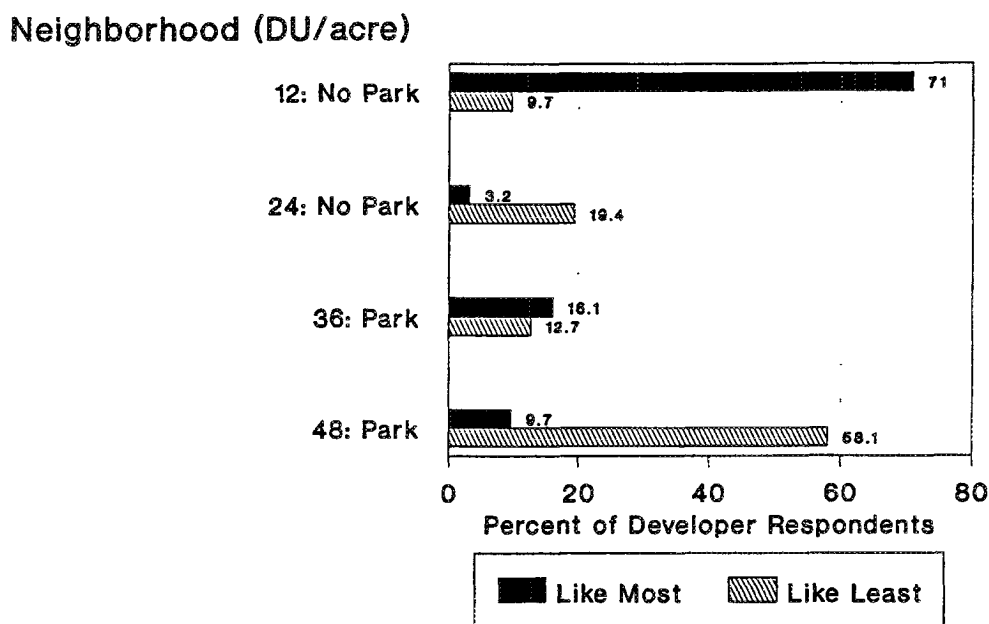


Figure 4.2. Ranking of Neighborhoods: Developers, Initial Rank

Verbal descriptions of what distinguished neighborhoods changed developers' rankings very little, as was the case with the general public. Figure 4.3 shows that the 36 d.u. per acre neighborhood benefitted the most by these disclosures. While a few developers ranked the 24 d.u. per acre neighborhood more highly in the second round, even more ranked it lower. Interest in the lowest- and highest-density neighborhoods fell off slightly in the second ranking.

## 4.4. General Comments by Developers

Following the slide presentation, everyone in attendance offered comments and suggestions about the research methodology itself as well as the general topic of promoting transit-based housing. Several developers mentioned that they found it difficult to distinguish differences in densities. One suggestion was to vary densities more in future surveys. While this might be viewed as a criticism of the visual images

## Neighborhood (DU/acre)



Horizontal bar chart with categories on the y-axis and "Percent of Developer Respondents" (0 to 80) on the x-axis.

- 12: No Park — Like Most: 63.3, Like Least: 10
- 24: No Park — Like Most: 10, Like Least: 33.3
- 36: Park — Like Most: 20, Like Least: 6.7
- 48: Park — Like Most: 6.7, Like Least: 60

Legend: ■ Like Most   ▨ Like Least
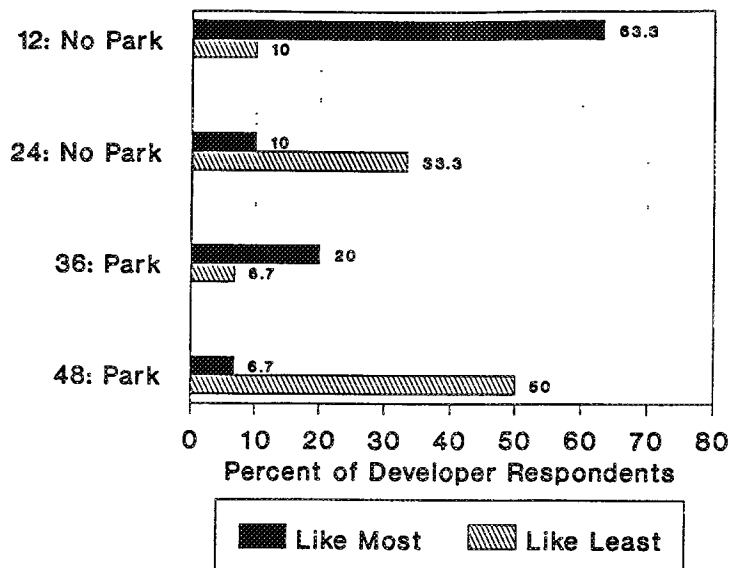
Figure 4.3. Ranking of Neighborhoods: Developers, Second Rank

shown, it might also be interpreted as further evidence that neighborhoods can be designed in such a way that 48 d.u. per acre are perceived to be similar to 12 d.u. per acre.

A second criticism of the research design was that the building architecture was indistinguishable, and for some rather dull. Several developers mentioned that they could not help but judge neighborhoods on the basis of architectural quality, although all realized that the point of the exercise was to evaluate the concept of building more housing near transit facilities.[3] Several also emphasized that architecture strongly influences density perceptions.

Our response to this second criticism was that we tried to control for building designs and architectural quality as a constant so that we could measure the unique effects of changes in density and neighborhood amenity. Altering architectural styles would have added another dimension of change and thus would have complicated the analysis and interpretations of the results. While it is generally accepted that higher densities are more marketable if building quality and design improve, whether the same is so for neighborhood amenities is less widely accepted. A central purpose of this research was to address this question: might people be willing to accept higher densities if given more neighborhood amenities, controlling for building designs and other factors? Additionally, by making architectural designs similar across neighborhoods, it was hoped that survey participants would concentrate less on building details and more on overall features of the neighborhoods. That is, we were more interested in having people focus on the macro context than on micro-design features. Despite these explanations, however, those

who risk their money on building residential housing, namely developers, seemed uneasy about a research design that does not incorporate normative features of successful high-density projects, such as the tendency for architectural design to improve as densities rise.

Several developers gave examples of where building designs were essential toward getting projects accepted by a community and eventually leased out. In the case of a recent Emeryville project, for example, the initial phase was built at 50 d.u. per acre, and because a standard podium building design was used, it was opposed by some local residents and has proven difficult to lease. The second phase, built at 65 d.u. per acre, was more readily approved because its architectural style was more to the Emeryville city council's liking. It has also filled up more quickly. The only difference between the projects was architectural style; unit size and location were virtually identical. The developer of this project maintained that architectural design can "hide density." Another developer of a similar project near Santa Clara County's light-rail line echoed similar comments. He maintained that architectural design was "the key issue" for most of his transit-oriented projects. City councils and citizens groups, he noted, are more concerned about "micro" than "macro" issues, especially as they related to NIMBY concerns.

In defense of the architecture chosen for our simulations, it should be pointed out, however, that most respondents, including developers, were unfamiliar with actual transit-oriented, medium-to-high density communities. Most existing and recently built medium-density developments have been designed for an automobile-oriented clientele, with surface parking lots next to units or podium parking underneath buildings. None of the architectural solutions that might have served as comparisons or were mentioned by the developers (for example, the Emeryville apartments) would have functioned in a transit-related community because these projects generally are oriented away from the streets. Residents drive through gates into, or underneath, such structures, and reach their homes on foot via interior elevators or walk-ways, or through courtyards shared only by residents of the projects and their visitors. A transit village would have to be designed for pedestrian movements between stations and surrounding residences. All dimensions would have to be optimized for pedestrians. In addition, the pedestrian paths would have to be prominent, safe, and convenient, by concentrating the largest number of people walking along such paths and keeping these routes under public observation. Thus, the architectural design of a transit-oriented community is very different in character from the typical automobile-oriented condominium project, but similar to traditional medium-density areas in cities built at a time when the automobile was less pervasive. Therefore, the layout and character of our simulated community was similar to urban areas built in the first two decades of this century. For some respondents, including many developers, the character of such streets and their architecture might be too dense, too "urban," too "public," and not "private" enough. Issues regarding architectural design are complex. Respondents might not only reflect on architectural style when they commented negatively on the architectural quality of the simulated setting, but on larger issues related to urban living.

Most others comment volunteered by developers pertained to the larger challenges of building transit-oriented housing projects. One developer emphasized the importance of phasing in amenities. He believed that neighborhood stores, open space, libraries, and the like must "happen together" in order to attract significant consumer interest. Parking was another concern of the developers. Many felt that their projects would not pencil out if they had to build structured parking to accommodate a dense housing project. One developer claimed he could make more profit from a 40 d.u. per acre project with surface parking than an 80 d.u. per acre project with structured parking. One possible way to minimize parking expenses would be to jointly develop a housing project with BART and co-share the cost of structured parking. This is currently being done for a mid-rise housing project at the El Cerrito del Norte station. Another would be to lower parking standards for housing near rail stations (such as to 1.1 cars per unit) in recognition of the fact that many of those living near rail stations might not need a second car.

## 4.5. Conclusion

Overall, developers responded to the transit-oriented neighborhoods just as most of the surveyed residents of the Bay Area did. Since developers' very financial survival depends on satisfying market preferences for housing, this was perhaps not unexpected. In general, the hypothesis that people will trade-off higher densities for more neighborhood amenities was supported by the survey responses of developers. To the degree that the responses of the general public represent demand-side preferences and those of the developers represent supply-side preferences, these findings suggest that there is probably a genuine yet untapped market for transit-oriented developments in the San Francisco Bay Area. In order for such projects to get built, however, it will be necessary to first gain the support of community groups and elected officials. Some developers felt that improving the quality of architecture was the most important way of securing such support.

The importance of building design and architecture came out during the course of general discussions on the research methodology itself as well as the general concept of transit-based housing. A number of developers stressed that quality design was pivotal toward creating a financially successful high-density residential project, every bit as important as providing such amenities as parks and shops, if not more so. Averting the need for structured parking was also essential toward the financial viability of such projects. These observations have important implications both for the research design as well as public policy. From a research standpoint, future simulations of building designs should consider improving architectural quality as densities increase, even if this means introducing a more complex research design. Statistically, the challenge will be to measure how building design and neighborhood amenities influence attitudes, both individually and together (interactively).

Perhaps more important is the implications of the developers' observations for public policy. The main challenge is how to make dense transit-oriented projects work financially. One important policy reform would be to loosen regulations on parking supplies for projects near rail stations, in recognition

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of the likelihood of many tenants owning only one car. Lowering parking standards could eliminate the need for parking structures at many transit-oriented projects, thus driving down the costs of housing units. This in turn would further promote affordable housing objectives. Where parking standards are retained, joint development of housing on existing transit parking lots might allow the costs of structured parking to be shared. The economies of building structured parking for rail users and nearby apartment and condo dwellers would get translated into lower housing costs. Perhaps an even bolder public policy reform would be to grant tax exemptions and credits against impact fees for housing projects built near rail stations in recognition of the social benefits such developments provide. To the degree that residents of transit-based housing use rail transit more often and thus reduce traffic loads on neighborhood streets, as has been shown in earlier research (Cervero, 1993), then an argument could be made that developers of such projects should be financially rewarded. This would allow such developers to spend more money on neighborhood amenities and building designs, factors that we believe this research shows are important toward building successful transit-oriented neighborhoods.

# NOTES

[1] The same demographic data were compiled among the surveyed the developers. The average survey respondent was 47 years of age and lived in a household with 3.3 individuals and 2.3 automobiles.

[2] In general, ordinal rankings did correlated closely with neighborhood density: 71 percent ranked the 12 d.u. per acre neighborhood first, 48.4 percent ranked the 24 d.u. per acre neighborhood second, 51.6 percent ranked the 36 d.u. per acre neighborhood third, and 58.1 percent ranked the 48 d.u. per acre neighborhood fourth.

[3] Another developer commented that the rather narrow streets in the images did project a positive "neighborhood feeling," but that the housing had an "affordable housing look."

# Chapter Five

## Conclusion

### 5.1. Key Findings and Policy Relevance

This research provides some encouragement about the prospects for creating transit villages in large metropolises like the San Francisco Bay Area. Most importantly, it found some public willingness to accept higher densities, at the level necessary to support rail transit services, in return for public parks, in-neighborhood shops, and easy access to rail stations. Notably, 2.5-story row houses with narrow front lots and modest backyards that are near a central public park and retail shops are preferred to row houses with bigger backyards and more frontage, but with no nearby park and fewer local services.

Among the amenities shown, having a rail station close by was consistently liked the most. Being near stores and services was particularly important to those who reacted positively to the denser simulated neighborhoods. Having a central park increased the average ratings of the densest neighborhoods, and not having a park slightly lowered the ratings of the less dense ones. While a public park was clearly perceived as a positive amenity, its ability to compensate for density seemed to hold only up to a certain density threshold — around 36 dwelling units per acre.

Those most receptive toward higher-density transit neighborhoods were young adults with moderate incomes who currently reside in large apartment complexes. Those who currently commute to work by transit or some other non-auto mode were also slightly more accepting of denser neighborhoods. No clear associations could be established between neighborhood preferences and such factors as household type, life-cycle stage (among non-singles), and place of employment.

Bay Area housing developers responded similarly to the simulated transit neighborhoods. On balance, however, developers reacted more harshly toward the denser neighborhoods, and were slightly less willing to trade-off higher densities in return for more amenities. This reaction might have reflected greater scepticism among developers, no doubt based on experience, about the market potential of denser housing projects.

Overall, this research suggests there is an untapped market potential for moderately dense housing projects near rail stations that feature nice amenities and neighborhood attractions. To bring this about, it will be necessary for various stakeholders— builders, lenders, local governments, transit boards, and neighborhood groups— to agree upon and set into motion various initiatives that will create a receptive policy environment. Permissive land use regulations, for instance, could encourage denser housing near major transit stops, through such measures as density bonuses and inclusionary zoning. Joint development opportunities might also be pursued, such as converting portions of park-and-ride lots to housing development, as several Bay Area transit authorities are currently pursuing. Credits against exactions, impact fee obligations, and local taxes might also be granted to builders of transit villages, in recognition

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of the transportation-related benefits of such projects, such as obviating the need to expand roads. In redevelopment zones, such fiscal tools as tax increment financing might be used to attract housing developers to station areas. Pending legislation in California would allow similar financial instruments to used in designated transit village zones. Such federal initiatives as the formation of empowerment zones and enterprise communities that aim to attract private capital to inner-city areas might also be used to leverage transit-based housing projects.

Another suggestion has been the creation of an "efficient-location" loan program, modeled after the energy-efficient mortgage, which permits a lender to qualify a borrower for a bigger mortgage when a home is deemed energy-efficient (and thus has low utility bills). With an "efficient-location" loan, a lender would increase the qualified mortgage by the amount of automobile costs saved from living near a rail station and being less dependent on the private automobile (Inman, 1994). Holtzclaw (1994) has demonstrated that the automobile cost savings from living in a transit-oriented, pedestrian-friendly environment can be substantial: a family in San Francisco's Nob Hill neighborhood spends an average of $6,000 less a year on automobile expenses than a family of similar size and income living in San Ramon, a newer East Bay suburb. Collectively, such initiatives as creative financing, land use incentives, and innovative mortgage programs would provide the kind of supportive policy environment that would allow more transit villages to take form.

## 5.2. Observations on Research Methodology and Directions for Future Research

The use of visual simulations is a novel approach toward conducting market research on the potential of various transit-oriented developments. In our work, the use of tightly controlled simulations allowed us to test the central hypotheses raised by this research. It would have been difficult to discern whether people are willing to trade-off higher densities for amenities using actual photo images or photomontages because of confounding influences, such as variations in architectural styles and levels of sunlight. By controlling for such factors, our work was able to demonstrate some degree of elasticity between preferences and neighborhood densities as long as attractive amenities are introduced.

While such controls are vital to the conduct of quasi-experimental research and are widely accepted in the world of academic research, they pose obvious shortcomings to those who face the challenge of building transit-oriented housing projects in the real world, namely housing developers. Based on the feedback we received about the simulations, especially from developers, many reacted negatively to the images because they did not particularly like the designs and style of buildings. Some felt potential homebuyers would be even more receptive to the denser neighborhoods shown if residential buildings were more attractive. It might very well be that improving building quality and enriching architectural designs as densities rise is every bit as important as adding parks, stores, and other other neighborhood amenities. That is, the micro-designs of buildings deserve the same consideration as the macro-designs of neighborhoods as a strategy for "masking" residential densities.

Any future research on consumer responses toward simulated transit villages should consider enlivening architecture in addition to adding neighborhood amenities as a compensatory strategy for higher densities. From a research standpoint, this introduces statistical challenges in separating out the unique and joint influences of design and amenities on peoples' attitudes. Measuring interactive effects, however, may very well be a moot point if indeed better design and more amenities are both viewed by the public as necessary, co-dependent features of attractive transit-oriented neighborhoods.

Future research might also consider more closely integrating cost estimates into the process of evaluating public responses to simulated neighborhood environments. One approach might be the use of contingency valuation approaches wherein respondents choose various "amenity packages" by trading off certain amenities and designs for others, at a cost. Contingency analysis might also be used to evaluate the potential cost savings of foregoing a second or third car when living in a transit village, and the attitudes of consumers to such possible savings.

The somewhat contradictory findings of this research with those of other marketing studies on attitudes toward higher residential densities might very well be attributable to differences in research methods. Traditionally, developers' marketing studies on housing rely mainly on words and numbers. Visual images, we believe, provide a much richer context for probing the market potential for transit village development, not only because they are concrete and graphic, but also because they allow for a much wider array of choices and opportunities. As noted by Constantine (1992: 11):

> ... it should not be surprising that surveys of consumers' visual preferences often
> contradict conventional marketing studies. By gauging people's preferences for
> various types of architecture, streetscapes, commercial centers, and even landscaping,
> visual preference surveys can become the basis for creating a more successful image
> for new development.

# APPENDIX

## Transit Housing Survey

Your contribution today will help us gain insight into the possibility of developing housing near transit stations. We will show you images of four simulated communities near transit stations and ask you to respond to questions about the images. On the next two pages, we would like you to answer a set of general questions.

COMMUTING PATTERN:

1. Where do you presently live?
   City_____Zip_____

2. Where do you presently work?
   City_____Zip_____
   (If you do not work, skip to question 6)

3. On average, how long is your commute trip, one way? (Circle one answer)
   1. 0 - 5 minutes    5. 20 - 30 minutes
   2. 5 - 10 minutes   6. 30 - 45 minutes
   3. 10 - 15 minutes   7. 45 - 60 minutes
   4. 15 - 20 minutes   8. More than 60 minutes
                  9. Other_____

4. Which of the following means of transportation do you use most often to get to work/school? (Circle one)
   1. Drive Alone    5. Bicycle
   2. Carpool        6. Walk
   3. Bus transit    7. Other (Specify)
   4. BART/Rail     _____

5. If it were equally easy to get to work by any of the following means of transportation, which would you prefer most? (circle one)
   1. Drive alone    5. Bus transit
   2. Rail           6. Walk
   3. Bicycle       7. Other(specify)
   4. Carpool      _____

6. How often do use BART/Rail? (Circle one )
   1. Nearly every day
   2. 1-2 times a week
   3. 1-2 times a month
   4. Less than once a month
   5. Never

7. How often is a car, van, truck or motorcycle available for your use? (Circle one )
   1. Every day
   2. Once a week
   3. Once a month
   4. Less than once a month
   5. Never

8. How many automobiles, trucks or vans are currently owned or available to members of your household?

   _____Vehicles

CURRENT RESIDENCY:

9. Do you own or rent your residence? (circle correct housing and indicate your rent or mortgage payments)
   1. Own $_____/month
   2. Rent $_____/month
   3. Other_____

10. a. What type of residence do you currently live in? (circle one)
    1. Single family home
    2. Duplex
    3. Apartment building (3-5 units)
    4. Apartment building (6-10 units)
    5. Apartment building (11 or more units)
    6. Townhouse or condominium
    7. Mobile home or trailer
    8. Other_____

    b. Please circle all residences you have lived in over the past ten years?
    1. Single family home
    2. Duplex
    3. Apartment building (3-5 units)
    4. Apartment building (6-10 units)
    5. Apartment building (11 or more units)
    6. Townhouse or condominium
    7. Mobile home or trailer
    8. Other_____

11. a. How satisfied are you with your current housing?

    -3..........-2..........-1..........0..........1.........2.........3
    unsatisfied       neutral     very satisfied

    b. List two things about your house you like most? (circle one)
    1._____
    2._____

12. a. How satisfied are you with your current neighborhood? (circle one)

    -3..........-2..........-1..........0..........1.........2.........3
    unsatisfied       neutral     very satisfied

    b. List two things about your neighborhood you like most?
    1._____
    2._____

13. How many people live in your household?____
    Their ages:_____

14. Which best describes your household?
    1. Live alone
    2. Roommates
    3. Couple (married or living together)
    4. Couple with children
    5. Single with children
    6. Retired
    7. Empty nesters (kids are grown)
    8. Other_____

15. Please indicate your income range.
    1. Less than $21,000
    2. $21,000 - 28,000
    3. $29,000 - 40,000
    4. $40,000 - 60,000
    5. $60,000 - 80,000
    6. $80,000 - and above

16. If you were indeed looking to buy a new
    home, what kind of neighborhood would
    you look for? (Circle or list top three
    qualities or conditions)
    1. Closeness to your work
    2. Quality of neighborhood schools
    3. Shops within walking distance
    4. Scenic view
    5. Proximity to open space
    6. Other_____
    _____
    _____
    _____

17. How important are the following
    neighborhood qualities to you?

a. Stores and services within walking distance

    -3...........-2............-1............0.............1...........2.........3
    undesirable          neutral         very desirable

b. Public transportation within walking distance

    -3...........-2............-1............0.............1...........2.........3
    undesirable          neutral         very desirable

c. Public parks within walking distance

    -3...........-2............-1............0.............1...........2.........3
    undesirable          neutral         very desirable

S T O P

# INTRODUCTION TO SLIDE VIEWING

Shortly you will see a simulated sequence of images depicting the experience of visiting and potentially living in a Bay Area community. There will be four sequences, each depicting a somewhat different neighborhood. We will show you each sequence twice. During the first showing you should concentrate on the images, imagining yourself in the places shown. Then, we will show you the same sequence again at a slower pace. You should watch the images very carefully. During the second showing of each sequence, you are to answer questions about some of the details you have seen .

The four residential communities do not actually exist. They are simulated using advanced computing techniques. Also, they appear as if they were brand new, recently completed. As you view the sequences, image yourself visiting the neighborhood with the purpose of possibly purchasing a home for yourself or your family. The houses in each sequence are of identical size, approximately 1,100 square feet, with two bedrooms and one and half baths. Each unit has a garage space for one car. Consider that the · neighborhood lies in a part of the San Francisco Bay Area similar to where you presently live and near a rail station like BART.

## Slide Group A

1. List one thing you like about the neighborhood.

_____

2. List one thing you dislike about the neighborhood.

_____

3. Based on the images you have seen, how desirable is the neighborhood in terms of:

a. stores and services

-3..........-2..........-1..........0..........1..........2........3
undesirable          neutral          very desirable

b. public transportation

-3..........-2..........-1..........0..........1..........2........3
undesirable          neutral          very desirable

c. public parks

-3..........-2..........-1..........0..........1..........2........3
undesirable          neutral          very desirable

d. housing density

-3..........-2..........-1..........0..........1..........2........3
undesirable          neutral          very desirable

e. buildings and architecture

-3..........-2..........-1..........0..........1..........2........3
undesirable          neutral          very desirable

4. In your opinion, what would be the value of the home at the beginning of this sequence, if it were built in a location similar to your current residence and served by BART?

a. Under $150,000    f. $250,000 - $275,000
b. $150,000 - $175,000    g. $275,000 - $300,000
c. $175,000 - $200,000    h. $300,000 - $325,000
d. $200,000 - $225,000    i. $325,000 - $350,000
e. $225,000 - $250,000    j. Over $350,000

5. Overall, how desirable is this neighborhood as a place to live?

-3..........-2..........-1..........0..........1..........2........3
undesirable          neutral          very desirable

## Slide Group B

1. List one thing you like about the neighborhood.

_____

2. List one thing you dislike about the neighborhood.

_____

3. Based on the images you have seen, how desirable is the neighborhood in terms of :

a. stores and services

-3..........-2..........-1..........0..........1..........2........3
undesirable          neutral          very desirable

b. public transportation

-3..........-2..........-1..........0..........1..........2........3
undesirable          neutral          very desirable

c. public parks

-3..........-2..........-1..........0..........1..........2........3
undesirable     .     neutral          very desirable

d. housing density

-3..........-2..........-1..........0..........1..........2........3
undesirable          neutral          very desirable

e. buildings and architecture

-3..........-2..........-1..........0..........1..........2........3
undesirable          neutral          very desirable

4. In your opinion, what would be the value of the home at the beginning of this sequence, if it were built in a location similar to your current residence and served by BART?

a. Under $150,000    f. $250,000 - $275,000
b. $150,000 - $175,000    g. $275,000 - $300,000
c. $175,000 - $200,000    h. $300,000 - $325,000
d. $200,000 - $225,000    i. $325,000 - $350,000
e. $225,000 - $250,000    j. Over $350,000

5. Overall, how desirable is this neighborhood as a place to live?

-3..........-2..........-1..........0..........1..........2........3
undesirable          neutral          very desirable

# Slide Group C

1. List one thing you like about the neighborhood.

_____

2. List one thing you dislike about the neighborhood.

_____

3. Based on the images you have seen, how desirable is the neighborhood in terms of:

a. stores and services

-3...........-2...........-1...........0...........1.........2.........3
undesirable          neutral          very desirable

b. public transportation

-3...........-2...........-1...........0...........1.........2.........3
undesirable          neutral          very desirable

c. public parks

-3...........-2...........-1...........0...........1.........2.........3
undesirable          neutral          very desirable

d. housing density

-3...........-2...........-1...........0...........1.........2.........3
undesirable          neutral          very desirable

e. buildings and architecture

-3...........-2...........-1...........0...........1.........2.........3
undesirable          neutral          very desirable

4. In your opinion, what would be the value of the home at the beginning of this sequence, if it were built in a location similar to your current residence and served by BART?

a. Under $150,000             f. $250,000 - $275,000
b. $150,000 - $175,000        g. $275,000 - $300,000
c. $175,000 - $200,000        h. $300,000 - $325,000
d. $200,000 - $225,000        i. $325,000 - $350,000
e. $225,000 - $250,000        j. Over $350,000

5. Overall, how desirable is this neighborhood as a place to live?

-3...........-2...........-1...........0...........1.........2.........3
undesirable          neutral          very desirable

# Slide Group D

1. List one thing you like about the neighborhood.

_____

2. List one thing you dislike about the neighborhood.

_____

3. Based on the images you have seen, how desirable is the neighborhood in terms of :

a. stores and services

-3...........-2...........-1...........0...........1.........2.........3
undesirable          neutral          very desirable

b. public transportation

-3...........-2...........-1...........0...........1.........2.........3
undesirable          neutral          very desirable

c. public parks

-3...........-2...........-1...........0...........1.........2.........3
undesirable          neutral          very desirable

d. housing density

-3...........-2...........-1...........0...........1.........2.........3
undesirable          neutral          very desirable

e. buildings and architecture

-3...........-2...........-1...........0...........1.........2.........3
undesirable          neutral          very desirable

4. In your opinion, what would be the value of the home at the beginning of this sequence, if it were built in a location similar to your current residence and served by BART?

a. Under $150,000             f. $250,000 - $275,000
b. $150,000 - $175,000        g. $275,000 - $300,000
c. $175,000 - $200,000        h. $300,000 - $325,000
d. $200,000 - $225,000        i. $325,000 - $350,000
e. $225,000 - $250,000        j. Over $350,000

5. Overall, how desirable is this neighborhood as a place to live?

-3...........-2...........-1...........0...........1.........2.........3
undesirable          neutral          very desirable

## FOUR SEQUENCES TOGETHER

Now you will see all four sequences again and we would like you to compare and rank them, from best to worst. Each sequence will be shown in exactly the same order as it was shown earlier, except it will be shortened to only four images. One sequence will be shown after the other until all four sequences are shown. After all four have been shown twice, we will stop the projector and you will answer the remaining questions. Please watch carefully.

1. Of the four communities shown, A through D, which do you like:

        Most_____

        Second best_____

        Third _____

        Least _____

a. Why do you like your first choice best?

b. Why do you like your second choice best?

c. What would have to change to make your least favorite neighborhood more acceptable?

2. Which of the four communities, A through D, appear to have the:

        a. Lowest density _____

        b. Next lowest density_____

        c. Next to highest density_____

        d. Highest density_____

# FINAL RANKING

We appreciate your participation thus far. We would like to take a minute to draw your attention to some specific details of the images shown. Each slide sequence has varying densities and community amenities, yet several things in the images remain the same. We have assumed in our study that people would approve of living in higher density if there were more amenities such as park open space, convenience stores, and access to rail transportation.

Items that remain the same are road widths, architectural style, building colors, the tree-lined streets, the blue sky, the parking garage near the BART station, the bus near the plaza and the BART station itself. Also consistent are the apartment buildings that are located at the end of the residential streets. Things that increase with increasing density are the amount of open space, convenience stores, cafes and benches in the plaza. Other things that change are the number of people and automobiles that would accompany the changing housing density levels. Now that you know about these changes, do they influence your perception of the communities? The sequences will be shown slowly one last time, using only four representative slides for each sequence, so that you may rank the communities again. (Please do not change your ranking on the previous page 6! Just rank the communities one last time on this page.)

1. Of the four communities shown, A through D, which do you like:

       Most_____
       Second best_____
       Third_____
       Least_____

2. Please write any comments you have with the space provided below.

* * THANK YOU . PLEASE RETURN THE SURVEY * *

# REFERENCES

Baldassare, M. 1979. *Residential Crowding in Urban America*. Berkeley: University of California Press.

Baldassare, M., R. Knight, and S. Swan. 1979. "Urban Service and Environmental Stessor: The Impacts of the Bay Area Rapid Transit System on Residential Mobility." *Environment and Behavior* 11(4): 125-141.

Bergdal, James, and Richard Williams. 1990. "Perception of Density." *Berkeley Planning Journal*, Vol. 5.

Bernick, M. 1993. "The Bay Area's Emerging Transit-Based Housing." *Urban Land* 52(7): 38-41.

Bernick, M., and R. Cervero. 1994. "Transit-Based Development in the United States." *Passenger Transport* 12(2): 7-8.

Blayney Associates. 1978. *The Study of Property Prices and Rents: BART Impact Study*. Berkeley: Metropolitan Transportation Commission.

Blumenfeld, H. 1968. *The Modern Metropolis: Its Origins, Growth, Characteristics, and Planning*. Cambridge, Massachusetts: MIT Press.

Bookout, L. 1992. "The Future of Higher-Density Housing." *Urban Land* 51(9): 14-18.

Bookout, L., and J. Wentling. 1988. "Density by Design." *Urban Land* 47: 10-15.

Bosselmann, P. 1993. "Dynamic Simulations of Urban Environments." In *Environmental Simulation Research and Policy Issues*, D. Stokols, ed., New York: Plenum Press.

Bosselmann, P., and K. Craik. 1987. "Perceptual Simulations of Environments." In *Methods in Environmental and Behavior Research*, R. Bechtel, R. Marans, and W. Michelson, eds., New York: Van Nostrant Reinhold.

Burkhardt, J. 1976. *Summary of Research: Joint Development Study*. New York: Administration and Managerial Research Association.

Campbell, A., P. Converse, and R. Willard. 1976. *The Quality of American Life*. New York: Russell Sage Foundation.

Cervero, R. 1993. *Ridership Impacts of Transit-Focused Development in California*. Berkeley: Institute of Urban and Regional Development, Monograph 45 (November).

Cervero, R., M. Bernick, and G. Gilbert. 1994. *Market Opportunities and Barriers to Transit-Based Development in California*. Berkeley: Insitute of Urban and Regional Development, Working Paper No. 621.

Commuter Transportation Services. 1994. *State of the Commute*. Los Angeles, Commuter Transportation Services.

Constantine, J. 1992. "Design by Democracy." *Land Development* (Spring-Summer): 11-15.

Cooper Marcus, C., and W. Sarkissian. 1986. *Housing as if People Mattered*. Berkeley: University of California Press.

Craik, K., and N. Feimer. 1988. "Environmental Assessment." In *Handbook of Environmental Psychology*, D. Stokols and J. Altmann, eds., New York: Wiley.

Dillman, J., and D. Dillman. 1987. "Private Outside Space as a Factor in Housing Acceptability." *Housing and Society* 14(1): 20-29.

Dornbush, D. 1975. "BART-induced Changes in Property Values and Rents." *Land Use and Urban Development Projects, Phase I, BART Impact Study*. Washington, D.C.: U.S. Department of Transportation and U.S. Department of Housing and Urban Development.

Foote, N., J. Abu-Lughod, M. Foley, and L. Winnick. 1960. *Housing Choices and Housing Constraints*. New York: McGraw-Hill.

Frank, L. 1994. "The Impacts of Mixed Use and Density on the Utilization of Three Modes of Travel: The Single Occupant Vehicle, Transit, and Walking." *Transportation Research Record* (forthcoming).

Harvey, G. 1990. *Relation of Residential Density to VMT per Resident*. Oakland: Metropolitan Transportation Commission.

Hass-Klau, C. 1990. *The Pedestrian and City Traffic*. London: Belhaven Press.

Hawley, A. 1972. "Population Density and the City." *Demography* 9: 521-529.

Holtzclaw, J. 1990. "Manhattanization versus Sprawl: How Density Impacts Auto Use Comparing Five Bay Area Communities." *Proceedings of the Eleventh International Pedestrian Conference*. Boulder, Colorado: City of Boulder: 99-106.

_____. 1994. *Residential Patterns and Transit, Auto Dependence, and Costs*. San Francisco: Resources Defense Council.

Jacobs, J. 1961. *The Death and Life of Great American Cities*. New York: Vintage Books.

Jensen, R. 1966. *High Density Living*. New York: Praeger.

Ketelsen-Johansson, J. 1994. *Perception of Housing Densities that are Transit Supportive and Maintain the Appeal of Single Family Home Ownership*. Berkeley: University of California, Departments of Landscape Architecture and City and Regional Planning, unpublished master's thesis.

Landis, J., S. Guhathakurta, and M. Zhang. 1994. "Capitalization of Transportation Investment into Single Family Home Prices: A Comparative Analysis of California Transit Systems and Highways." Berkeley: Institute of Urban and Regional Development, Working Paper 619.

Lansing, J., R. Marans, and R. Zehner. 1970. *Residential Location and Urban Mobility*. Ann Arbor: Survey Research Center, Institute for Social Research, University of Michigan.

Louviere, J. 1981. *Analysis of Housing Choices for the Elderly*. Iowa City: Institute of Urban and Regional Research, University of Iowa, Technical Report 138.

McLeod, P. 1984. "The Demand for Local Amenity: A Hedonic Price Analysis." *Environment and Planning A* 16: 389-400.

Metropolitan Transportation Commission. 1993. *The Journey-to-Work in the San Francisco Bay Area.* Oakland: MTC, Working Paper 5.

Michelson, W. 1968. "Most People Don't Want What Architects Want." *Transaction* 5(8): 37-43.

_____. 1977. *Environmental Choice, Human Behavior, and Residential Satisfaction.* New York: Oxford University Press.

Nelson, A., and S. McClesky. 1990. "Improving the Effects of Elevated Transit Stations on Neighborhoods." *Transportation Research Record* 1237: 29-38.

Pisarski, A. 1992. *New Perspectives in Commuting.* Washington, D.C.: Federal Highway Administration, U.S. Department of Transportation.

Pucher, J. 1988. "Urban Travel Behavior as the Outcome of Public Policy: The Example of Modal-Split in Western Europe and North America." *Journal of the American Planning Association* 54(4): 509-520.

Pushkarev, B., and J. Zupan. 1977. *Public Transportation and Land Use.* Bloomington: Indiana University Press.

Rappaport, Amos. 1975. *Environmental Behavior* 7(2): June.

RIDES. 1994. *Commute Profile '94.* San Francisco: RIDES, Inc.

Shaw, J. 1994. "Transit-Based Housing and Residential Satisfaction: Review of the Literature and Methodological Approach." *Transportation Research Record* 1400: 82-99.

_____. 1994. *Transit-Based Housing and Residential Satisfaction.* Berkeley: University of California, Department of City and Regional Planning, unpublished dissertation (forthcoming).

U.S. Department of Transportation. 1994. *Journey to Work Trends in the United States and Its Major Metropolitan Areas, 1960-1990.* Washington, D.C.: U.S. Department of Transportation.

Uyeki, E. 1985. "Residential Location and Satisfaction with Neighborhood Characteristics." *Journal of Urban Affairs* 7(5): 37-50.