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Where Do People Walk? The Impacts of Urban Form on Travel Behavior and Neighborhood Livability

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The Impacts of Urban Form on Travel Behavior and Neighborhood Livability

by

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Abstract

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Doctor of Philosophy in Environmental Planning

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Intensified critiques of urban sprawl and its associated ecological and social impacts, have led to a broad movement - New Urbanism - that calls for incorporating the elements of compact urban form, mixed land uses, public spaces, and greater pedestrianization into the design of urban spaces. Proponents of this program argue that, among other benefits, increased pedestrian activity will reduce the adverse impacts of automobile travel, while stimulating greater public interaction and a higher quality of life overall. This dissertation evaluates the accuracy of these claims, using four case studies in the San Francisco Bay Area to examine the interactions of urban form with residents' travel behavior and use of their neighborhoods, and to develop models of walking frequency based upon these relationships.

The research methodology integrates both qualitative and quantitative analytic approaches. It conducts analyses across a range of scales, from regional land use, demographic, and access data that are more typically associated with transportation policy studies, to fine-grained urban form and travel behavior characteristics at the block

and parcel levels, that are generally addressed only in studies with a strong urban design or architectural emphasis.

A detailed urban form survey evaluates the specific urban form characteristics of each case study neighborhood, in order to develop a hypothesized "walkability" spectrum for the four case studies based on urban form features. An extensive mail-back survey targets residents' travel behavior and use of local neighborhood, providing data that is linked to the analysis of urban form in each of the case studies.

The results of these two surveys are integrated to determine the effect that variations in urban form have on the perceived walkability of neighborhoods, residents' use of their neighborhood centers, and ultimately, whether this affects their perceptions of the neighborhood's overall livability. A combination of univariate, bivariate, and multivariate statistical analyses are applied to develop predictive models of walking frequency as a function of neighborhood urban form.

Research findings indicate that the walkability spectrum hypothesized for the four case studies based on urban form surveys, is confirmed by actual travel behavior and residents' perceptions of their neighborhood. Walking frequency models are influenced most highly by the variable of distance, but retain a residual neighborhood effect as well, which appears to correlate with the urban form variations related to walkability in the four case studies. Findings also suggest that some individuals self-select into neighborhoods due in part to the perception that they offer good pedestrian, bicycle, and transit amenities.

I dedicate this dissertation to my parents,

Hayes Corliss Lamont and Izolde Silkovskis Lamont,

who inspired in me an eagerness to learn, a passion for the environment, and the confidence to hold fast to my convictions,

and to

my best friend and love, Phil.

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Chapter 1: Overview and Introduction

Overview of Dissertation Topic

Intensified critiques of urban sprawl and its associated ecological and social impacts, have led to a broad movement - New Urbanism - that calls for incorporating the elements of compact urban form, mixed land uses, public spaces, and greater pedestrianization into the design of urban spaces. Proponents of this program argue that, among other benefits, increased pedestrian activity will reduce the adverse impacts of automobile travel, while stimulating greater public interaction and a higher quality of life overall. Is there a basis for these claims, and if so, to what extent? This dissertation will evaluate the accuracy of these claims by examining the interactions of urban form with residents' travel behavior and use of their neighborhoods, and developing to develop models of walking frequency based upon these relationships.

Introduction

The planning and design of American cities has undergone intense scrutiny in recent years, due to increasing dissatisfaction with current urban patterns, and an overall backlash against the modernist principles that have dominated the development of urban form for most of this century. The perceived failure of these principles towards establishing cohesive, livable communities has been expounded upon with growing frequency and vehemence, beginning with Lewis Mumford's *The Culture of Cities* (1938), followed by Jane Jacobs' popular critique, *The Death and Life of Great American Cities* (1961), and recently, sophisticated analyses such as Christine Boyer's *Dreaming the Rational City* (1983). Critics have pointed to deficiencies in the current urban landscape across a range of spheres: socio-political, economic, ecological, and aesthetic. Over the last decade, there has been a growing movement to re-think common assumptions about city planning and design, in an attempt to address and redress the range of problems now viewed as the consequences of these poor decisions in the past. One of the strongest, and most popular of these recent movements, is that of the "New Urbanism" (Katz 1994), also termed, neotraditionalism.

New Urbanism, in its broadest sense, embraces a vision of the ideal city as a return to the vernacular designs of old: compact, mixed-use developments, with town squares and gridded streets, and a dynamic pedestrian environment. Contemporary New Urbanists, such as the architectural team of Duany and Plater-Zyberk, and architect Peter Calthorpe, have looked directly to vernacular models in forming their town and city designs, extracting elements from a range of urban visions, from the romantic idealism of Camillo Sitte, to the Garden City schemes of the early twentieth century, and more recently, to the post-modern typologies of architects such as the Krier brothers. Their visions stand as a direct rejection of the sprawling suburban patterns arising from the more typical post-World War II ("postwar") New Towns and Planned Unit Developments (PUDs).

The broad umbrella of New Urbanism houses several distinct interpretations of the ideal urban form, which display slightly different emphases and goals. Broadly categorized, these are: Transit-Oriented Developments (TODs) or Pedestrian Pockets (PPs); Neotraditional Design; and Sustainable Communities. A comparison of these three recent urban form typologies, as contrasted with the earlier New Towns and Planned Unit Developments, is presented in Table 1-1, with a listing of each typology's key variables and proponents.

Table 1-1. Comparisons of Key Variables Related to Various Recent Urban Form Typologies

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Examples	Laguna West, CA Pleasant Hill, CA	Kentlands, PA Seaside, FLA	Arcata, CA Civano, AZ	Irvine, CA
Variables Land Use	Mixed	Mixed	Mixed	Single Use
Housing Density*	Med/High	Med/High	High	Low
Street Layout	Grid Dense Linked	Grid Dense Linked	(Not Specified)	Curvilinear; Cul-de-Sacs
Transit Availability	Transit Hub	Not Required	Transit Available	Not Required
Town Center	Main Street	Civic Buildings; Central Plazas	Town Center	Not Required
Open Space	Required	Not Required (but may be present)	Required	Not Required
Architecture	Varied	Vernacular	Use of Ecological Designs	(Not Specified)
Geographic Scale	1/4 to 1/2-mile radius (~100 ac)	50-200 ac; Small blocks (~2000 ft2 per block)	50-200 ac	Large (>200 ac)
Streetscape/ Pedestrianization	Increased Pedestrian Access; "Pedestrian Friendly"	"Pedestrian Friendly"; Narrower Roads	Increased Pedestrian Access; "Pedestrian Friendly"	Auto-Friendly
Housing Diversity	Moderate to High	High	Moderate to High	Low
References/ Sources	Calthorpe 1993 Katz 1994 Cervero 1998	Duany and Plater-Zyberk 1989 Katz 1994 Southworth 1995	Van der Ryn 1986 Walter et al 1992 Platt et al 1994 Gordon 1990	Stein 1966

* Density thresholds are roughly categorized as: Low = 1-4 units/ac, Med = 5-11 units/ac, High = 12 or more units/ac

In general, these various interpretations can be distinguished by their relative levels of emphasis on social/political, ecological, economic, and aesthetic concerns. For example, Sustainable Community proponents place a relatively greater amount of emphasis on ecological factors (Van der Ryn and Calthorpe 1986), as compared to proponents of Neotraditional Design (Duany and Plater-Zyberk 1989; Southworth 1995).

However, it is the strength of the commonalties among the various interpretations that leads to their identification as a single, broad planning and design response to present-day urban critiques. Of these commonalties, four elements stand out as being particularly representative of the New Urbanism movement overall:

* high residential density;
* mixed use development around a town center, main street, or core;
* gridded street layout; and
* pedestrian-friendly streets

(Van der Ryn and Calthorpe 1986; Duany and Plater-Zyberk 1989, 1991; Calthorpe 1993; Audirac and Shermyn 1994; Southworth 1995; Crane 1996).

New Urbanists claim that these elements, once implemented, will encourage the development of neighborhoods and cities that display coveted urban qualities, including:

* improved air quality due to shorter trips and increased access to, and use of, alternatives to the automobile;
* greater social interaction and cohesiveness due to higher levels of pedestrian activity;
* increased preservation of open space through clustered, high density development;
* greater demographic diversity;
* a wider range of housing choices;
* improved jobs-housing balance; and
* improved overall aesthetic appearance.

By offering a multi-pronged urban design "solution" to the problems perceived as pervading the modern American city, and by marketing the solution as a simple, neat package, the New Urbanists have offered an attractive response to a variety of complex and interconnected problems.

Such claims have led to a flurry of recent conferences and books addressing the concept of New Urbanism (Congress-for-the-NewUrbanism conferences, 1991-2000; Katz 1994), as well as forming the basis for legislative urban planning recommendations such as California Senate Bill 2559, California Assembly Bill 3152 (Transit Village Development Planning Act), and California Assembly Bill 1338.[1] Cities such as Portland, Oregon, and Toronto (Canada), have based broad land use development policies and urban growth initiatives on the New Urbanism concepts (Blizzard 1996). Finally, the New Urbanist prescription has spawned specific urban designs such as those built at Laguna West (California), Kentlands (Pennsylvania), and Seaside (Florida) (Duany and Plater-Zyberk 1989; Calthorpe 1993; Southworth 1995). In addition, stricter environmental regulations such as the 1990 Clean Air Act Amendments[2] and the mandates of comprehensive transportation planning policies such as ISTEA[3], have spurred - or demanded - an interest in alternative community development models, adding even greater weight to the appeal of these designs.

Yet in spite of the New Urbanism's current popularity, very little substantive research is available to verify the movement's expansive and optimistic claims. In fact,

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[1] AB 1338 was a land use planning initiative originally introduced to the California legislature in 1994, authorizing funds for transit facilities, in an effort to encourage the development of transit villages across California. The initiative was eventually vetoed in 1995, by Governor Pete Wilson.

[2] The first set of Clean Air Act Amendments was passed in 1970, encouraging a reduction in average automobile emissions (CO, HCs, NOX), and decreasing the use of lead in gasoline. However, the stringency of the 1990 Amendments catalyzed the use of a much broader range of pollution reduction strategies, moving from a reliance on simple technological improvements to the acknowledgement of the need for system-wide transportation management policies (Weiner 1992).

[3] ISTEA, the acronym for the Intermodal Surface Transportation Efficiency Act of 1991, authorized roughly $151 billion over a six-year period, for various highway, mass transit, and safety programs. The Surface Transportation Program (STP) was created as one part of the act, allowing for the flexible funding of a wide

studies addressing the linked areas of urban form and travel behavior articulate a far more complex set of relationships that suggest clear limitations to the impacts of the New Urbanism prescriptions (Deakin 1991; Handy 1992; Audirac and Shermyn 1994; Cervero and Gorham 1995; Ben-Joseph 1995; Cervero and Kockelman 1996; Cervero and Radisch 1996; Crane 1996; Steiner 1996). In a recent discussion of research related to the New Urbanism typologies, Randall Crane notes that, "The conclusion that auto travel will decrease in more compact and grid-like land-use developments...has been reported as a virtual fact in almost all discussions of neotraditional design principles." [4] In reality, research findings have pointed to more ambiguous relationships: for example, while urban forms displaying elements of the New Urbanism typology may exhibit increased local levels of pedestrian, bicycle, and transit activity, these increases are not necessarily accompanied by a reduction in automobile usage, but rather, may be *additional* to vehicle trips (Handy 1992; Cervero and Gorham 1995). Moreover, Crane's own research suggests that a gridded street layout may be equally likely to *increase* auto use - due to increased accessibility across all transport modes - as it is to *decrease* auto use, which has been the accepted view (Crane 1996).

Equally importantly, the typology described by the New Urbanism does not necessarily lead to more ecologically sound land use, and may in fact encourage suburban and ex-urban sprawl just as much as conventional suburban development, by demanding the use of yet more undeveloped, ecologically important open space, rather than focusing on infill or renewal of degraded vacant spaces (Deakin 1991). Furthermore, while the New Urbanism typology may be well-suited for compact and

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range of mass transit, environmental, safety, and highway projects, thereby encouraging more innovative approaches to transportation planning and management (Weiner 1992).

centralized regions such as New England, it may be a less effective planning and design response for fundamentally decentralized regions such as California and the mid-west (Deakin 1991). Finally, as Audirac and Shermyn have noted, the vision of increased economic and social heterogeneity often ascribed to the New Urbanism typology may be an illusion: costs associated with the building of Seaside, for example, were significantly higher than for typical subdivisions of similar size, thus implying a potential economic elitism inherent in these types of designs (Audirac and Shermyn 1994).

Hence, while the typologies described by New Urbanism plans might appear to be substantively different, and more appealing, than conventional suburban typologies from a visual design standpoint, their impact on the larger development picture may be negligible in terms of changes in travel behavior, air quality, the preservation and protection of critical open space, or economic and demographic equity. This, in turn, suggests that the ecological and social impacts of these strategies may fall short of intended long-term goals, and that the New Urbanism is simply an additional suburban design option, rather than the progressive and rehabilitating urban planning and design strategy it is often purported to be. Given that the "package of goods" embedded in the New Urbanism typology is being used increasingly to justify new urban planning strategies and designs, it is imperative that the assumptions behind this package are tested and confirmed. If the assumptions are disproved, or, as more recent research suggests, simply more ambiguous than previously thought, this would imply a need for re-assessing the impacts of the New Urbanism prescription, and its value or effectiveness as a solution for current urban development problems.

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[4] Crane, Randall. 1996. "Cars and Drivers in the New Suburbs: Linking Access to Travel in Neotraditional Planning." *Journal of the American Planning Association* 62,1: 52.

Dissertation Questions

The assumption that urban form can promote pedestrian activity, and that increased pedestrian activity will lead to a reduction in automobile usage, and to greater neighborhood livability, are arguably some of the most attractive and compelling features of more recent urban planning strategies, including those described by the New Urbanism typology. In my dissertation, I have focused on clarifying the relationships among urban form, travel behavior, and neighborhood livability. I have defined urban form to include not only large-scale form such as street layout and low-resolution land use mix, but also the fine-grained design details of the block and parcel-level environment. I have examined neighborhood livability through the lens of "pedestrian-friendliness," under the hypothesis that it is one of the key indicators of neighborhood livability, as New Urbanists contend.

I have examined a set of four neighborhoods possessing combinations of the elements characterizing the New Urbanism, ranging from more "pedestrian-friendly" to less pedestrian-friendly. The aim of the analysis has been to identify selected relationships between physical urban design characteristics of the neighborhoods and residential satisfaction, as well as the relationships between the neighborhood physical design characteristics and general travel behavior and mode choices. Specifically, I have examined both regional data on the topic, and detailed neighborhood-level data (including fine-grained urban form data), incorporating a wide set of specific variables, to determine the extent to which urban form affects pedestrian activity and residents' satisfaction with their neighborhoods. My analysis has focused both on the design and use of the neighborhood as a whole, as well as on the neighborhood "center" or core.

Mode choice in neighborhoods tends to be most strongly influenced by the quality of the transportation alternatives available in that area. However, urban form characteristics may support or deter the use of travel alternatives, and more specifically, the general levels of pedestrian activity. For example, the ease of getting to and from a transit stop (walking distance, safety, security, etc.) will be a factor in whether a resident chooses to walk to that destination. Moreover, it has been argued that residents may be more willing to do without their cars if they can readily walk to restaurants, personal services, banks, etc. Both the availability of these land uses within walking distance (less than one mile) and the ease of walking (presence of sidewalks, ease of crossing the streets, personal safety considerations, etc.) may affect travel choices. The data I have assembled, and the analysis that I have subsequently performed, has been used to assess these factors.

The methodologies and specific tasks outlined below have provided the framework through which to address the major research questions of this dissertation:

1) How do residents choose particular neighborhoods in which to live? Is a neighborhood's degree of "pedestrianization" a significant factor in influencing residential choice? Is the *option* of walking important in that choice? Do the elements of a more pedestrian-friendly environment produce greater residential satisfaction for residents of that neighborhood?

2) To what degree does local urban form (street layout, streetscape, etc.) impact pedestrian activity at the neighborhood level? In other words, controlling for social (e.g. ethnic/racial mix), economic (e.g. median household income levels),

and ecological (e.g. climate, topography) variables, what is the difference in overall pedestrian activity levels between neighborhoods which possess a set of more pedestrian-friendly urban form variables, and those that possess a less pedestrian-friendly set? Can one identify clusters of variables that appear to work in a synergistic fashion in terms of encouraging or discouraging greater pedestrian activity? Overall, once a neighborhood is chosen as a place to live, is the actual travel behavior of its residents consistent with their original residential choice priorities?

Summary of Methodology

The research methodology integrates both qualitative and quantitative analytic approaches. It conducts analyses across a range of scales, from regional land use, demographic, and access data that are more typically associated with transportation policy studies, to fine-grained urban form and travel behavior characteristics at the block and parcel levels, that are generally addressed only in studies with a strong urban design or architectural emphasis.

A detailed urban form survey evaluates the specific urban form characteristics of each case study neighborhood, in order to develop a hypothesized "walkability" spectrum for the four case studies based on urban form features. An extensive mail-back survey targets residents' travel behavior and use of local neighborhood, providing data that is linked to the analysis of urban form in each of the case studies.

The results of these two surveys are integrated to determine the effect that variations in urban form have on the perceived walkability of neighborhoods, residents' use of their neighborhood centers, and ultimately, whether this affects their perceptions of the neighborhood's overall livability. A combination of univariate, bivariate, and multivariate statistical analyses are applied to develop predictive models of walking frequency as a function of neighborhood urban form.

Summary of Findings and Contributions

There are several major findings of this research. First, that the four case studies differ significantly as to their urban form configurations as a whole, as well as on specific characteristics and details which may directly impact pedestrian activity levels within those neighborhoods. Results of the urban form surveys lead to the conclusion that these four case studies define a clear "walkability" spectrum for the "general environs" of each neighborhood, with Rockridge at the most walkable, followed by Albany/North Berkeley, Walnut Creek, and after a much larger gap, Fremont. The neighborhood centers (the "site area"), fall out somewhat differently, with Rockridge and Walnut Creek sharing a position as "most walkable," followed again by Albany/North Berkeley, and at the far end of the spectrum, Fremont.

Second, initial assessments of trip diaries and travel behavior data from the mail-back surveys indicate that the hypothesized walkability spectrum determined through the urban form surveys and analysis, is in fact confirmed for these four neighborhoods, with Rockridge at the "most walkable" end of the spectrum (and fewest vehicle trips), followed by Albany/North Berkeley, Walnut Creek, and finally, Fremont.

Third, statistical analyses applied to refine these initial conclusions confirm expected behavior, in that that there is a large "distance effect" in relation to walking behavior, when looking at results across all four neighborhoods, with a high concentration of the most frequent walkers located close to the neighborhood center.

While walking frequency models are influenced most highly by this variable of distance, they retain a residual neighborhood effect as well, which appears to correlate with the urban form variations related to walkability in the four neighborhoods.

Finally, findings also suggest that that although self-selection into more walkable neighborhood typologies may be occurring because the *option* to walk exists there, the self-selection does not guarantee greater walking activity from the individuals who chose neighborhoods for their perceived walkability, as some previous research has hypothesized. In other words, the relationship is not that all people who show higher walking frequencies have deliberately self-selected into more walkable neighborhoods, but rather that a substantial fraction of people may be self-selecting into more walkable neighborhoods where the *option* of walking exists.

Ultimately, this research offers the potential to improve overall community urban planning and design strategies, both through its potential application to new community designs, and through its application to the rehabilitation of existing neighborhoods. Improved understanding of the relationships among urban form, travel behavior, and neighborhood livability will aid, in the narrower realm, in assessing the impacts of New Urbanism schemes more accurately. But more importantly, it will provide broader benefits by identifying which variables are critical in the design of more livable urban communities. Within the context of the larger transportation planning framework, this project could serve as a prototype for a much larger neighborhood sample, across the United States, through which to investigate the relationships between neighborhood urban form and livable communities.

Specific contributions resulting from my dissertation include the following:

1) Theoretical and methodological contributions:

a) Linkage of high-resolution urban form analysis (i.e. block and parcel level) with regional-scale urban form analysis. Previous studies have tended to focus on one scale or the other, not both.

b) Application of a range of tested methods from various fields of research (e.g. statistics, visual comparison analyses, and survey development), to assemble and analyze complex sets of urban form and planning data, in order to more effectively respond to the challenges of applied, interdisciplinary research.

c) Holistic analysis of multivariate systems, including the integration of qualitative and quantitative variables in urban planning analysis, the examination of the synergistic effects of variables, and the development, testing, and application of methods to improve the analysis of typically "subjective" and qualitative urban form and urban design variables.

2) Contributions towards the development and refinement of guidelines for designing neighborhoods, and for suggesting guidelines for retrofitting existing neighborhoods to better reflect current planning goals.

3) Improvement of comprehensive transportation, neighborhood planning and design policies, through increased understanding of the relationships among travel behavior, land use, and urban form.

4) Identification of strengths and weaknesses in New Urbanism strategies.

Organization of the Dissertation

This dissertation is organized into six chapters. Chapters One and Two present an overview of the dissertation topic, and a review of prior research in the field. Chapter Three presents the research methodology used, including how data was compiled, and how the four case study neighborhoods were selected. Chapter Four provides a detailed description and analysis of the four case study neighborhoods, including their demographics and urban form, as derived from census data, topographic data, and detailed urban form surveys. Chapter Five presents descriptive and analytic statistics from the mail-back household surveys of travel behavior and neighborhood use, for the four case studies. This analysis examines travel behavior patterns (derived both from survey questions and from the survey's trip diaries), as well as general residential satisfaction with the neighborhoods. It also compares the urban form typologies and descriptions with the mail-back survey results, to analyze relationships among urban form, travel behavior, and residents' use of their neighborhoods. Finally, statistical analyses are applied to develop models of walking frequency in the case study neighborhoods. Chapter Six presents a final summary of the research findings, and a discussion of their implications for urban design and planning policy.

Chapter 2: Theory

Summary: Theories Examining Relationships Among Urban Form, Travel Behavior, and Neighborhood Livability

In this chapter, I present a summary and critique of previous research examining the relationships among urban form, travel behavior, and neighborhood livability (as defined/indicated by pedestrian-friendliness). I start with a review of the evolution of urban planning and design, which form the foundation upon which any urban planning models and recommendations rest. I then focus on a discussion of previous research and theories themselves, in particular: 1) the influence of previous research in catalyzing the development of alternative urban planning models; 2) the role of transportation planning in shaping urban form; and 3) the influence of both of these forces in forming the assumptions behind the New Urbanism typology. I then discuss the validity of these assumptions in light of more recent urban design and transportation policy research, focusing on a review and critique of the methods and conclusions of keystone studies. Finally, I discuss the future research directions suggested by this body of work, and the justification for my research project in the context of this framework.

The Evolution of Urban Planning and Design: An Historical Overview

Over the decades, urban planners, theorists, and designers have both celebrated and vilified the city. On one hand, it is lauded for its complexity, its diversity, its celebration of public life, and above all, its sense of community, all of which embody a rich, dynamic urban fabric for which planners and designers express deep optimism and faith. Yet much attention has also been directed to the failure of modern American cities to meet such expectations, from the public health and social concerns of early Garden City planners such as Ebenezer Howard and Raymond Unwin (Howard and Osborn 1945 [1902]; Unwin 1909), to the full-scale attack on urban planning launched by Jane Jacobs (1961), to the more recent and continuing pleas for greater integration of issues such as ecology, equity, and access into urban planning and design (Lynch 1981; Hester 1975, 1990; Hough 1984, 1990; Spirn 1984, 1989, 2000).

Current trends in urban planning and design, including the New Urbanism, rest on the critique that the modernist movement that dominated twentieth century American city development has failed to produce cohesive, livable cities and neighborhoods, and in fact, has actively contributed to increased social isolation, ecological degeneration, and economic inequities. As some would describe it, the modern urban landscape is in crisis, with the city core suffering from crime, a loss of aesthetic identity, ecological deterioration, and economic decay, while suburbia is now a sprawling, faceless expanse (Jackson 1985; Hiss 1990; Kunstler 1993). In struggling to address these concerns, urban planning literature, research, and practice has attempted, with varying degrees of success, to define the substantive qualities of urban form, and the effects of alternative planning and design approaches. Such attempts have fallen across a wide, interdisciplinary range of planning spheres, from the general city and regional planning arena, to specific subject areas of planning expertise.

In 1985, Judith Innes deNeufville defined modern planning as "a set of activities intended to improve the quality of decisions for a community, to help it be prepared for its future...[it] is comprehensive in attempting to deal with many factors; it makes some systematic use of information; and it involves creation of images of the future and strategies to reach them."[1] Other definitions vary as to their specifics (Hudson 1979; Friedmann 1987), but common to most are the following threads, as reflected in deNeufville's original definition: understanding the present as a means of impacting future conditions; emphasizing process over product in all analyses; and making and implementing decisions based on analysis. Implicit as well is the notion of public good or public welfare: for example, John Friedmann's "public domain" (Friedmann, 1987) or deNeufville's "community," towards which planning is ostensibly directed. Furthermore, as Barclay Hudson notes, the practice of planning is continually evolving, thus precluding the formulation of a single standard, comprehensive definition of the field (Hudson, 1978).[2]

Historically, planning in the United States first emerged with an urban focus, primarily in response to social and public health concerns generated by the rise of the industrial city at the turn of the century (Reps 1965; Benevolo 1967; Kostof 1991). This focus led to its early title of "physical planning," reflecting the emphasis on physical form engendered by the architectural roots of influential physical planners such as Raymond Unwin and Clarence Perry. In turn, during the 1930s and 1940s, physical planning evolved into the more familiar practice of urban and regional planning under the influence of members such as Lewis Mumford, reflecting the broadening scope of

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1 deNeufville, Judith, 1985. *Planning Theory and Practice: Bridging the Gap*, Reprint No. 201, Berkeley, CA: Institute of Urban and Regional Development, University of California, p. 36.

2 I have presented the dominant views of modern planning in this definition; alternative views and approaches such as radical planning exist, but have not yet had significant influence on the development of urban form. The incrementalist view of planning, however, deserves note. First developed by Charles Lindblom, it argues that due to the realities of knowledge limitations and policy mandates, planning decisions are necessarily made on an incremental, day-by-day basis - what Lindblom terms, "the science of muddling through." (Lindblom, 1959) This view of planning has gained increasing popularity in the past decade, gaining a strong foothold in the halls of planning "theory." As a final point of note: the development of chaos theory lends strong support to Lindblom's view, in its fundamental rejection of long-term predictability in systems, suggesting that planning efforts may be better directed towards the short-term periods of Lindblom's analysis (Cartwright, 1991).

planning concerns, particularly towards housing and development (Mumford 1938, 1961; Reps 1965). Over the last half of the twentieth century, the profession has come to encompass numerous sub-areas, or specialties, such as transportation planning (Deakin 1989, 1993, 1996; Newman and Kenworthy 1989, 1999; Cervero 1992, 1996), land use (Wingo 1961, 1963; Alonso 1964; Cowart 1976; Deakin 1987, 1990, 1991), and more recently, environmental planning[3] (McHarg 1969; Glikson 1971; Ortolano 1984; Steiner 1991; Slocombe 1993; Leitmann 1999) and urban design (Lynch 1981, 1984; Moudon 1991; Southworth 1990; Lang 1994; Loukaitou-Sideris 1998; Sternberg 2000). While the New Urbanism movement draws on a full range of these planning sub-sets, it is most heavily influenced by the practice of urban design.

Urban design has developed from a diverse set of disciplines and practices, including architecture, landscape architecture, urban planning, and more recently, sociology, environmental psychology, environmental planning and science, and anthropology, among others (Lynch 1981; Alexander 1987; Southworth 1990; Moudon 1991; Lang 1994; Loukaitou-Sideris 1998; Sternberg 2000).[4] Urban design's focus on three-dimensional physical form, and its tendency towards physical determinism, are derived from its original architectural roots and from its physical planning predecessor of the early twentieth century (Reps 1965; Benevolo 1980; Kostof 1991; Moudon 1992; Lang 1994; Sternberg 2000). However, early influences from landscape architecture

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[3] Environmental planning encompasses the general characteristics of planning outlined above, but focuses more specifically on these concerns as they relate to the bio-physical environment and human impacts upon it, such as air and water quality management, and land suitability analysis (Ortolano 1984; Steiner 1991; Leitmann 1999; Sternberg 2000). While environmental planning is considered to be a relatively young practice, emerging in response to the stricter federal environmental regulatory framework associated with the passage of the National Environmental Policy Act (1969) and the Clean Air Act Amendments of 1970, historically the field has its strongest roots in ecology, which first appeared as a distinct discipline at the turn of the century (Slocombe 1993).

and sociology have also introduced both environmental and human behavioral aspects to its overall character and research focus (Isaacs 1998), with even more recent contributions from "soft" fields such as psychology (Gans 1968; Lynch 1972; Lynch 1981; Lang 1994; Sternberg 2000).

The overall direction of the field's evolution has been towards an increasingly comprehensive and integrative nature, across a range of scales, from the smaller, more traditional building scale, to the larger regional landscape, while incorporating growing attention to issues of ecology, social equity and interaction, and community participation (Hester 1975, 1990; Lynch 1981; Marcus and Sarkissian 1986; Marcus and Francis 1990; Lynch 1990; Southworth 1990; Sternberg 2000). Moreover, the field has incorporated the idea of the "experience" of place (such as sequences, etc.) as being integral to urban design theory and practice (Isaacs 1998; Sternberg 2000). Finally, while earlier urban design theorists such as Kevin Lynch tended to focus their discussions around the traditional city core, such as downtown Boston or San Francisco, the continuing expansion and development into suburban areas, and the breakdown of clear distinctions between urban and rural communities, has resulted in a more expansive definition of the concept, "urban," itself. This, in turn, has led to more recent changes in the scope of urban design practice, with a broader base that now addresses urban, suburban, ex-urban, and even rural, communities alike (Southworth 1990).[5]

Thus, a general definition of current urban design might state that it is an inter-disciplinary practice focusing on both the physical *design* of urban forms (the more

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[4] I have dated the profession's emergence as the late 1950s, to coincide with the publication of Kevin Lynch's early works, generally considered as signaling the beginning of urban design as it is perceived today (Lynch 1960, 1972; Lang 1994; Moudon 1991).

[5] Michael Southworth, in fact, suggests that "so much 'urban design' activity now occurs outside central cities that one wonders whether the field should be renamed" (Southworth,1990: 2).

traditional, architectural emphasis), as well as a more recent trend to *analyze* patterns of urban form and their relationship to, and impact on, human behavior, across scales from the individual building and its details to regional landscape patterns, with the aim of addressing the behavioral, aesthetic, and experiential needs of urban, suburban, and rural communities.

The Postmodern Urban Planning Backlash: Roots of the New Urbanism

The New Urbanist design schemes, which apply a heavy architectural orientation to a range of urban planning concerns, clearly fall within the physical planning tradition of the broader planning framework, and thus relate most closely to the practice of urban design, as defined above. They also mark, in many aspects, a return to the comprehensive planning approaches of the early twentieth century, in their view of city design as a holistic process with numerous, interconnected elements (Howard 1945 [1902]; Calthorpe 1993). Indeed, much like the New Town planners, New Urbanists display a tendency towards environmental determinism, by linking specific design elements with behavioral goals. Their supposed incorporation of more contemporary and abstract concerns, such as ecological integrity and demographic diversity, suggest the acknowledgment of a planning framework that is larger, and more complex, than simple physical determinism. However, the degree to which these broader concerns have actually been implemented in the new plans, and the effectiveness of the design mechanisms - gridded streets, mixed use, and the like - which have been chosen to address these concerns, are questionable. Moreover, the dogmatism with which New Urbanists often portray their visions may obscure some of their greatest weaknesses.

Do these mechanisms, in fact, describe a fundamentally more successful approach to the design of livable communities?

New Urbanists argue that their plans counteract the failed modernist urban growth patterns through a return to the vernacular city traditions of old Europe and pre-war United States. They state that their designs will re-create the dynamic urban environments of cities such as Venice and Boston, or the Garden City success of Radburn (Calthorpe 1993). The specific elements of this conviction derive from the perceived causes of current, sprawling urban and suburban growth patterns. On one level, the low-density sprawl that so typifies post-war city development in the United States, is in part the result of a strong faith in the "new town" theories and plans of the early twentieth century, of the acceptance of Clarence Perry's "neighborhood unit" as the ideal urban form (Unwin 1909; Perry 1929), and of an overall faith in the power of "rational" planning as the determinant of city and neighborhood form (Boyer 1983). The standardization of this view, initially through attempts to counteract the urban decay engendered by the Depression and concurrent flight from the city core, followed by the Federal Housing Administration's (FHA) rigid guidelines for post-war suburban subdivisions, and finally through the development of increasingly rigid zoning regulations and street standards overall, permanently imprinted this inflexible planning mentality on the face of the modern American city (Boyer 1983; Southworth and Ben-Joseph 1995, 1997).

The current New Urbanism schemes show a marked similarity to the original visions of Howard's and Unwin's Garden Cities, in their focus on the creation of self-sufficient neighborhoods, small-scale design, the promotion of pedestrian streets, and the protection of open space corridors for the public benefit (Howard [1902], 1945;

Unwin 1909). Unwin also favored cul-de-sacs and vehicular discontinuities, with the rationale that such features would promote greater safety and peaceful neighborhood qualities, and would complement the first set of elements described above. Unfortunately, these elements were subsumed by Euclidean zoning and the homogenous FHA subdivision standards that guided suburban development from the 1930s onward, and cul-de-sacs and disjointed street access schemes were the only elements of Unwin's original vision to remain. By 1930, the prevailing rationalist, mechanistic functionalism of physical planners such as Le Corbusier, complemented and encouraged by the institutional developments related to physical planning actions, modified and obscured the initial Garden City ideal.[6] Instead, urban renewal programs advocated and promoted the separation of residences from the city heart through housing subsidy programs, simultaneously encouraging sprawling, low-density suburban patterns with wide arterial streets and disconnected cul-de-sacs, while draining resources from the city centers to subsidize these new developments, leaving the city core barren and bleak (Boyer 1983; Southworth and Owens 1993; Southworth and Ben-Joseph 1997; Southworth and Parthasarathy 1997).

Moreover, the institutional and administrative framework of urban planning moved away from the comprehensive approach of the early physical planners, towards an increasing degree of specialization and separation among particular planning spheres, such as transportation planning, and housing and development, among others. With various planning agencies operating independently and in isolation, urban planning policies were developed and implemented as fragmented components of an undefined

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[6] Clearly, there are a much wider range of issues that could be argued as significantly affecting urban design and land use in the United States, as evidenced in discussions by Wingo (1961), Alonso (1964),

whole, leading to piecemeal and disconnected planning practices whose impacts were often far removed from their original intentions, and from what was ultimately built (Boyer 1983; Southworth and Parthasarathy 1997).

Impacts of Transportation Planning on Urban Form

While the individual elements described above worked synergistically to shape current urban forms, and particularly to advance the dominance of the sprawling suburban development pattern, one common - and critical - factor in this post-war evolution of city planning strategy was the advent of the automobile. Within the context of continuing interplay among these numerous economic and social forces, the introduction of the automobile acted as the catalyst for the emergence of the post-war suburban typology, levying a tremendous influence on urban planning policies and directions from the early twentieth century onwards. In particular, communities built since the advent of the automobile have been based on design and land use patterns that facilitate automobile use, permit long distance separations of housing and employment, consume significant amounts of land, and reduce access to, interaction within, and availability of urban public space, even while increasing access (for those with automobiles) to large expanses of metropolis and hinterland (Appleyard et al. 1981; Newman and Kenworthy 1989, 1999; Hass-Klau 1990; Tolley 1990).

Early modernists such as Le Corbusier were quick to herald the opportunities presented by the automobile, and their urban designs reflected this fascination with the new technology: streets became channels for traffic, with the automobile as the focal point for design strategies, rather than people (LeCorbusier 1929). This approach

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Bairoch (1988), and others. However, for the purposes of this analysis I have limited my discussion to the spliced neatly into the institutional framework for urban and transportation planning that was developing over the same period, allowing and encouraging the urban design strategies advocated by the modernist planners.[7] Simultaneously, Clarence Perry's "neighborhood unit"[8] was quickly adopted as the ideal for new suburban development in the United States, ultimately serving as the basis for FHA subdivision standards and regulations, along with Euclidean zoning laws requiring the separation of land uses, implemented after World War II (Reps 1965; Boyer 1983; Wolfe 1990). The final outcome of these developments in postwar design and planning policy was the promotion and subsidization (especially through federal mortgage assistance programs, and property tax and mortgage interest deduction allowances) of the suburban tract subdivision, with its wide arterials and cul-de-sac street hierarchy, its requirements for strictly uniform zoning and street standards, its array of detached single-family homes on large lots, and its rapid consumption of, and expansion into, agricultural lands and open space.

The ecological impacts of this shift are wide-ranging and well-documented, highlighted by the fact that the automobile is currently the single largest source of urban air pollution (US EPA 1990), and is thus a major contributor to public health problems, and to environmental problems such as global climate change and acid rain deposition (Lowe 1990; Marland 1991). The road infrastructure required to support the increased

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immediate physical planning framework of the early twentieth century United States.

[7] In brief, from the Federal Highway Act' creation of the Bureau of Public Roads in 1916 (subsequently renamed the Federal Highway Administration in 1966), up until the late 1960s and early 1970s, urban transportation planning was seen as a supply-side activity, focusing almost exclusively on the expansion of highways and regional-level transit facilities (Weiner, 1992). This institutional framework reinforced the emphasis on efficiency of traffic circulation as the guiding principle for street design, and subsequently, for urban form (Southworth and Ben-Joseph 1997).

[8] The "neighborhood unit" was a design in which arterial streets were used to bound defined neighborhoods consisting of curvilinear, scaled street networks interspersed with open space (Perry 1929).

auto load has resulted in greater fragmentation in urban and rural areas, which in turn lead to reductions in open space and biological diversity (Forman and Godron 1986; Soule 1991). Indirect environmental impacts associated with the extraction and transportation of oil and gas have also increased due to the greater demand for oil and gas used as automobile fuel. While the development of "environment-friendly" automobile technologies, such as natural gas and electric cars, has been heralded by some as a solution for these ecological ills, the mixed environmental impacts and economic realities of such technologies render this angle of attack a partial remedy at best. More importantly, it fails to address the more fundamental social and economic consequences of automobile use and its associated urban forms, including congestion, social inequities, and social isolation.

Increased traffic congestion, continual widening of streets and highways to accommodate higher traffic volumes, higher car speeds on residential roads due to widening for safety regulations, loss of urban open space, and the higher level of mobility afforded by the car, have all resulted in urban patterns that, some claim, increase isolation of the individual and reduce the contact and street activity that encourages the development of safer, more cohesive communities (Appleyard et al. 1981; Hass-Klau 1990; Lowe 1990; Tolley 1990; Eubank-Ahrens 1991). The Planned Unit Development (PUD) and "superblock" approaches to planning and design have resulted in the mass production of gated, large-scale residential developments, which house an increasingly mobile population that is often only superficially connected to its community. These trends have obscured or eliminated the sense of linkage, or identity, that newer urban areas might have with their surrounding cultural and biological environments, with the harshest critics stating that the result has been a proliferation of cultural and aesthetic wastelands (Sale 1985; Hiss 1990; Kunstler 1993).

In addition, the greater mobility offered by the automobile has supported an increasing separation of jobs and residences. As the introduction of trolleys in the early twentieth century allowed for migration away from the city centers, the introduction of the car has essentially negated the need for proximity to jobs, with many employees now regularly traveling thirty or more miles per day in their commutes to and from work (Porter and Deakin 1996). Moreover, this movement is not related to the availability of public transit, which has traditionally followed a radial pattern outward from the central business districts of major cities. Hence, the growth of satellite cities around the suburban periphery is a distinct characteristic of recent urban growth patterns, as automobile transport allows for free access around this periphery. In sum, "automobile access has dictated the very character of urban life, most obviously in the design of the modern city."[9, 10]

While there is certainly a strong planning contingent that continues to celebrate the presence of the automobile in modern society (for example, Webber 1973, 1980; Altshuler et al. 1979), many current urban planning and design strategies have been heavily directed towards reducing the auto dependence that is viewed as being at the core of an array of social, economic, ecological and aesthetic ills. These alternative strategies rely on evidence presented in a variety of urban planning and design studies as supporting the key elements of their schemes, both from social and aesthetic

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9 Lowe 1990: 7.

10 Robert Cervero, among others, has defined this problem as one of supply-side transportation planning – i.e. focusing on improving traffic flows and speed - and has framed the discussion as constituting a fundamental planning paradigm: "automobility" planning instead of "accessibility" planning. Cervero

perspectives (Whyte 1980; Appleyard et al. 1981; Gehl 1987; Moudon 1991; Eubank-Ahrens 1991; Francis 1991), and from the economic and ecological perspectives related to transportation behavior and land use relationships (Pushkarev and Zupan 1975, 1977; Newman and Kenworthy 1989, 1999; Deakin 1990, 1991, 1996; Holtzclaw 1990, 1994; Tolley 1990; Cervero 1992, 1996a, 1998; 1000 Friends of Oregon 1997). The New Urbanists have been quick to incorporate these assumptions into their designs, while adding the visual familiarity and comfort of the aesthetic details associated with such models as the small, New England town, and thus have drawn attention and popularity to their neatly packaged plans.

Review and Critique of Research-to-Date

Several recent studies indicate that the New Urbanist package may not be as successful on all fronts as claimed, which in turn would suggest re-evaluating the policy significance and recommendations arising from the New Urbanism movement, and the implications for the design and planning of cities overall. In general, proponents of more recent, alternative planning and design strategies have been drawn to the four core elements of the New Urbanism typology - higher residential densities, mixed use development around a town center (or main street), gridded street design, and pedestrian-friendly streets - due to the unqualified acceptance of a set of assumptions regarding the behavioral consequences ascribed to these planning and design mechanisms. This set of assumptions includes: improved air quality due to shorter trips and increased access to, and use of, alternatives to the automobile; greater social interaction and cohesiveness due to higher levels of pedestrian activity; increased

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contends that transportation planners must change their "objective function" from planning for automobiles preservation of open space through clustered, high density development; greater demographic diversity; a wider range of housing choices; improved jobs-housing balance; and improved overall aesthetic appearance.

By offering a multi-pronged urban design "solution" to the problems perceived as pervading the modern American city, and by marketing the solution as a simple, neat package, the New Urbanists have offered an attractive response to a variety of complex and interconnected problems. These core elements have often been derived from pure assumption (absent any research), or are derived from studies conducted in what will be divided, for simplicity's sake, as forming two broad areas of research: 1) urban design studies; and 2) travel behavior and transportation policy studies.

Urban design studies have provided the greatest contributions in the areas of pedestrianization, street design, and their associated social consequences. This is primarily a result of the architectural backgrounds, and social sciences orientation and training of many urban designers (Whyte 1980; Appleyard et al. 1981; Jacobs 1985, 1993; Gehl 1987; Moudon 1991; Southworth and Owens 1993; Southworth 1995; Southworth and Ben-Joseph 1997). The impetus behind these studies has been primarily a social one: increasing concern about the negative social impacts of automobile-dependent urban forms has sparked a surge in efforts to recapture the "publicness" of streets, and to create more livable communities. In addition, concerns with aesthetic appearance, and with environmental impacts, have formed additional momentum for this body of research.

Research addressing the social functions, or publicness, provided by "pedestrian friendly" environments has thus been primarily related to the physical design of

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to planning for "people and places" (Cervero, 1996c: 1).

pedestrian and livable streets. In early work, normative visions such as those of Jane Jacobs dominated the framing of the issue. Jacobs, for example, claimed that well-used public streets could solve a host of social and community concerns, including: reducing crime, increasing the chances for self-governance, strengthening local economies, and increasing the formation of social and public networks, including opportunities for child's play (Jacobs 1961).

Such normative visions have been bolstered by the more substantive research of urban designers such as Appleyard (1981), Gehl (1987), and more recently, Hass-Klau (1990), Eubank-Ahrens (1991), Southworth and Ben-Joseph (1995, 1997), and Bosselman and MacDonald (1999). These studies address qualitative variables related to aesthetics and spatial form, as well as the broader social and behavioral issues associated with the design of particular spatial forms and patterns. Appleyard (1981) and Gehl (1987), in particular, were the first to provide strong descriptive frameworks for linkages between streets and social behavior.

Appleyard's extensive surveys, observation, and analysis of traffic data in San Francisco Bay Area neighborhoods culminated in his own conception of the "ideal street" for residential neighborhoods, and prescriptions for a holistic "street management" scheme.[11] The key elements he outlined as forming this ideal included: safe vehicle speeds; low traffic volumes; low noise and vibration from traffic; improved pedestrian "right-of-way" on streets; adequate parking; the "greening" of streets through trees and landscaping; continual maintenance of the street's appearance; and a unique historical or qualitative "identity" to the street.[12] In a portent of the New Urbanist planning

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[11] Appleyard et al. 1981: 243-54.

[12] Ibid, pp. 243-53.

entreaties that have now become so prevalent, Appleyard ultimately concluded that "residential streets should be destinations, not routes,"[13] thus emphasizing the critical notion that people, not automobiles, should dominate the design of livable streets.

Jan Gehl also used observations of behavior in, and use of, outdoor spaces, to identify the underlying spatial-behavioral requirements of such interactions (Gehl 1987). His focus on the outdoor plazas of Copenhagen demonstrated that well-designed public spaces, with ample opportunity for pedestrian activity, could contribute to greater social interaction. Studies of these types have tended to confirm the normative conceptions of pedestrian environments contributing to social well-being, forming a basis for the appeal and adoption of more recent "pedestrian-friendly" planning and design strategies as a mechanism for building more livable neighborhoods.

More recently, urban design studies have tried to confirm, or dispute, the specific elements of "pedestrian-friendly" streetscape design that were outlined in broader strokes by earlier urban designers such as Jacobs, Appleyard, and Gehl. In general, these studies have targeted several elements as being central to the perceived attractiveness of streetscapes to pedestrians: grid-iron street patterns, or at least patterns that increase the number of intersections and thus accessibility (Moudon and Untermann 1991; Southworth and Owens 1993; Southworth 1995); reduced traffic speeds (Eubank-Ahrens 1991; Ben-Joseph 1995a; Bosselman and MacDonald 1999); presence of trees and landscaping (Bosselman and MacDonald 1999); and compactness (Cervero and Kockelman 1996).

However, research in the urban design realm has faced unique challenges due to its interdisciplinary and multivariate character, and to the difficulties associated with

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13 Ibid, p. 244

determining precise indicators and measurements for the many qualitative variables it must address, such as aesthetics, and attitudes relating to social interactions. On one hand, these difficulties have led to tremendous innovation in urban design research methods, such as the use of time-lapse film sequences to demonstrate use of public space in New York City (Whyte 1980), the use of "composite maps" to describe residents' locations and attitudes about their street (Appleyard 1981), and the use of morphological maps and drawings to analyze neighborhood street patterns (Southworth and Owens 1993; Southworth 1997; Southworth and Ben-Joseph 1997). On the other hand – and often by necessity – these studies have tended to assume a high degree of physical determinism, with a consequent focus on high-resolution physical variables such as building details, sunlight, etc., as opposed to explorations and inclusion of more abstract variables related to economics, demographics, and other non-spatial data.

By contrast, the second broad category of studies, travel behavior and transportation policy, has lent greatest influence to the issues of settlement densities, land use, and regional accessibility, by virtue of its focus on the broader framework of integrated transportation behavior analysis. Research of this type includes a range of empirical studies relating residential densities to travel behavior,[14] analyses of transit-based development and its implications for transportation policy (Cervero and Landis 1997; Cervero 1998c), studies of linkages between land use and transportation behavior (Deakin 1990, 1991), as well as applied studies such as LUTRAQ in Portland, Oregon.[15]

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[14] Noteworthy studies in this category would include Pushkarev and Zupan's analysis of numbers of public transit trips made as a function of residential densities in the New York metropolitan region (Pushkarev and Zupan 1977), Newman and Kenworthy's comparison of auto usage in high density versus low-density cities (Newman and Kenworthy 1989, 1999), and Holtzclaw's neighborhood-level comparisons of annual automobile travel per household among neighborhoods of varying densities (Holtzclaw 1990, 1994).

[15] LUTRAQ has focused on evaluating alternative land use patterns identified as being conducive to reduced travel demand and to increased use of alternate travel modes (1000 Friends of Oregon 1997).

A strong policy and planning perspective is characteristic of these studies, leading to an emphasis on two-dimensional analysis at neighborhood or greater scales. Typical variables of focus in these approaches include income, population and unit densities, trip lengths and trip generation, and mode choice - essentially a combination of demographic, geographic, and travel behavior characteristics. The primary conclusions emerging from these studies have been that mixed land use and higher population densities appear to encourage greater use of alternative transportation modes, and to encourage higher levels of pedestrian activity (Newman and Kenworthy 1989,1999; Cervero and Kockelman 1996; Cervero and Radisch 1996). These conclusions have thus been used (and cited frequently) by urban planners and designers alike, to provide the rationale for implementation of the New Urbanism typology and its core elements, as mechanisms to reduce vehicle miles traveled (VMT), to alleviate associated air pollution impacts, and to reduce, or check, urban sprawl.

However, recent studies in the field of transportation policy suggest a more mixed set of conclusions with respect to travel behavior, urban design, and land use, which have strong implications for the specific issue of pedestrian activity. First, much of the description and analysis of pedestrian behavior has been couched in a broader travel behavior framework, and in fact may be a by-product of the research focus (e.g. land use studies, public transit studies, etc.). Moreover, while analyses of these types may have identified several specific - and significant - variables related to pedestrian activity, such as density, the reductionist tendency for viewing variables in isolation often does not allow for the analysis of potential multivariate and synergistic qualities of pedestrian environments. In addition, many of these studies have tended to exclude social, cultural, and lifestyle factors from the analytic framework.

For example, studies conducted by Handy (1992) and Cervero and Radisch (1996) suggest that while cities possessing the core elements of the New Urbanism typology may have benefits in increasing the amount of pedestrian activity within the neighborhood environs, this activity does not necessarily replace automobile trips within the area, but rather may simply add to the total number of trips taken across all modes. Meanwhile, Crane (1996) notes that, contrary to common assumptions, gridded street patterns appear to produce highly ambiguous, or uncertain, travel behavior effects, other than increasing accessibility across all modes of transportation - thereby presenting the possibility that automobile usage may be as likely to increase in gridded street communities, as it is to decrease. Finally, individual preferences may not always reflect the New Urbanist hopes. Shaw (1995) and Audirac (1999) have both demonstrated that the desire for single-family housing is still a strong preference over high-density housing, even when that housing is located near amenities such as public transit.

The methodological limitations of this group of studies also limit their conclusiveness in many cases. For example, Cervero and Radisch's comparison of travel behavior in two San Francisco Bay Area cities treats "urban form" simply as street layout patterns, rather than examining specific urban design features at the block-level or parcel level (Cervero and Radisch 1996). Hence, conclusions regarding pedestrian "friendliness" of urban form are based solely on street layout (i.e. grid versus curvilinear or cul-de-sac) and distance, rather than analyzing the complex array of urban design features that comprise the pedestrian environment. Similarly, Crane (1996) focuses his analysis of urban form on general street layout patterns, specifically addressing what he terms the "uncertain" travel behavior effects of the grid layout.[16] However, his analysis framework fails to include any discussion of the details of street design (e.g. landscaping, architectural details, etc.), as well as the effects of traffic calming, woonerfs, and street standards, in impacting the effects of increased access (provided by the grid layout) on travel patterns, in spite of the fact that such studies are extensive (Hass-Klau 1990; Eubank-Ahrens 1991; Ben-Joseph 1995a, 1995b; Southworth and Ben-Joseph 1997; Weinstein and Deakin 1998). Thus prescriptions for pedestrian design derived from these studies, such as advocacy for higher densities and mixed land uses, may *by themselves* fall far short of providing the base for the complex, dynamic social interactions envisioned by proponents of more livable communities, although they may certainly contribute to this goal.

Clearly, such ambiguities in previous findings, if borne out in more extensive research efforts, would have significant ramifications for the implementation of New Urbanism strategies, and for the current faith in its core planning and design elements as panacea to urban ills. If, indeed, new urban villages do not lead to an overall reduction in vehicle miles traveled, reduced air pollution, and reduced traffic congestion, many ecological claims of transit villages do not hold. Moreover, if regional access has a strong influence on pedestrian and bike activity (Cervero and Gorham 1995), it could be argued that local efforts to improve pedestrian and bike environments are futile without a concurrent improvement in regional accessibility by non-automobile transportation modes. Finally, it is possible that residents of neighborhoods exhibiting New Urbanism typology have self-selected to live in such places, just as residents of more conventional suburbs may self-select for that particular urban form. The current planning faith is that

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[16] Crane, Randall. 1996: 51.

building designs with New Urbanism elements will lead to changes in travel behavior and community character, because *all* members of the population would fundamentally prefer urban areas with these characteristics. However, if studies that support these claims look only at neighborhoods where these characteristics already exist, then it is possible that residents have already self-selected for these neighborhoods, and thus the studies are coming to pre-ordained conclusions.[17]

The complex, multivariate nature of urban planning problems has also acted as a continuing constraint on these types of studies. Analysis methods can be grouped as simulations (Kulash et al. 1990; 1000 Friends of Oregon 1997), descriptive studies (Friedman et al 1992) or empirical studies (Handy 1992; Holtzclaw 1994; Cervero and Gorham 1995; Cervero and Kockelman 1996; Cervero and Radisch 1996; Steiner 1996). Each of these groupings has attempted to address the multivariate nature of the problems in question by a variety of techniques, such as statistical regression, behavioral observation, and predictive modeling. However, rarely are several tools layered or combined in an effort to capture the differing qualities of variables being addressed, nor have there been consistent attempts to address the synergistic qualities of variables rather than utilizing the more typical reductionist approach of viewing variables in isolation. As a result, conclusions are typically limited to a narrower framework than that encompassed by the real urban planning world. The development of methods that can capture the larger urban planning framework would thus be a critical and necessary contribution towards the effective progression of urban planning research.

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[17] Research by Eran Ben-Joseph, who has surveyed residents of neighborhoods displaying more typical suburban street characteristics (cul-de-sacs, etc.), suggests that not all people prefer the gridded layout prescribed by the New Urbanism typology (Ben-Joseph 1995a).

Overall, the two broad categories of studies discussed above tend to show a marked boundary between, on the one hand, research focusing on qualitative variables, and a high-resolution, building-level scale (urban design studies), and research focusing on quantitative variables, or abstract policy variables, at a city or regional scale (travel bahavior and transportation policy studies). While this separation certainly does not invalidate, or reduce the importance of these studies, it suggests a weakness in addressing the synergistic behavior among urban design and planning variables across several scales, as well as the interplay among the multivariate qualitative and quantitative aspects of the urban planning realm.

Several recent studies have attempted to integrate these typically separate approaches, most notably: Handy's research examining both local and regional access and its relation to travel behavior (Handy 1992); Southworth and Ben-Joseph's treatment of the evolution and impact of street standards on community development (Southworth and Ben-Joseph 1997); Southworth and Owens' work discussing neighborhood urban form (Southworth and Owens 1993); Cervero and Radisch's study of differences in travel behavior in two San Francisco Bay Area cities, Lafayette and Rockridge (Cervero and Radisch 1996); Crane's discussion of the ambiguous travel behavior changes associated with gridded street design (Crane 1996); and Cervero and Kockelman's statistical analysis of travel demand and its relation to density, land-use diversity, and "pedestrian-oriented" designs (Cervero and Kockelman 1996).

Conclusion

In sum, previous urban design, and travel behavior and transportation studies have effectively identified and characterized a number of variables that appear to influence pedestrian activity and neighborhood livability. However, due to the reasons discussed in this chapter, the investigations have been limited either to the analysis of fine-grained urban design features, or to larger-scale analysis such as overall street layout, or general housing and population densities. Moreover, variables of focus have been isolated from one another during analysis, thereby obscuring the synergism and interactions that are inherent in complex systems, of which the urban environment is certainly one. Finally, studies have tended to separate the analysis of quantitative and qualitative variables, focusing on one type or the other, and thus losing the robustness and depth of information that could be gained by examining the two types together. My dissertation project attempts to address these weaknesses, while building on the information and conclusions previously developed in this general body of research.

Chapter 3: Research Methodology, Data Collection, and Selection of Case Study Neighborhoods

Overview of Research Questions and Research Approach

The central questions of this research focus on the relationships among urban form, travel behavior, and neighborhood livability. In an effort to test one of the core assumptions behind the New Urbanist prescriptions, the pedestrian-friendliness of the neighborhood environment is identified as a key urban form element in achieving New Urbanist goals. Specifically, this research seeks to determine the degree to which pedestrian-friendliness - or walkability - influences residents' travel behavior within the neighborhood, their use of neighborhood centers, and their overall satisfaction with their neighborhood environment. Previous research (as presented in Chapter Two) has shown that urban form does influence the pedestrian-friendliness of given areas, although the specific nature of this relationship appears to be much more complex than originally assumed. Therefore, this research attempts to explore and answer two sets of questions about this relationship:

1) How do residents choose particular neighborhoods in which to live? Is a neighborhood's degree of "pedestrianization" a significant factor in influencing residential choice? Is the *option* of walking important in that choice? Do the elements of a more pedestrian-friendly environment produce greater residential satisfaction for residents of that neighborhood?

2) To what degree does local urban form (street layout, streetscape, etc.) impact pedestrian activity at the neighborhood level? In other words, controlling for social (e.g. ethnic/racial mix), economic (e.g. median household income levels), and ecological (e.g. climate, topography) variables, what is the difference in overall pedestrian activity levels between neighborhoods which possess a set of more pedestrian-friendly urban form variables, and those that possess a less pedestrian-friendly set? Can one identify clusters of variables that appear to work in a synergistic fashion in terms of encouraging or discouraging greater pedestrian activity? Overall, once a neighborhood is chosen as a place to live, is the actual travel behavior of its residents consistent with their original residential choice priorities?

I have explored specific variables thought to influence this relationship by comparing and contrasting four case study neighborhoods in the San Francisco Bay Area region, all of which contain at least several of the key urban form elements targeted as being central to the New Urbanism neighborhood visions. By matching the neighborhoods as closely as possible on the non-built variables of income, demographics, regional accessibility, and topography, I have isolated specific urban form variables at the block and parcel-level, to determine their influence on residents' travel behavior and use of their neighborhoods.

I have implemented both a detailed urban form survey to collect data on the specific urban form characteristics of each case study neighborhood (see Appendix V), as well as a mail-back household survey that investigates residents' perceptions of their neighborhood and their travel behavior within and around the neighborhood, including a one-day trip diary, specifically focusing on questions related to the walkability of the neighborhood (see Appendix VI).[1] The results from these two surveys have been integrated to determine what effects - if any - variations in urban form have on the perceived walkability of neighborhoods, actual travel behavior within that neighborhood, residents' use of their neighborhood centers, and whether urban form characteristics affect residents' views of the overall livability of these neighborhoods. Ultimately, the results of the two surveys are used to develop predictive models of walking behavior in the four case study neighborhoods.

The methodology employed in this research integrates qualitative and quantitative analytic approaches, in an effort to better reflect the complexity of urban form variables and their inter-relationships in the real world. Specifically, the research includes an analysis of variables across a range of scales, from the regional land use, demographic, and access variables that are more typically associated with transportation policy studies, to the fine grained urban form and travel behavior characteristics of the block and parcel levels - generally addressed only in studies with a strong urban design or architectural emphasis. This integration thus addresses one of the methodological weaknesses of much of the previous research in this area: the failure to consider physical urban design details in conjunction with general urban planning and transportation policy variables.

The compilation of data thus includes:

1) import and sorting of 1990 U.S. census data;

2) review and sorting of USGS topographic data;

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[1] The two surveys are presented and discussed in detail, in Chapters Four (urban form survey) and Five (mail-back survey). These discussions include a full listing and description of the variables analyzed in the two surveys.

3) urban form "inventories" and surveys; and

4) residential mail-back surveys.

Analysis techniques were also selected to address limitations of past research, with the goal of developing a richer, and more complete, analytic framework. Qualitative data is thus discussed both in traditionally more "qualitative" terms, such as narrative text and pictorial comparisons, but is also analyzed using standard statistical techniques in an effort to describe the data in more "quantitative" terms. Data description and analysis techniques thus include:

1) textual narrative;

2) content analysis;

3) statistical analysis; and

4) photographic and pictorial analysis.

More specifically, I have investigated the dissertation questions through a series of steps, summarized as follows:

1) reviewed and critiqued previous research on the subject to develop theory (presented in Chapters 1 and 2)

2) conducted a regional analysis of neighborhood demographics, to identify initial case study pool (Chapter 3)

3) surveyed the general urban form characteristics of neighborhoods in the case study pool (Chapter 3)

4) defined preliminary indicators of pedestrian-friendliness, and developed a preliminary typology of pedestrian-friendliness (Chapter 3)

5) performed final selection of case study neighborhoods (Chapter 3)

6) surveyed the detailed urban form characteristics of the case study neighborhoods (Chapter 4)
7) constructed a comparative neighborhood urban form database (Chapter 4)
8) developed and implemented a neighborhood household travel behavior and residential neighborhood use survey (Chapter 5)
9) performed final analysis and evaluation of case studies, comparing findings both across, and within, case study neighborhoods (Chapters 5 and 6)

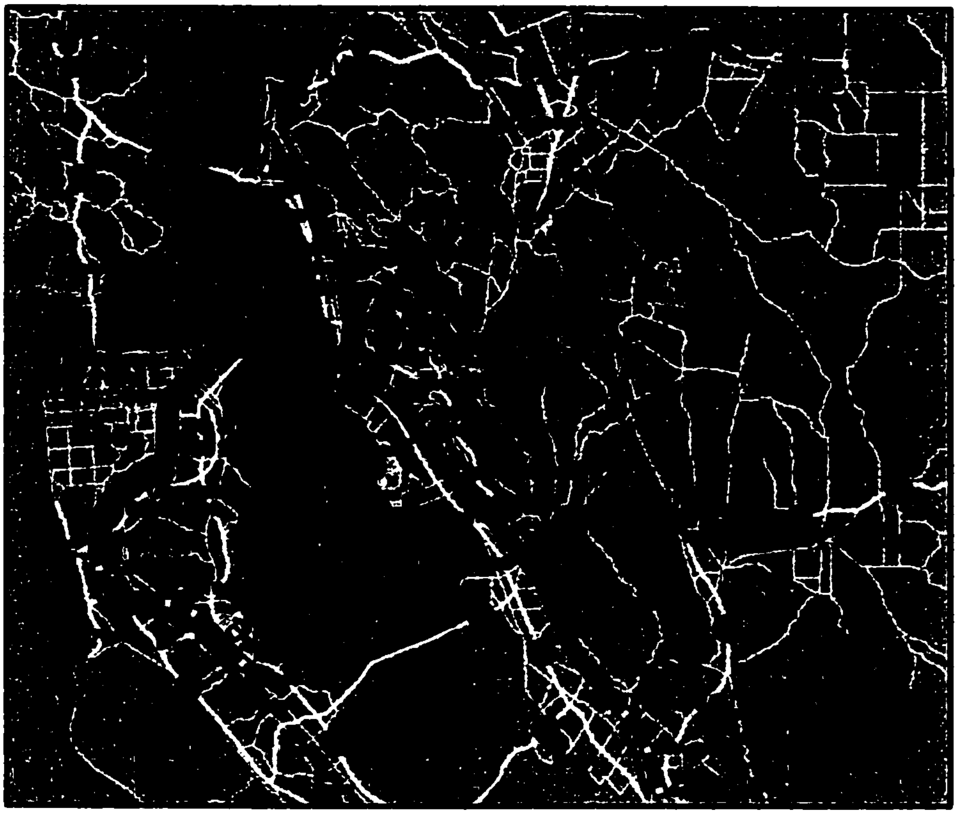
A detailed description of the case study selection process and results (steps 2 – 5) comprises the bulk of the remaining sections in this chapter. A brief overview of steps 6 – 9 is presented in the final sections of this chapter, with more detailed results and discussions presented in Chapters 4 - 6.

Regional Analysis of Neighborhood Demographics and Selection of Initial Case Study Pool

A comprehensive analysis of regional accessibility factors and U.S. census data was used to develop an initial pool of potential case study neighborhoods. The goal of this analysis was to initiate the process of distilling a final set of potential case study neighborhoods that controlled for demographics, income, and regional accessibility – i.e. the macro-scale features that impact travel behavior and mode choices within particular neighborhoods. The selected case studies would thus differ primarily on neighborhood-level urban form characteristics, which constitutes the basis for my research questions. As Handy (1992) and Cervero and Gorham (1995) have noted, regional accessibility to transit appears to be one of the underlying factors affecting travel mode choice, particularly for commute trips. Moreover, both demographics and income can, by themselves, influence the expected travel behavior and mode choices of any given individual (Holtzclaw 1990, 1994; Kitamura et al. 1997).

Given these considerations, and the fact that a key element of the New Urbanism prescription is high accessibility to public transit, it was determined at the start that all potential case study neighborhoods should be located within one mile of a major public transit center. In the Bay Area, the most easily identifiable, and regionally consistent, type of public transit is heavy rail, as levels and quality of service vary only minimally from city to city, relative to other forms of public transit (e.g. buses). CalTrain and Bay Area Rapid Transit (BART) are the only two heavy-rail, commuter services in the Bay Area, which immediately limited case study selections to neighborhoods along those two lines. However, CalTrain was not designed for local use, but rather for longer commutes into and out of San Francisco, and has only more recently been used for local access within the South Bay Peninsula area. Therefore, BART was determined to be the more integrated, regional access choice, and thus all neighborhoods initially selected were situated along the Bay Area Rapid Transit (BART) lines, within one-to-two miles of the BART stations[2] (see Figure 3-1 and Table 3-1).

Figure 3-1. Map of San Francisco Bay Area and BART Station Locations



[2] This stage of the research was performed in 1997, prior to the opening of the most recent BART additions,

Table 3-1. Initial Neighborhood Selection Pool

Fremont	Fremont, CA
Union City	Union City, CA
South Hayward	Hayward, CA
Hayward	Hayward, CA
Bay Fair	San Leandro, CA
San Leandro	San Leandro, CA
Coliseum/Oakland Airport	Oakland, CA
Fruitvale	Oakland, CA
Lake Merritt	Oakland, CA
Oakland C. C./12th St.	Oakland, CA
19th St./ Oakland	Oakland, CA
MacArthur	Oakland, CA
Ashby	Berkeley, CA
Downtown Berkeley	Berkeley, CA
North Berkeley	Berkeley, CA
El Cerrito Plaza	El Cerrito, CA
El Cerrito Del Norte	El Cerrito, CA
Richmond	Richmond, CA
Concord	Concord, CA
Pleasant Hill	
Walnut Creek	Walnut Creek, CA
Lafayette	Lafayette, CA
Orinda	Orinda, CA
Rockridge	Oakland, CA
West Oakland	Oakland, CA
Daly City	Daly City, CA
Balboa Park	San Francisco, CA
Glen Park	San Francisco, CA
24th St./ Mission	San Francisco, CA
16th St./ Mission	San Francisco, CA
Civic Center	San Francisco, CA
Powell St.	San Francisco, CA
Montgomery St.	San Francisco, CA
Embarcadero	San Francisco, CA

Census data was then used to further describe the cities with respect to income and demographics. This analysis was conducted at two levels: 1) the *city/place* level (e.g. Berkeley, Oakland, etc.); and, after initial sortings, 2) the *tract* level, in which all tracts within a one-to-two-mile radius of each neighborhood center (and thus considered to roughly constitute a "neighborhood") were analyzed with respect to factors such as income, population density, employment, etc. This was done both to develop a general demographic characterization of the neighborhoods at the city "macro"-scale (Table 3-2, and Appendix I:City-Level Summary of Candidate Pool Socio-Demographic

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and hence included 34 total neighborhoods, corresponding to the 34 BART stations then operating.

Characteristics) and the tract-level "micro"-scale (Appendix II: Tract-Level Summary of Candidate Pool Socio-Demographic Characteristics).[3]

Table 3-2. General Income and Demographic Characteristics, by City/Place

Albany	$34,836	70.9	6.1	19.8	3.2
Berkeley	$29,737	62.3	18.8	14.8	4.1
Concord	$41,675	83.9	2.1	8.7	5.3
Daly City	$41,533	39.8	7.7	43.6	8.9
El Cerrito	$39,538	65.6	9.2	22.5	2.6
Fremont	$51,231	70.7	3.8	19.4	6.1
Hayward	$36,058	61.8	9.8	15.6	12.8
Lafayette	$64,806	93.0	0.7	5.8	0.5
Oakland	$27,095	32.5	43.9	14.9	8.7
Orinda	$80,968	91.7	0.8	6.9	0.7
Pleasant Hill	$46,885	89.0	1.2	7.0	2.8
Richmond	$32,165	36.2	43.8	11.8	8.2
San Francisco	$33,414	53.6	10.9	29.1	6.3
San Leandro	$35,681	74.1	5.8	13.8	6.3
Union City	$46,988	44.2	8.6	33.4	13.8
Walnut Creek	$45,529	90.8	0.8	6.7	1.7

(Sources: 1980, 1990 U.S. Census)

Analysis at the city/place level indicated that the selected cities show a high level of variation in their general income and demographic characteristics. When sorted by median household income, and by race (Table 3-3), median household incomes range from roughly $27,000 (Oakland) to nearly $81,000 (Orinda), while racial composition (measured as percentage of the population that is white) ranges from a low of 32.5% (Oakland) to a nearly homogenous 93.0% (Lafayette).

[3] In several of the cities studied, (e.g. Oakland), income and demographics can vary quite significantly across the city, requiring tract-level analysis to target the income and demographics of specific neighborhoods. For example, Oakland's1989 median household income level is approximately $27K; however, median household income levels in the tracts surrounding the Coliseum range as low as $13K, while those in tracts around Rockridge are as high as $46K (1990 U.S. Census, STF3A).

Table 3-3. Sorting* of City/Place by Income and Race

By Income:

Oakland	$27,095
Berkeley	$29,737
Richmond	$32,165
San Francisco	$33,414
Albany	$34,836
San Leandro	$35,681
Hayward	$36,058
El Cerrito	$39,538
Daly City	$41,533
Concord	$41,675
Walnut Creek	$45,529
Pleasant Hill	$46,885
Union City	$46,988
Fremont	$51,231
Lafayette	$64,806
Orinda	$80,968

By Race (% White):

Oakland	32.5
Richmond	36.2
Daly City	39.8
Union City	44.2
San Francisco	53.6
Hayward	61.8
Berkeley	62.3
El Cerrito	65.6
Fremont	70.7
Albany	70.9
San Leandro	74.1
Concord	83.9
Pleasant Hill	89.0
Walnut Creek	90.8
Orinda	91.7
Lafayette	93.0

*All sorts done in ascending order (low to high)

Sorting at the tract level (Tables 3-4a-c and 3-5a-c, below) describes a high level of demographic variation *within* several of the cities, notably Oakland, while cities such as Lafayette and Orinda are markedly homogenous (white) and wealthy, across all researched tracts.

Based on city and tract demographics for the potential neighborhood areas, as presented above, several immediate decisions were made as to their suitability for this research project's case studies. First, it was determined that lower-income neighborhoods (as defined as a majority of corresponding tracts being less than 75% of the regional household median of $41, 459) would be removed from the candidate pool. Virtually all of the prior research regarding New Urbanist conceptions of the relationships between urban form and travel behavior has focused on middle-income, or higher, neighborhoods. While research focusing on New Urbanism as it applies to lower-income neighborhoods constitutes a necessary step in future studies, the degree of variability already present in this research project precluded the possibility of adding such a potentially significant (as demonstrated by Holtzclaw 1990 and 1994), but unknown, variable.

Second, all neighborhoods that possessed a racial composition of less than 50% white were also eliminated from the candidate pool. Again, prior research has indicated that cultural preferences, which are often linked to race, appear to impact travel behavior and mode choices (Kitamura et al. 1997). Since previous research has focused on communities with a predominantly white racial composition, it was determined that the variable of race should be as consistent as possible with this prior research, again to maintain a focus on the influence of urban form. Having implemented these socio-economic screening criteria, the candidate pool of neighborhood areas was reduced by over one-half, leaving fourteen neighborhoods to be further refined through characterizations of general urban form (via windshield surveys), and through their rankings with respect to pedestrian-friendly typologies developed for this research project.

The fourteen remaining neighborhood areas were: central Fremont; South Hayward; the area around the Bay Fair BART station (San Leandro); the area along the border of Albany and north Berkeley; the area around the El Cerrito Plaza BART station (El Cerrito); central Concord; the area around Pleasant Hill (Lafayette); central Walnut Creek; central Lafayette; central Orinda; the area around the Rockridge BART station (Oakland), the area around the Glen Park BART station (San Francisco), the area around the Montgomery Street BART station (San Francisco), and the area around the Embarcadero BART station (San Francisco).

Table 3-4a. Sorting of Tracts by Income (Ascending Order)

Oakland City Center/12th St.	4031	$7,626	18.4
Civic Center	125	$7,747	18.7
Powell St.	125	$7,747	18.7
19th St./Oakland	4028	$8,566	20.7
Civic Center	178	$9,193	22.2
Powell St.	178	$9,193	22.2
West Oakland	4022	$9,573	23.1
West Oakland	4021	$9,802	23.6
Lake Merritt	4030	$9,886	23.8
Oakland City Center/12th St.	4030	$9,886	23.8
West Oakland	4018	$10,104	24.4
19th St./Oakland	4029	$11,193	27.0
Downtown Berkeley	4228	$12,381	29.9
Coliseum/Oakland Airport	4088	$12,736	30.7
Civic Center	124	$12,754	30.8
Embarcadero	117	$13,350	32.2
Montgomery St.	117	$13,350	32.2
Powell St.	123	$14,075	33.9
Coliseum/Oakland Airport	4089	$14,099	34.0
Richmond	3760	$14,146	34.1
Downtown Berkeley	4229	$15,940	38.4
16th St./Mission	201.98	$16,711	40.3
Fruitvale	4062	$16,817	40.6
MacArthur	4010	$17,126	41.3
Concord	3280	$17,276	41.7
Lake Merritt	4060	$18,471	44.6
Richmond	3770	$18,511	44.6
Ashby	4240	$18,738	45.2
16th St./Mission	208	$19,551	47.2
Lake Merritt	4034	$20,300	49.0
West Oakland	4019	$20,958	50.6
MacArthur	4011	$20,995	50.6
Richmond	3750	$21,574	52.0
Lake Merritt	4033	$21,726	52.4
Downtown Berkeley	4224	$22,030	53.1
Ashby	4005	$22,135	53.4
El Cerrito del Norte	3810	$22,302	53.8
Richmond	3810	$22,302	53.8
Fruitvale	4072	$22,426	54.1
El Cerrito Plaza	3892	$23,484	56.6

* Based on 1989 Median Household Income figure of $41,459 for the San Francisco-Oakland-San Jose, CA CMSA (1990 U.S. Census)
NOTE: Cell highlighted in gray (Table 3-4b) denotes the cut-off point for case study candidates (neighborhoods in which a majority of corresponding tracts had median Household Income levels that fell below 75% of the regional median, were thrown out of the candidate pool).

Table 3-4b. Sorting of Tracts by Income (Ascending Order)

24th St./Mission	209	$23,514	56.7
Hayward	4354	$23,822	57.5
North Berkeley	4231	$24,015	57.9
Ashby	4235	$24,672	59.5
24th St./Mission	229	$26,083	62.9
Fruitvale	4061	$26,142	63.1
16th St./Mission	202.98	$26,162	63.1
Ashby	4234	$26,377	63.6
North Berkeley	4223	$27,109	65.4
North Berkeley	4222	$27,173	65.5
Concord	3361	$27,435	66.2
16th St./Mission	177	$27,550	66.5
Hayward	4366	$27,679	66.8
Hayward	4363	$28,810	69.5
Downtown Berkeley	4230	$28,892	69.7
North Berkeley	4230	$28,892	69.7
El Cerrito del Norte	3820	$29,666	71.6
El Cerrito del Norte	3860	$30,000	72.4
Richmond	3740	$30,105	72.6
San Leandro	4326	$30,115	72.6
Ashby	4239	$30,165	72.8
24th St./Mission	210	$30,212	72.9
San Leandro	4323	$30,733	74.1
Bay Fair	4338	$31,282	75.5
Fremont	4419.02	$31,331	75.6
El Cerrito Plaza	3891	$31,364	75.7
Walnut Creek	3390	$31,382	75.7
Pleasant Hill	3240	$31,879	76.9
Union City	4402	$32,140	77.5
Bay Fair	4331	$32,344	78.0
Rockridge	4003	$32,625	78.7
El Cerrito Plaza	3830	$33,113	79.9
El Cerrito Plaza	3880	$33,292	80.3
Daly City	6007	$34,795	83.9
Hayward	4365	$35,028	84.5
Embarcadero	176.02	$35,125	84.7

* Based on 1989 Median Household Income figure of $41,459 for the San Francisco-Oakland-San Jose, CA CMSA (1990 U.S. Census)
NOTE: Cell highlighted in gray (Table 3-4b) denotes the cut-off point for case study candidates (neighborhoods in which a majority of corresponding tracts had median Household Income levels that fell below 75% of the regional median, were thrown out of the candidate pool).

Table 3-4c. Sorting of Tracts by Income (Ascending Order)

Montgomery St.	176.02	$35,125	84.7
Powell St.	176.02	$35,125	84.7
South Hayward	4382.02	$36,290	87.5
South Hayward	4379	$36,745	88.6
San Leandro	4325	$36,925	89.1
Daly City	313	$37,364	90.1
Balboa Park	261	$38,208	92.2
Concord	3350	$39,481	95.2
Daly City	262	$39,908	96.3
Glen Park	311	$40,859	98.6
El Cerrito del Norte	3852	$41,382	99.8
Concord	3310	$41,429	99.9
Embarcadero	179.01	$41,465	100.0
Montgomery St.	179.01	$41,465	100.0
Pleasant Hill	3400.01	$41,734	100.7
Balboa Park	255	$43,125	104.0
Glen Park	255	$43,125	104.0
Union City	4403.09	$43,245	104.3
Union City	4403.08	$44,085	106.3
South Hayward	4378	$44,732	107.9
Pleasant Hill	3382.02	$45,000	108.5
Embarcadero	116	$45,581	109.9
Fremont	4419.01	$46,212	111.5
Fremont	4418	$46,216	111.5
Rockridge	4002	$46,512	112.2
Glen Park	218	$47,042	113.5
Daly City	6009	$48,417	116.8
Lafayette	3500	$51,626	124.5
El Cerrito del Norte	3840	$52,386	126.4
Pleasant Hill	3382.01	$57,129	137.8
Lafayette	3490	$58,832	141.9
Walnut Creek	3400.02	$60,000	144.7
Rockridge	4043	$61,171	147.5
Orinda	3530.02	$77,962	188.0
Orinda	3530.01	$80,289	193.7
Lafayette	3480	$85,749	206.8
Orinda	3540.02	$95,789	231.0
Civic Center	176.01	N/A	N/A
Powell St.	176.01	N/A	N/A

* Based on 1989 Median Household Income figure of $41,459 for the San Francisco-Oakland-San Jose, CA CMSA (1990 U.S. Census)

NOTE: Cell highlighted in gray (Table 3-4b) denotes the cut-off point for case study candidates (neighborhoods in which a majority of corresponding tracts had median Household Income levels that fell below 75% of the regional median, were thrown out of the candidate pool).

Table 3-5a. Sorting of Tracts by Race: % White (Ascending Order)

West Oakland	4021	0.8
Coliseum/Oakland Airport	4089	2.8
West Oakland	4018	5.0
Coliseum/Oakland Airport	4088	6.5
West Oakland	4022	7.4
Richmond	3760	7.8
MacArthur	4010	9.4
Lake Merritt	4030	11.0
Oakland City Center/12th St.	4030	11.0
El Cerrito del Norte	3820	11.2
Lake Merritt	4033	11.2
El Cerrito del Norte	3810	11.4
Richmond	3810	11.4
Fruitvale	4062	14.9
19th St./Oakland	4028	16.0
Ashby	4240	17.6
Lake Merritt	4060	19.3
Richmond	3770	21.9
West Oakland	4019	22.7
Daly City	313	23.1
Oakland City Center/12th St.	4031	26.2
19th St./Oakland	4029	26.4
Richmond	3750	28.5
Fruitvale	4072	29.1
Fruitvale	4061	31.6
Daly City	6007	32.4
Ashby	4234	32.5
MacArthur	4011	35.4
Ashby	4005	35.4
Daly City	262	36.0
Civic Center	178	36.0
Powell St.	178	36.0
Union City	4402	39.5
Lake Merritt	4034	39.8
16th St./Mission	201.98	40.4
Embarcadero	117	42.2
Montgomery St.	117	42.2
24th St./Mission	229	42.7
Civic Center	125	42.8
Powell St.	125	42.8
Balboa Park	261	45.5
Union City	4403.08	46.0
El Cerrito del Norte	3880	47.3
Balboa Park	255	47.9
Glen Park	255	47.9

NOTE: Cell highlighted in gray (Table 3-5b) denotes the cut-off point for case study candidates (neighborhoods in which a majority of corresponding tracts had a racial composition of less than 50% white, were thrown out of the candidate pool).

Table 3-5b. Sorting of Tracts by Race: % White (Ascending Order)

North Berkeley	4231	48.4
Civic Center	124	49.7
16th St./Mission	208	50.6
Union City	4403.09	51.0
Powell St.	123	53.4
Downtown Berkeley	4228	53.8
El Cerrito Plaza	3892	54.3
Hayward	4366	54.6
Ashby	4235	56.0
24th St./Mission	209	56.5
El Cerrito del Norte	3852	58.2
16th St./Mission	202.98	59.1
El Cerrito Plaza	3830	59.3
Richmond	3740	59.6
Hayward	4363	59.7
South Hayward	4378	59.8
Downtown Berkeley	4229	59.9
16th St./Mission	177	60.4
Glen Park	311	61.1
South Hayward	4382.02	61.2
Downtown Berkeley	4230	61.3
North Berkeley	4230	61.3
El Cerrito del Norte	3840	64.2
Ashby	4239	65.3
Downtown Berkeley	4224	66.2
South Hayward	4379	66.6
Hayward	4354	66.7
Rockridge	4004	66.9
Fremont	4419.02	67.2
San Leandro	4325	67.3
Daly City	6009	67.3
Bay Fair	4331	68.0
24th St./Mission	210	69.1
Bay Fair	4338	70.3
Fremont	4419.01	70.4
Hayward	4365	71.7
Concord	3361	72.4
El Cerrito Plaza	3880	73.9
North Berkeley	4223	74.1

NOTE: Cell highlighted in gray (Table 3-5b) denotes the cut-off point for case study candidates (neighborhoods in which a majority of corresponding tracts had a racial composition of less than 50% white, were thrown out of the candidate pool).

Table 3-5c. Sorting of Tracts by Race: % White (Ascending Order)

[illegible]	[illegible]	[illegible]
Rockridge	4003	75.2
El Cerrito Plaza	3891	75.2
San Leandro	4326	77.1
Fremont	4418	77.4
Embarcadero	179.01	78.1
Montgomery St.	179.01	78.1
Glen Park	218	78.5
San Leandro	4323	80.9
Embarcadero	176.02	82.4
Montgomery St.	176.02	82.4
Powell St.	176.02	82.4
Embarcadero	116	83.5
Pleasant Hill	3382.01	86.2
Walnut Creek	3390	86.8
Concord	3310	87.3
Concord	3280	87.5
Rockridge	4043	87.7
Rockridge	4002	87.9
Pleasant Hill	3400.01	88.4
Pleasant Hill	3240	88.5
Concord	3350	88.5
Lafayette	3500	89.8
Pleasant Hill	3382.02	89.9
Walnut Creek	3400.02	90.5
Lafayette	3490	91.0
Orinda	3530.01	91.0
Orinda	3530.02	92.3
Lafayette	3480	94.4
Orinda	3540.02	94.7
Civic Center	176.01	N/A
Powell St.	176.01	N/A

NOTE: Cell highlighted in gray (Table 3-5b) denotes the cut-off point for case study candidates (neighborhoods in which a majority of corresponding tracts had a racial composition of less than 50% white, were thrown out of the candidate pool).

Survey of General Urban Form Characteristics of Neighborhoods

For the candidate neighborhoods identified in the regional socio-economic analysis (above), a multi-pass survey of urban form was conducted. This survey was used as an initial screening method for characterizing the general urban form of potential case study neighborhoods, which would then be applied to further distill the candidate pool.

This survey covered the "general environs" of the remaining candidate neighborhood areas. The general environs can be thought of as setting the urban context for the neighborhood, and for the purposes of this survey, was defined to be the area within a roughly one-to-two mile radius of the neighborhood center - a somewhat larger area than what is typically thought to be "within walking distance" of the neighborhood center (0.5 mi. or a 15-20 minute walk, assuming people walk 2-3 miles per hour).

The survey focused on gathering data about features such as: principal land uses in the area; special features and notable sites; general building descriptions (height/number of stories, bulk, typical frontage, typical front and side yard setbacks, building materials, type and size of signage, design style, approximate age, maintenance); typical street characteristics in the general area (major streets and their widths, numbers of lanes, types of traffic controls, etc.); general level of traffic; presence or absence of sidewalks; level and quality of landscaping; presence of notable noise, fumes, etc. Data was entered on a standard survey form[4] (see Appendix III: Windshield Survey Form), as well as photographing relevant features, and developing site sketches

[4] This survey form was originally developed and tested by Elizabeth Deakin and Anastasia Loukaitou-Sideris, for a study of neighborhoods in the Los Angeles area. The survey was further refined for a more

when necessary. Full narrative descriptions were developed for the surveyed neighborhoods, incorporating both the socio-economic data gathered previously in this research, and the general urban design data gathered from the "windshield" urban form surveys[5] (see Appendix IV: Windshield Survey Summaries). These characterizations were then used to evaluate the "pedestrian-friendliness" of the candidate neighborhoods, as determined through the indicators and typologies developed in the subsequent research step.

Definition of Preliminary Indicators of Pedestrian-Friendliness, and Development of a Preliminary Typology of Pedestrian-Friendliness

Variables identified through the literature as forming the key elements of New Urbanism typologies were used to define preliminary indicators of pedestrian-friendliness.

The variables considered in defining the indicators were:

1) pedestrian accessibility, as defined by street patterns: grid, freeform, or cul-de-sac
2) presence/absence of a city or town center, or main street
3) parking availability and type: large formal lot (e.g. Bay Area Rapid Transit (BART) lot, on-street, or "other" facility (e.g. small, informal lots, etc.)
4) topography: flat, moderate slope, or steep slope
5) land use mix: single-use, multiple-but-separate, or mixed-use

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recent study of neighborhoods in the San Francisco Bay Area, as part of the "BART @ 20" research program.

[5] This full set of surveys and write-ups, prepared by Associate Professor Elizabeth Deakin and research associate Juliet Lamont, will be presented in an upcoming publication of the Institute for Urban and Regional Development, at the University of California.

6) land use types: government/institutional, office, commercial/retail, industrial, residential

7) pedestrian appeal of streetscape design (e.g. landscaping/trees, transparency, sidewalk presence and continuity, etc.): low, medium, or high

8) architectural interest/diversity: low, medium, or high

9) housing density (units/acre)

These indicators were then applied to characterize the remaining candidate neighborhoods, as well as to construct a set of preliminary urban form typologies for neighborhood analysis (Tables 3-6 and 3-7).

Table 3-6. Candidate Neighborhood General Environs: Urban Form Characteristics (1-2 mi. radius)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fremont	Suburban	Flat	Mixed	G, O, C, R	2-6
South Hayward	Suburban	Flat	Single	R	1-4
Bay Fair	Suburban	Flat	Single	C, (R)	1-7
Albany/No. Berkeley	Semi-Urban	Flat/Mod Slope	Mixed	G, O, C, R	4-11
El Cerrito Plaza	Suburban	Flat/Mod Slope	Mixed	C, R	6-12
Concord	Suburban	Flat	Mixed	G, O, C, R	3-12
Pleasant Hill	Suburban	Flat	Mixed	O, R	2-5
Walnut Creek	Suburban	Flat	Mixed	G, O, C, R	2-6
Lafayette	Suburban	Flat/Mod Slope	Mixed	G, O, C, R	1-2
Orinda	Suburban	Flat/Mod Slope	Mixed	G, O, C, R	1
Rockridge	Semi-Urban	Flat/Mod Slope	Mixed	G, O, C, I, R	3-11
Glen Park	Urban	Mod/Steep Slope	Mixed	O, C, R	9-14
Montgomery St.	Urban	Flat	Mixed	O, C, R	2-9
Embarcadero	Urban	Flat	Mixed	O, C, R	2-17

* US Geological Survey data was used to characterize topography. Flat= <10% slope; Mod= 10-20% slope; Steep= >20% slope.

** G=Government/Institutional, O=Office, C=Commercial/Retail, I=Industrial, R=Residential

*** Figures derived from tract data for 1-2 mile radius from each station (see Appendix II)

Table 3-7. Candidate Neighborhood General Environs: Urban Form Characteristics (1-2 mi. radius)

Fremont	Grid/Cul-de-Sac	Low	No/Yes	B, S	Low
South Hayward	Grid/Cul-de-Sac	Low/Med	No	B, S	Low
Bay Fair	Grid	Low	No	B, O, S	Low
Albany/No. Berkeley	Grid	Med/High	Yes	B, S	Med/High
El Cerrito Plaza	Grid	Low	No	B, O, S	Low
Concord	Grid/Cul-de-Sac	Low/Med	No/Yes	B, (S)	Med
Pleasant Hill	Cul-de-Sac	Med	No	B, S	Med
Walnut Creek	Cul-de-Sac	Med	Yes	B, S	Med
Lafayette	Cul-de-Sac	Med	Yes	B, S	Med/High
Orinda	Cul-de-Sac	High	Yes	B, O, S	High
Rockridge	Grid	High	Yes	B, S	High
Glen Park	Grid	Med/High	No	B, S	Med/High
Montgomery St.	Grid	High	Yes	(O), S	High
Embarcadero	Grid	High	Yes	(O), S	High

* B=BART Parking facility, O=Other Parking facility, S=On-street

The neighborhood characterizations presented in Tables 3-6 and 3-7 suggested a range of "pedestrian-friendliness" across the candidate neighborhood areas, as determined by the presence or absence of New Urbanism variables (e.g. town center/main street), and/or the specific measurements associated with the variables (e.g. housing density). A summary of the initial "pedestrian-friendliness" assessments for the fourteen candidate neighborhoods is presented in Table 3-8.

Table 3-8. Initial Assessment of Candidate Neighborhoods' Pedestrian-Friendliness

Fremont	Medium
South Hayward	Low
Bay Fair	Low
Albany/No. Berkeley	High
El Cerrito Plaza	Low
Concord	Medium
Pleasant Hill	Medium
Walnut Creek	Medium
Lafayette	Medium
Orinda	Low
Rockridge	High
Glen Park	Medium
Montgomery St.	Low
Embarcadero	Low

The process for the final selection of the case studies integrated these variables to define a final set of four neighborhoods, through several final selection criteria. The first set of criteria related *to individual* neighborhood screening, while the second set related to criteria for *grouping* the neighborhoods (i.e. determining a reasonable four-neighborhood case study sub-set). The major individual screening criteria were:

1) The neighborhood study area (i.e. within 1-2 mile radius of neighborhood center) must have a significant residential component, since the research would focus on residents' use of the neighborhoods.
2) The neighborhood study area must have significant shopping/trip attractors, since use of a neighborhood "center" is a significant aspect of the research project.

Based on these two criteria, Montgomery Street and the Embarcadero were immediately eliminated from further consideration, since both areas are predominantly commercial/retail areas, in a highly urban environment. Pleasant Hill and South Hayward were also eliminated, since both lacked significant retail commercial activity, thus removing the possibility for shopping or trip attractors. Finally, Bay Fair was eliminated at this stage, because although it possessed a residential component, it was determined that a large majority this residential component is so distant from the mall center (0.25 miles or greater), that it would effectively be eliminated from the detailed urban design study that is an integral part of the subsequent research.

The second set of criteria, implemented to determine the final case study sub-set of four neighborhoods, were:

1) Case study sub-sets must be composed of neighborhoods from the same typology/classification (i.e. urban or suburban).

2) Within case study sub-sets, neighborhood study areas must have similar demographics and income.

3) Within case study sub-sets, neighborhood study areas must display some differentiation in the urban form variables described by the New Urbanism typology (presented in Tables 3-6- and 3-7), so as to define a range of four neighborhoods hypothesized to be "less" pedestrian-friendly to "more" pedestrian–friendly.

Based on these criteria, Glen Park was eliminated as being the only remaining neighborhood corresponding to a fully "urban" typology.[6] Lafayette and Orinda were also eliminated, because both neighborhoods were almost completely racially homogenous, and at the far upper end of the income scale. Only Walnut Creek was even within range of these two areas, with respect to income and race, therefore a grouping of four neighborhoods was not possible. In reviewing tract-level data, both the El Cerrito Plaza and Concord neighborhoods each contained tracts that were significantly below the regional median of $41,459.[7] Although the majority of their corresponding tracts were within the acceptable income range, the outliers presented a potentially problematic aspect to the subsequent research, and therefore it was determined that these two neighborhoods should be eliminated.

The final set of case study neighborhoods was thus determined to be: Fremont, Walnut Creek, Albany-North Berkeley, and Rockridge. A final hypothesized

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[6] Glen Park, which sits on the outskirts of downtown San Francisco, is less urban in nature than the Montgomery Street or Embarcadero neighborhoods, but its integration into the highly urban San Francisco framework made it a questionable choice for this study.

"pedestrianization," or "walkability," spectrum was constructed for the four case studies, based on the initial assessments of urban form undertaken at this stage of the research, and described in this chapter (Tables 3-6 and 3-7). As discussed in Chapter Two, Rockridge has frequently been cited as one of the premier examples of the New Urbanist neighborhood typology (Cervero and Radisch 1996) ranking high in all of the key urban form variables typically ascribed to "pedestrian-friendliness." It was thus hypothesized to be positioned at the "most walkable" end of the spectrum.

Albany/North Berkeley, as defined by the neighborhood "center" of the eastern half of Solano Avenue, ranked high on nearly all of the key variables as well, and thus fell next on the hypothesized walkability spectrum. Its two potential weaknesses were the neighborhood center's distance from a heavy rail station (approximately one mile), and the existence of a steeper slope (greater than 20%) above the east end of Solano Avenue. However, Solano Avenue is served by a very frequent, and heavily-used AC Transit bus service – specifically the "51" line, which runs from Oakland through downtown Berkeley, and north through Albany – thus offsetting, to a reasonable degree, any local public transit accessibility issues that would otherwise be present. It was determined that the topographic feature of the steeper slope would provide a valuable variable for analysis at the detailed urban form level.

Walnut Creek was hypothesized to constitute the third neighborhood along the hypothesized walkability spectrum, ranking fairly high on such variables as the presence of a main street or town center, general streetscape design, and mix of land use types. However, it ranked lower in terms of housing density and the degree to which land uses are segregated (although technically mixed), thus presenting a contrast to the denser,

[7] $23,484 for El Cerrito Plaza tract 3892, and $17,276 for Concord tract 3280 (1990 U.S. Census).

mixed-use neighborhoods of Rockridge and Albany. Finally, Fremont was hypothesized to be the least "pedestrian-friendly" neighborhood of this New Urbanist case study grouping, due to lower housing densities (relative to the other neighborhoods), and the distance between destinations in its center. Moreover, it did not rank high on streetscape design or architectural diversity, suggesting analysis potential in these areas as well. In spite of being touted as one of the "most noteworthy concentrations of transit-oriented-development [in the Bay Area]"[8] over the last fifteen years, Fremont presents a potentially noteworthy case study for the examination of the variables *necessary* for neighborhood pedestrian-friendliness, not simply those that are highly desirable.

Overall, the four neighborhoods selected for case study comprise a grouping of New Urbanist typology neighborhoods that vary in urban form at the neighborhood, block, and parcel-level. The subsequent stages of the research were designed to describe the detailed urban form of these neighborhoods, focusing on micro-scale variables related to pedestrian-friendliness, as well as to evaluate residents' travel behavior in, and satisfaction with these neighborhoods, in order to determine the degree to which these latter factors are linked to neighborhood urban form.

Survey of the Detailed Urban Form Characteristics of the Case Study Neighborhoods

A detailed survey of urban form within a 0.25-mile radius of the case study neighborhood centers was conducted, in order to obtain detailed urban design data for these areas at the block and parcel levels, and thus to allow for more detailed characterizations of the fine-resolution urban form features of the case study

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[8] Cervero 1998, p. 13.

neighborhoods. The survey was designed so as to allow for a consistent evaluation and recording of both qualitative and quantitative variables.

The survey focused on gathering data at a very fine resolution, at the block and parcel levels, about features such as: land uses and building characteristics (including preparation of a map or diagram along major streets, describing both first floor and upper floor land uses); detailed descriptions of street characteristics along each major street (e.g. width, number of lanes, turning lanes/bays, traffic controls, signals, etc.); on-street parking characteristics (e.g. permitted, metered, other); signage; transit shelters; street furniture (benches, newspaper boxes, planter boxes, etc.); landscaping (types of plant materials, spacing of street trees, if any, maintenance quality, etc.); sidewalk widths, bike parking, etc. Surveyors also noted and recorded the presence of "negative" factors such as high levels of graffiti, street people, miscellaneous criminal activity, etc. Finally, surveyors recorded general impressions about levels of pedestrian activity (rough numbers of pedestrians, dynamic versus static environments, etc.).

Data was entered on a standard survey form, as well as extensive photographing of urban design features, and development of site sketches, diagrams, and maps when appropriate (see Appendix V: Detailed Urban Form Survey). Results of this survey are presented and discussed in Chapter Four.

Neighborhood Urban Form Database Compilation and Construction

The combination of the data acquired through neighborhood-level characterizations of census data and USGS topographical data, general environs surveys, and detailed urban design surveys, allowed for the construction of a database for analysis of the detailed urban form characteristics of the four case study neighborhoods, and for a further refinement in the ranking of these neighborhoods according to their hypothesized pedestrian-friendliness. The database has been structured as a combination of spreadsheets (both general income and demographic data, plus data from the general environs and detailed urban form surveys), photographs, and visual tools such as diagrams and maps (see Chapter 4 for a full presentation of this urban form database).

Preliminary analysis focused on identifying the presence or absence of specific urban design variables, qualitative analysis of photographs, and descriptive statistics for individual urban form variables. Results of this analysis are presented in Chapter Four, as the detailed Case Study Descriptions.

Results were used to further refine the absolute and relative rankings of case study neighborhoods according to their hypothesized pedestrian-friendliness, as determined by an evaluation of the urban design variables discussed above. These findings and conclusions are also presented and discussed in Chapter Four.

Development and Implementation of Survey Examining Household Travel Behavior and Residents' Satisfaction Levels with their Neighborhoods

A household mail-back survey was developed and implemented in the case study neighborhoods, to identify general household travel behavior, and to identify the factors influencing residents' levels of satisfaction with those neighborhoods. The survey questions focused on:

1) Identifying the factors that have influenced residential choices in these neighborhoods (e.g. how have people selected to live in their neighborhoods,

and to what degree was/is pedestrian-friendly urban form a factor in that decision?

2) Characterizing general patterns of automobile use, transit use, and pedestrian activity within the neighborhood by residents, both through one-day trip diaries, and survey questions probing general neighborhood usage.

3) Assessing residents' attitudes about, and use of, their neighborhood as a whole (corresponding to the "general environs" of the urban form survey).

4) Characterizing residents' use of their neighborhood center (corresponding to the "site area" of the urban form survey).

The mail-back survey was developed with extensive input from survey experts, in order to ensure the implementation of a robust methodology. Moreover, the survey was pre-tested in two steps: first, a one-on-one pre-test, in which respondents were hand-picked, and consulted after survey completion, to determine areas for improvement; and second, a random mailing of the survey to thirty "pre-test" respondents, with no post-completion consultation, but simply a review of survey responses to determine the final survey content.

A minimum of 50 completed surveys per case study neighborhood was the goal, in order to provide necessary levels of data for accurate statistical analysis. Assuming a 35% final response rate for the mailback surveys, this necessitated the distribution of 1400 total surveys to potential respondents (350 surveys per case study neighborhood).

The sampling strategy consisted of gathering a random sample of 350 residential addresses per neighborhood, provided by a professional statistical survey consulting firm. Surveys, and all follow-up mailings, were conducted in three waves over the course of a year. The initial mailing was conducted in May of 1999; the first follow-up mailing was conducted in October of 1999; and the final follow-up mailing was conducted in May of 2000. Responses were coded and entered into a spreadsheet database for further analysis. A more detailed discussion of the survey background, methodology, and results is presented in Chapter Five.

Case Study Analysis, Findings, and Evaluation

The neighborhood-level data compiled through the urban form surveys, and through the mail-back surveys, was used to develop models of residential travel behavior and perceptions of neighborhood livability, as a function of the neighborhood's "pedestrian-friendliness". This model focuses on questions such as: are there significant, identifiable relationships between pedestrian activity and neighborhood design? Is pedestrian-friendly urban form a significant factor in residential location choice? Do the broader objectives of the New Urbanism actually coincide with the factors identified as affecting individuals' choices of neighborhoods? Does the *hypothesized* spectrum of neighborhood "pedestrian-friendliness," developed for the four case study neighborhoods based on urban form variations, correlate with *observed* travel behavior and level of residential satisfaction with these neighborhoods?

In sum, a combination of descriptive statistics, multivariate analysis, and pictorial and photographic analyses were applied to:

a) develop model(s) of travel behavior as a function of neighborhood urban form, with emphasis on the influence of pedestrian-friendly urban design variables; and

b) to assess levels of residential satisfaction and neighborhood usage as a function of neighborhood urban form.

Data collected for this dissertation, models developed from this analysis, and conclusions derived from these models, ultimately serves to validate, invalidate, or supplement relevant areas of this body of previous research. The results of this analysis, and the final evaluations and implications of this research, are presented and discussed in Chapters Five and Six.

Chapter 4: Case Study Descriptions and Urban Form Analysis

Overview of Case Study Descriptions: Demographic Profiles, General Urban Form Features, and Detailed Urban Form Surveys

This chapter summarizes and analyzes the results of an extensive urban form survey conducted in the four case study areas (Figures 4-1a-d: Maps of Case Study Neighborhoods). The data collection effort was designed to gather information on urban form characteristics of these four study areas. The purpose of the survey was to assess the urban form configurations of the four case study neighborhoods, in order to develop specific urban form typologies, and in particular, to evaluate their success as "walkable" environments. The results of this urban form analysis are subsequently integrated with results of the mail-back survey, to determine the effect that variations in urban form have on residents' travel behavior around the neighborhoods, the perceived walkability of these neighborhoods, residents' use of their neighborhood centers, and ultimately, whether this affects their perceptions of the neighborhood's overall livability. These analyses are presented in Chapter Five.

Figure 4-1a. Street Map of Rockridge Study Area

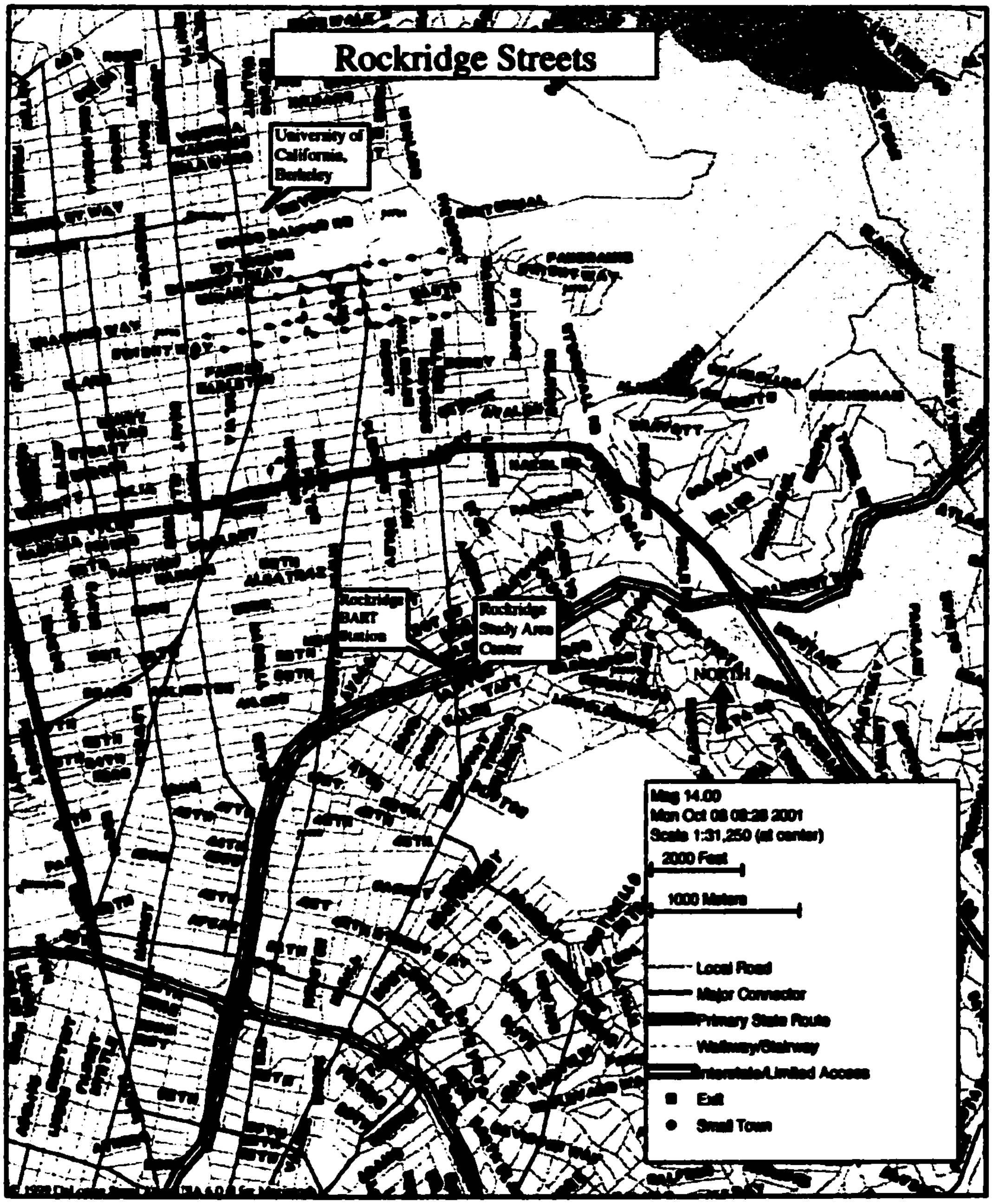


Figure 4-1b. Street Map of Albany/North Berkeley Study Area

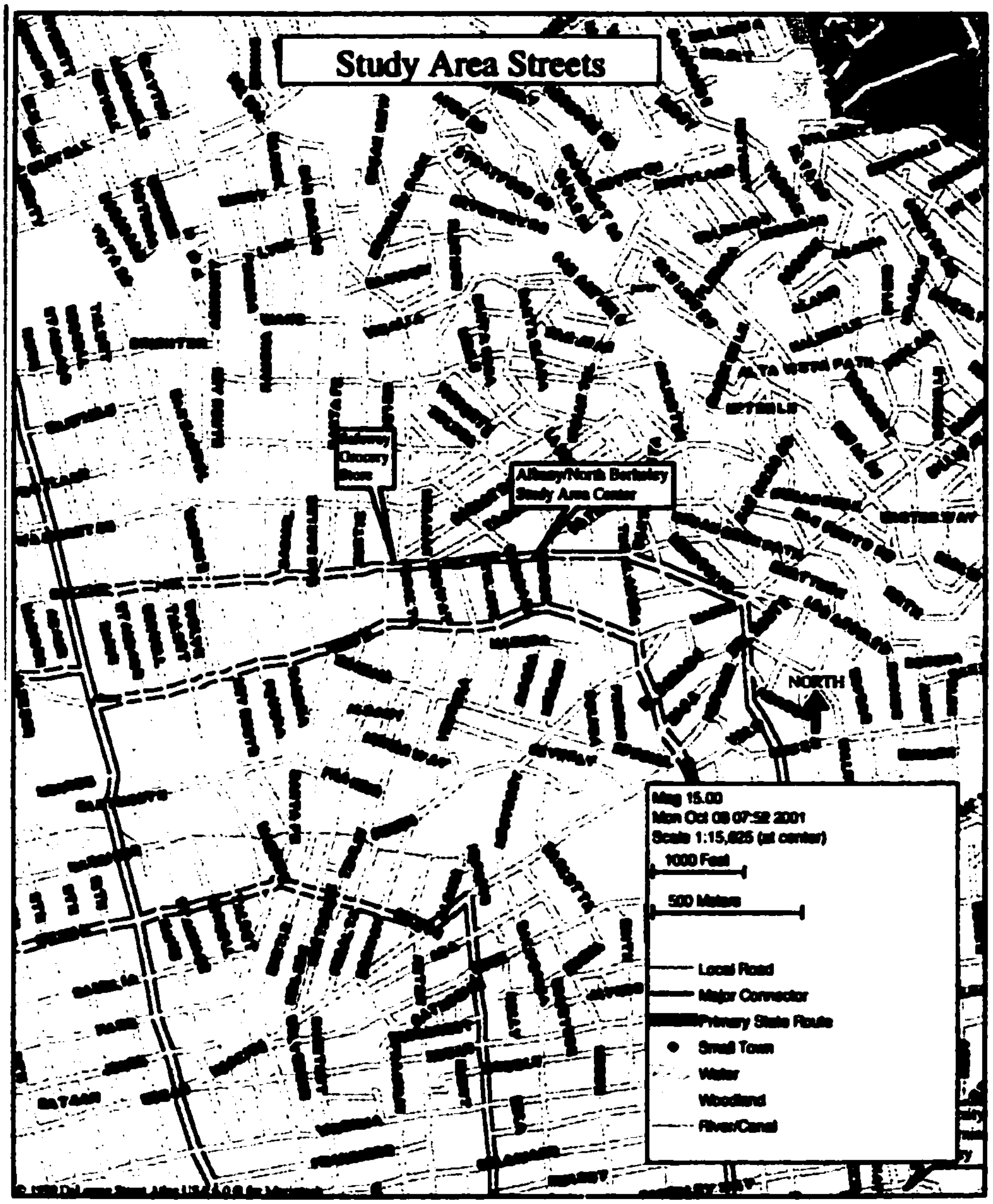


Figure 4-1c. Street Map of Walnut Creek Study Area

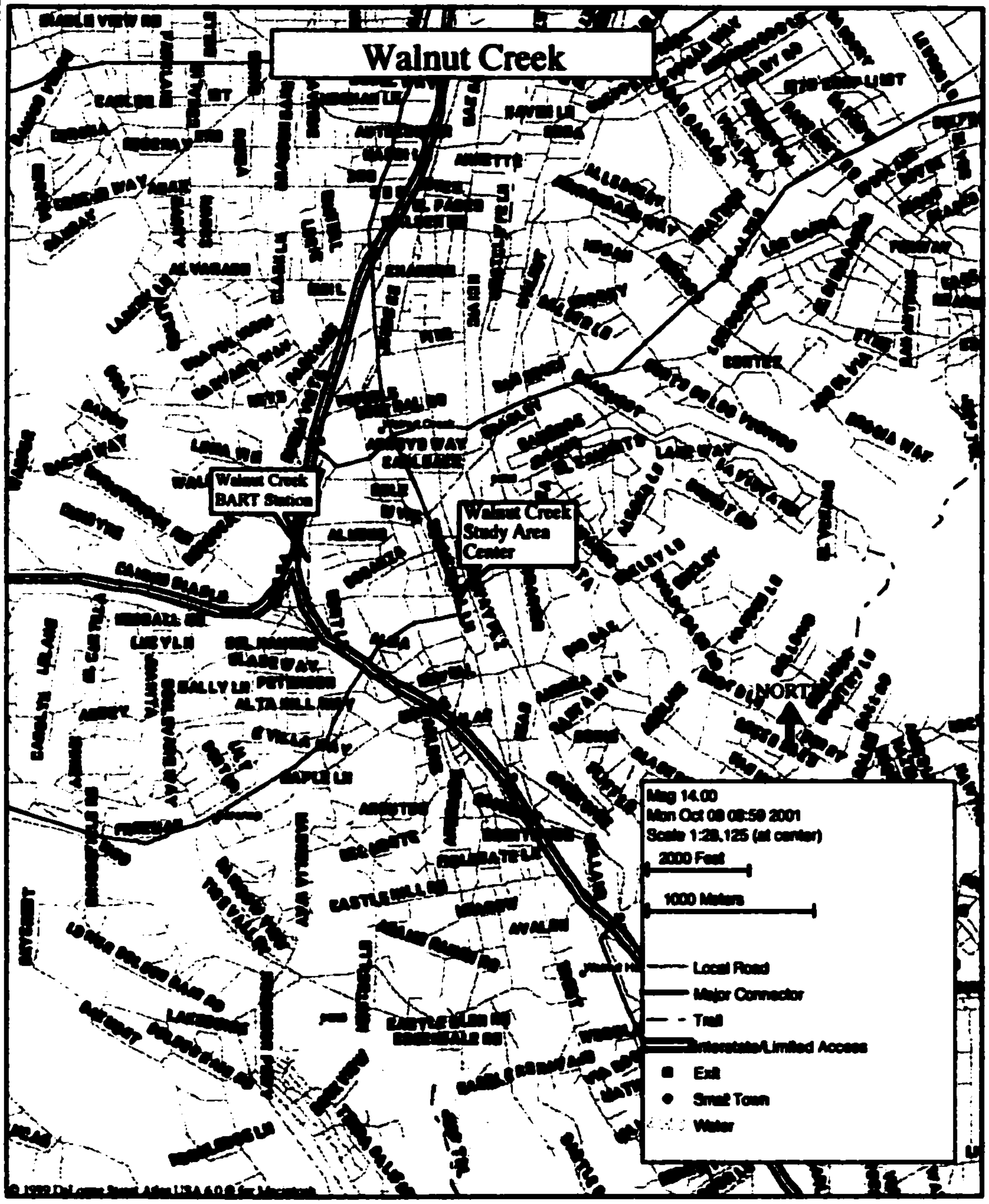


Figure 4-1d. Street Map of Fremont Study Area

Urban Form Survey Methodology

Mode choice in the case study neighborhoods is probably most strongly influenced by the quality of the transportation alternatives available in that area. However, urban form characteristics may support or deter the use of non-automobile travel/transport alternatives, and more specifically, the frequency of pedestrian travel. The data assembled in the urban from survey will be used to help assess these factors.

Survey data was collected at two levels, (1) the *general environs* of the study area (i.e. the neighborhood area surrounding the study area's center); and (2) the *site area* (within approximately one-quarter to one-half mile of the study area center). The data gathered for the general environs was intended to identify general characteristics about neighborhood urban form, such as land use mixes and overall street form. Data gathered at the "site area" level was intended to provide very fine-grained urban form inventories and characteristics. These two levels of data would then be integrated to develop a detailed profile of neighborhood urban form for each case study. Data was entered on a standard survey form (Appendix V), and also included photographing relevant features, and developing site sketches when necessary.

Both levels of data were considered critically important for this dissertation, since travel behavior and activity within urban and suburban areas is highly dependent on regional context as well as the local one (see Chapter Two). For example, local transit is likely to be used more often if linked to regional systems; likewise, use of local transit is often combined with local pedestrian and bicycle trips. Hence, this research aimed to gather data along the full spectrum of such linkages, on the premise that each layer of data would add to the accuracy and robustness of the final conclusions.

The *general environs* can be thought of as setting the urban context for the site and in most cases is somewhat larger than the area typically thought to be "within walking distance" of the study area center (one mile or less, or a 15-20 min. walk, assuming people walk 2-3 mi./hr. in urban/suburban settings.) For the purposes of this survey, "general environs" is defined to be roughly a 1-2 mile radius from the neighborhood center. The survey focused on gathering data about features such as: principal land uses in the area; special features and notable sites; general building descriptions (height/number of stories, bulk, typical frontage, typical front and side yard setbacks, building materials, type and size of signage, design style, approximate age, maintenance); typical street characteristics in the general area (major streets and their widths, numbers of lanes, types of traffic controls, etc.); general level of traffic; presence or absence of sidewalks; level and quality of landscaping; presence of notable noise, fumes, etc.

The *site area* contains the land uses (restaurants, childcare post offices, banks/bank machines, etc.) and transportation facilities, (parking, transit stops, etc.) within "easy" walking distance of the neighborhood's center (one-half mile or less). The data collected at this level included: land use mixes and grain; street characteristics; block characteristics; general building characteristics; sidewalk characteristics; pedestrian characteristics; and landscape quality. Each of these data categories contains numerous, specific urban form variables (a full list of these variables is presented in Tables 4-1a and 4-1b).

Table 4-1a. Site Area Urban Form Survey Data List

General Land Use:	
Land Use Mix	Single, Mixed Horizontal, Vertical
Land Use Type	Residential, etc.
Grain	Coarse, Fine, Mixed
Services	Restaurants, Groceries, etc.
Street Characteristics:	
Street Type	Minor, Collector, etc.
Design Features	Median On-Street Parking
Traffic Volumes	Low, Medium, High
Street Layout	Width One-Way, Two-Way Total # of Through Lanes Special Turn Lanes
Public Transit	Bus, BART, Other
Noise	Quiet, Moderate, Loud
Sidewalk Edge - Built Edge	Setback Vacant Lots Parking Along Sidewalk
Streetwall Quality	Continuous, Frgamented Transparent, Blank Wall Monotonous, Interesting
Adjacent Uses	Open, Fenced, Walled
Signage -For Parcel Use	Small, Large Attached, Free-Standing Neon
Signage - Unrelated to Parcel Use	Billboards, Graffiti,Other
Block Characteristics:	
Block Density	Empty,Partially Built, Fully Built
Block Form	Superblock, etc.

The specific variables selected for inventory and evaluation in the urban form survey comprise a set of urban form characteristics that previous research has shown may impact travel behavior, residents' satisfaction with their environments, and specifically, the walkability of given environments, as discussed in Chapter Two. There are seven general categories of characteristics studied in this survey, comprised of individual variables directly related to the larger characteristics. First are general land use characteristics, which can affect the variety and density of housing and services within a given area, and thus access to local jobs, stores, services, etc. (Deakin et al. 1992; Handy 1992; Blizzard 1996; Cervero 1996a; Steiner 1996; Cervero and Wu 1997).

Second and third are street and block characteristics, which impact a variety of behaviors, such as the degree to which residents may interact with each other (Appleyard et al 1981; Bosselman et al 1999), ease of both vehicle and non-vehicle access within neighborhoods (Southworth and Ben-Joseph 1997), and the social functions of street spaces (Whyte 1980; Gehl 1987; Moudon 1991; Jacobs 1993; Banerjee 2001). Fourth are general building characteristics, which impact the overall aesthetic appearance of urban (and suburban) spaces, as well as their functional success and appeal to users (Lynch 1960; Alexander 1987; Gehl 1987; Marcus and Francis 1990; Isaacs 1998). Fifth are sidewalk characteristics, which impact both the flows of pedestrians (Hass-Klau 1990; Bowman et al. 1994), and form their immediate connection to the surrounding environment (Southworth and Ben-Joseph 1997; Isaacs 1998). Sixth are pedestrianization characteristics, which are actual inventories and characterizations of pedestrian activity levels and types of pedestrians within the neighborhoods. And finally are landscape quality characteristics, which again impact perceptions of overall appeal and the level of comfort with given environments (Hester 1975; Gordon 1990; Hester 1990; Marcus and Francis 1990; Tolley 1990).

Table 4-1b. Site Area Urban Form Survey Data List (cont'd.)

General Building Characteristics:	
Size	Low-Rise, Med-Rise, High-Rise
Distinctive Arch. Style	Yes, No
Overall Aesthetic Appearance	Low, Medium, High
Materials	Stucco, Glass, Brick, etc.
Orientation	Inward, Outward
Scale	Small, Medium,Large
Maintenance	Poor, Average, Good
Sidewalk Characteristics:	
Formal	Yes, No
Width	Actual Width
Pavement Type	Unpaved, Asphalt, Concrete, etc.
Maintenance Quality	Smooth, Broken
	Clean, Littered
Sidewalk Zones	Tree/Shrub/Grass Strip
	Arcades/Awnings
Street Furniture	Benches, Kiosks, etc.
Pedestrianization Characteristics:	
Any Pedestrian Activity	Yes, No
Pedestrian Make-up	Businesspeople, Shoppers, etc.
Pedestrian Activity Level	Low, Medium, High
Pedestrian Activity Type	Dynamic, Static
	Concentrated, Scattered, Varies
Landscape Quality:	
Trees	Deciduous, Leafy
Tree Spacing	Sparse, Average, Dense
	Interupted, Uniform
Tree Size	Small, Medium, Large
Shade	Minimal, Moderate, Heavy
Canopy Effect	Yes, No
Other Vegetation	Sparse, Average, Dense
	Interupted, Uniform

The physical urban form characteristics surveys were then supplemented by a comprehensive analysis of income, demographics, topography, and housing characteristics, using US Census data (1990 and 1980)[1], and USGS topographic data. The analysis was conducted at two levels: 1) the *city/place* level (e.g. Berkeley, Oakland, etc.); and 2) the *tract level*, in which all tracts within a one to two-mile radius of the study area were analyzed with respect to factors such as income, population density, employment, etc. Full city and place data and analyses for the cities containing the study areas are summarized in Appendices I, II, and IV. Of this full data set, the data specifically relevant to the following analyses are presented directly in the discussions below.

These various sets of data - the more fine-grained urban form characteristics collected from the survey, and the regional demographic, topographic, and land use statistics gathered from census surveys and topographic surveys, were combined and analyzed to develop a comprehensive summary of the urban form and socioeconomic profiles of the four case study areas, and to further delineate a new set of "place typologies" that would more accurately reflect the variations in urban form that exist at these different locations. The individual case study summaries are presented below, followed by a comparison and analysis of the four case studies.

Case Studies' General Environs and Socioeconomic Profiles

The general environs of the four case studies include census tracts in Oakland, Berkeley, Albany, El Cerrito, Walnut Creek, and Fremont. All four general environs are of roughly the same size: a one-to-two mile radius from the study area, but because of the locations of the case studies, some encompass tracts across several cities, while some do not. The study areas of Fremont and Walnut Creek include *only* tracts from those respective cities. For Fremont, only the tracts within a one-to-two mile radius of central Fremont are included in the land use and socioeconomic data analysis, since these tracts are slightly different from city trends overall (higher housing density, and slightly lower median household incomes). For Walnut Creek, the overall city land use

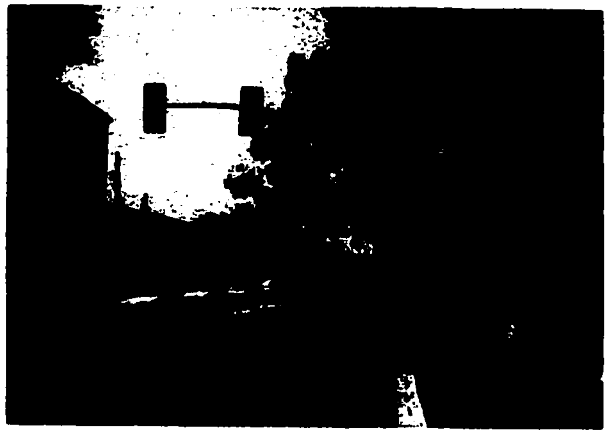
[1] During the period of time that this research was being conducted, and analyses performed, the US 1990 Census data was the most recent detailed data available. The US Census 2000 data did not become available until mid-2001, by which time this research had been completed.

and demographic characteristics are consistent with nearly all tracts within the general environs of the case study area; however, two specific tracts are also presented, because they differ somewhat from the overall city trends. The general environs of the Albany/North Berkeley case study includes the entire city of Albany, as well as several tracts within Berkeley (north) and El Cerrito (south). Therefore, tract data for this case study area includes the full city of Albany, plus relevant tracts in Berkeley and El Cerrito. The general environs for Rockridge includes tracts from Berkeley (south) and Oakland (north), with no one city fully included; therefore, only specific tract data, as relevant to the Rockridge case study area, have been presented.

Rockridge

The Rockridge general environs area are semi-urban, with the central study area centered at College Avenue and Keith Avenue, in Oakland, with this "center" considered as extending approximately one-quarter mile in either direction along College Avenue. This area is situated along the Route 24 freeway, between the separated freeway road directions. There is a BART station located directly at this site, at the College and Keith intersection. The station is an above-ground, concrete structure, with a moderate-sized BART surface parking lot running lengthwise underneath and along the BART tracks.

Figure 4-2. General View of Rockridge (on College Avenue)



This area of Oakland ranges from middle to upper-middle income[2], with 1989 median household incomes[3] ranging from $31,107 to $61,171 (Table 4-2a). Overall housing densities are low to moderate, with three to eleven units per acre. The ethnic mix varies with location, although it is generally predominantly white (>66%), with a substantial black population (>16%) in several tracts (Table 4-2b).

Table 4-2a. Summary Land Use and Income Profile for Rockridge

Rockridge	4002	163	2,032	6	$46,512
	4003	265	5,008	10	$32,625
	4004	172	3,857	11	$31,107
	4043	454	3,237	3	$61,171

Sources: 1980, 1990 U.S. Census

Table 4-2b. Summary Racial Composition for Rockridge

4002	87.9	4.4	5.2	2.5
4003	75.2	16.1	5.8	3.0
4004	66.9	22.4	7.7	3.0
4043	87.7	4.7	6.5	1.1

Sources: 1980, 1990 U.S. Census

[2] Median Household Income (annual) levels have been categorized as follows: Low = <$20K, Lower-Middle = $20K to $30K, Middle = $30K to $45K, Upper-Middle = $45K to $60K, Upper = $60K or more.
[3] US Census data, which was used for this dissertation, always cites the income data from the year prior to the actual census, since this is the latest year for which census respondents have their financial data.

The land uses in the study area are highly mixed, both vertically and horizontally, and the area is often used as a premier example of moderate-density, mixed use development. Land uses include: small retail, commercial, and service facilities; medium-density single family detached, and multi-unit residential areas; corporate office (e.g. Dreyer's); manufacturing (garment workshop); and a notable gourmet food retail sector (Market Hall).

The general building profile for retail and commercial facilities is one to two story, tightly packed buildings, with glass storefronts and a wide variety of architectural styles. The retail environment is distinctly "pedestrian scale," with high pedestrian activity levels at almost all times during the day. Residential buildings include: one to two-story, single family detached, wooden "craftsman-style" homes, although often these may have smaller studios or apartments in basements or backyards; and older, two-story concrete or stucco apartment buildings. However, again, architectural styles range tremendously, producing a diverse array of building types.

The general street pattern is a fine-grained grid. All streets have formal sidewalks, with crosswalks at major intersections. The main streets in the area are College Avenue and Claremont Avenue, with the Route 24 freeway running perpendicular to (and over) College Avenue. College Avenue is a minor arterial. It has one through traffic lane in each direction, on-street parallel parking, and is signalized at major intersections. Traffic volumes on this street are high, while traffic speeds are generally low to moderate, due to heavy congestion. Residential streets have one through lane in each direction, with on-street parallel parking. Traffic volumes are low to moderate on these streets.

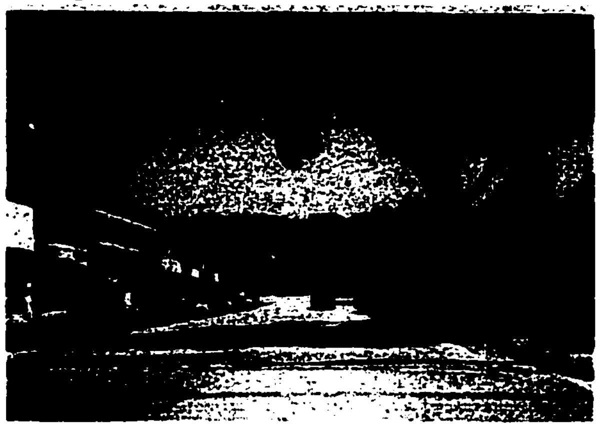
Landscaping in this area is generally of high quality, with large, mature trees along the streets, and well-maintained yards and gardens. College Avenue possesses some stretches, particularly south of the station, that have few or no trees, and/or the trees are very young and small.

The quality of the pedestrian environment appears to be high, with high activity levels throughout the day, varied architecture and visual interest, and numerous pedestrian destinations within a compact area.

Albany/North Berkeley

The Albany/North Berkeley general environs are semi-urban, with the central study area, the east half of Solano Avenue, located approximately two miles north of University Avenue and downtown Berkeley, crossing the borders of both the cities of Berkeley and of Albany. The general environs of the study area encompass all of the City of Albany, and several tracts in North Berkeley and El Cerrito. Solano Avenue is roughly one mile north of the North Berkeley BART station, and 0.75 miles southeast of the El Cerrito Plaza BART station. This area is also within two miles of the University of California, Berkeley campus.

Figure 4-3. General View of Solano Avenue



The area surrounding Solano Avenue to the east and north (e.g. tracts 4213, 3910) is a predominantly upper-middle income neighborhood, with 1989 median household incomes of $48,000 and upwards. (Table 4-3a). The areas farther to the west (e.g. tracts 3891, 4219) are less affluent, with 1990 median household incomes ranging between $30,000 to $40,000 (Table 4-3a). Overall housing densities are generally moderate, with roughly four to six units per acre. The notable exception to this pattern is tract 4217, in North Berkeley, which has a much higher density of eleven units per acre.

Table 4-3a. Summary Land Use and Income Profile for Albany/North Berkeley

Albany/	Albany (city)	1,088	16,327	7	$34,836
North	3891	161	1,785	6	$31,364
Berkeley and	3902	147	1,927	6	$52,048
ElCerrito tracts	3910	352	2,443	3	$59,103
	4211	186	2,034	4	$69,699
	4212	320	3,655	5	$75,443
	4213	269	3,873	6	$48,615
	4214	115	1,696	6	$62,654
	4215	371	3,469	4	$68,106
	4216	384	3,735	5	$66,627
	4217	147	2,890	11	$35,349
	4218	134	2,053	7	$41,371
	4219	211	3,619	8	$33,902

Sources: 1980, 1990 U.S. Census

The ethnic mix is predominantly white (>70%), with the remaining population showing a relatively high proportion of Asian/Pacific Islanders (>10%), and fairly small Black and "Other" populations (<10% in aggregate) (Table 4-3b). Tract 4219 breaks from the overall trends, with a notably larger Black population (21.3%) than any other tract in this study area.

Table 4-3b. Summary Racial Composition for Albany/North Berkeley

Albany	70.9	6.1	19.8	3.2
3891	75.2	7.5	13.7	3.6
3902	79.9	2.0	17.6	0.5
3910	87.8	1.7	6.8	3.8
4211	85.3	3.3	10.2	1.1
4212	89.4	2.5	7.3	0.9
4213	85.6	3.4	10.4	0.7
4214	84.8	3.4	10.1	1.7
4215	88.8	3.1	6.7	1.5
4216	87.5	2.9	9.3	0.3
4217	81.0	2.5	14.9	1.5
4218	78.2	8.3	13.1	0.5
4219	56.3	21.3	17.0	5.3

Sources: 1980, 1990 U.S. Census

The predominant land uses within a one-to-two-mile radius of Solano Avenue are small retail/commercial (along Solano Avenue itself), and single family residential. There are several small gourmet food services and retail areas within one mile of Solano Avenue (Monterey Market area at Gilman Street, and the Shattuck Avenue/Vine Street area). The general building profile is postwar, one to two-story single-family homes, constructed of wood or stucco/concrete. Lots are small and densely packed, with well-maintained gardens and yards.

The general street pattern in the study area is the traditional grid. All streets have formal sidewalks, with crosswalks at most intersections. The main streets in the immediate vicinity of the central study area include Solano Avenue itself, Marin Avenue, and the Alameda. Solano Avenue runs east-west for roughly one and one-half miles from the foot of the Berkeley hills, almost to Highway 880 and the San Francisco Bay. It is a collector street (and a continuation of Shattuck Avenue, running through Berkeley) which often acts as a minor arterial. It has one wide through lane in each direction, with occasional turning lanes at major intersections, and on-street diagonal parking. There are several signalized intersections along its length. Traffic volumes on this street are high.

Marin Avenue is an undivided arterial that runs parallel to Solano Avenue, one block to the south. It has two through lanes in each direction (without turning lanes), and on-street parallel parking. There are several major, signalized intersections along its entire length. Rose and Hopkins Streets each have one through lane in each direction, plus on-street parallel parking. Traffic volumes on these streets are high. Traffic volumes on the smaller residential streets are low to medium.

The Alameda is a collector street, often acting as an arterial, and is a continuation of Martin Luther King Drive, a major through-road for the city of Berkeley. In the Solano Avenue area, it runs north-south, with two through lanes in each direction and on-street parallel parking. There are no turning lanes at major intersections.

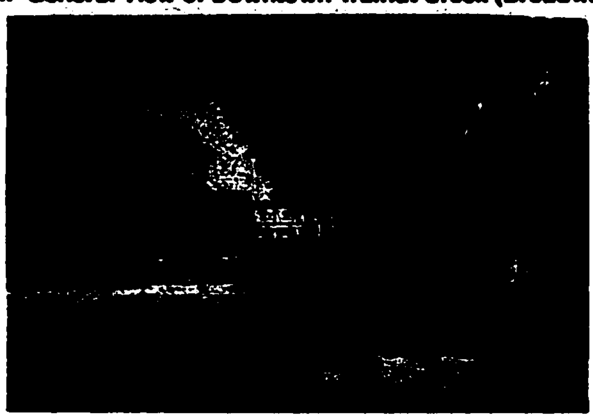
Landscaping quality in the residential areas is high, marked by lush, mature trees, well-maintained gardens and yards, several parks, and generally high levels of well-maintained vegetation. Solano Avenue itself has varied landscaping quality, with some stretches lacking major trees or vegetation, while other stretches are lusher and more heavily planted.

The pedestrian quality of the area appears to be medium to high, primarily due to the pleasant landscaping and generally high visual qualities of the surrounding neighborhoods. Buildings are small-scale, with varied architectural styles, allowing for visual interest. Notably, the western half of Solano Avenue, near San Pablo Avenue, recently underwent a re-design, which included the widening of sidewalks, and the addition of attractive street lamps and street furniture, but also included the removal of several blocks' worth of lush, mature trees, which had been considered a real pedestrian asset.

Walnut Creek

The Walnut Creek general environs are a suburban downtown typology, with the central study area located in an area bounded by Newell Avenue, Broadway, Civic Drive, and California Boulevard. This area contains Main Street and the Broadway Plaza shopping area. The area sits at the intersection of two highways, Route 24 and Interstate 680, which is a major commute juncture. There is a BART station roughly one-half mile to the east of this downtown area, and major civic buildings sit at the east and north portions of the downtown core.

Figure 4-4. General View of Downtown Walnut Creek (Broadway Plaza)



The Walnut Creek general environs are middle to upper-middle income, with 1989 median household incomes ranging from $31,382 to $60,000 (see Table 4-4a). Overall housing densities are low to moderate, ranging from two to six units per acre.

Table 4-4a. Summary Land Use and Income Profile for Walnut Creek

Walnut Creek	Walnut Creek	12,355	60,569	2	$45,529
	3390	839	7,377	6	$31,382
	3400	1,582	7,284	2	$60,000

Sources: 1980, 1990 U.S. Census

The racial composition is the most homogenous of all of the case study neighborhoods, with a predominantly white population (>85%), and a small Asian-Pacific Islander population comprising most of the balance (Table 4-4b).

Table 4-4b. Summary Racial Composition for Walnut Creek

Walnut Creek	90.8	0.8	6.7	1.7
3390	86.8	2.1	6.7	4.4
3400	90.5	0.3	7.6	1.6

Sources: 1980, 1990 U.S. Census

Predominant land uses within a one to two-mile radius of central Walnut Creek include: institutional (civic buildings, hospital); residential (both single-family ranch style, and multi-unit condo/townhouses); commercial (small retail and commercial along main Street; larger retail and upscale boutiques in Broadway Plaza and beyond); office parks; and recreational (Heather Farms Park and Shell Ridge Open Space). Land uses are mixed horizontally, but in many cases the major land uses are segregated, with predominantly commercial and retail comprising the downtown core, while residential areas start at the downtown peripheries and beyond.

The general building profile for the small retail stores is one to two-story buildings, with mixed architecture. There are also a number of large, multi-story (six stories or more) office and commercial buildings, with distinctly contemporary architecture. The residential areas are mainly postwar, one to two-story single-family homes, constructed of stucco/concrete or wood. Lots are moderately sized (0.25 acres or more) and moderately dense, with well-maintained gardens and yards. There are also a large number of two and three-story townhouses and multi-unit condominium and apartment complexes, again with modern architectural features.

The general street pattern is a combination of gridded streets (in a small area of the downtown core), and cul-de-sacs in the surrounding residential areas. All streets have formal sidewalks, and there are crosswalks at all signalized intersections, and occasionally mid-block as well, in the downtown core. The main streets in the central area are: Mount Diablo Boulevard, a large arterial with two through lanes in each direction, additional turning lanes at some intersections, and on-street parallel parking along most sections; Main Street, a collector-type street located in the heart of the downtown core, with one through lane in each direction, and on-street parallel parking along its full length; Broadway Plaza, a minor street also located in the downtown core, with one through lane in each direction, and on-street parallel parking.

Landscaping quality is varied. Residential properties are generally of medium to high quality, with medium and large-sized trees, shrubbery, and small gardens. The commercial buildings in the downtown core are of low to medium landscaping quality; some have formal landscaping, although several of the larger buildings are devoid of any surrounding greenery. The retail area of the downtown core (Main Street and Broadway Plaza) is of high landscaping quality, with numerous plantings, flowers, trees, and landscaped plazas.

The general environs appears to be of medium to high quality for pedestrians, depending on the specific location. Distances between several of the major residential areas and the downtown core may discourage pedestrian activity. Moreover, the distance and obstacles between BART and the downtown core could discourage pedestrian flows between these two areas. Finally, while crosswalks are present at major intersections, high volumes of traffic on the wider arterials may also discourage pedestrian activity.

On the other hand, the downtown retail core includes numerous well-delineated walking areas, crosswalks, and pedestrian-only plazas. Moreover, Main Street and Broadway Plaza are narrower streets with slow traffic speeds, while the building profiles are distinctly human-scale and visually attractive. The architecture is varied in style and size, adding to visual appeal, and landscaping is of high quality. Thus this portion of the study area appears to be of high pedestrian quality. The residential areas of the general environs have pleasant, tree-lined streets with sidewalks and crosswalks at major intersections, again appearing to be of high pedestrian quality.

Fremont

The Fremont general environs are a suburban downtown typology, with the central study area located bounded by Mowry Avenue, Walnut Street, Paseo Padre Parkway, and Fremont Avenue. This "center" lies approximately one-half mile from the main Fremont civic buildings (police administration, court building, etc.), and approximately 0.75 miles from Fremont Central Park recreational facility, in central Fremont. There is a BART station approximately one-quarter mile from the center. The station is concrete, above-ground, and surrounded by a BART surface lot parking facility, which reaches 0.13 to 0.25 miles in all directions.

Figure 4-5. General View of Central Fremont

The Fremont general environs are middle to upper-middle income, with 1989 median household incomes ranging from $31,331 to $46,216 (see Table 4-5a). Tracts within a one to two-mile radius of the station exhibit a slightly lower median income than the city as a whole. Overall housing densities are low to moderate, ranging from two to six units per acre, and the ethnic mix is predominantly white (>67%), along with a substantial Asian-Pacific Islander population (roughly 20%) (Table 4-5b).

Table 4-5a. Summary Land Use and Income Profile for Fremont

Fremont	4419	1,252	6,124	2	$46,212
	4418	514	5,929	4	$46,216
	4419	831	12,101	6	$31,331

Sources: 1980, 1990 U.S. Census

Table 4-5b. Summary Racial Composition for Fremont

4419	70.4	3.8	20.1	5.7
4418	77.4	3.9	13.1	5.5
4419	67.2	8.6	15.5	8.7

Sources: 1980, 1990 U.S. Census

Predominant land uses within a one to two-mile radius of central Fremont include: institutional (civic buildings, hospital); residential (both single-family ranch style, and multi-unit condo/townhouses); commercial (smaller shopping malls, "strip" development); office parks; and recreational (Fremont Central Park). However, land uses are segregated, and distances between individual buildings (other than those within malls) are large (0.13 to 0.25 miles, and more).

The general building profile of the institutional and office park structures is one-to-three story newer buildings, constructed primarily of glass and concrete, occupying large lots of two or more acres that contain extensive surface parking areas and formally landscaped grounds. The townhouse/condominium complexes are two-to-four story postwar buildings (some are very new), constructed of various proportions of stucco, concrete, glass, and occasionally, wood. They are generally gated or walled-in, with carports and/or surface level parking, and landscaped grounds. Single-family residences are typically one-story ranch-style homes, on 0.5-acre - or larger - lots, with setbacks of 15-20 feet.

The general street pattern in the area is a mixture of wide, gridded arterials and smaller residential cul-de-sacs. All streets have formal sidewalks. The main streets in the vicinity of central Fremont are Walnut Street, Mowry Avenue, Paseo Parkway, and along the southern border of the BART parking lot, Civic Center Drive. The first three of these streets are divided arterials (2-3 through lanes in each direction), signalized only at main intersections, with no on-street parking. Traffic speeds on these arterials are high (30 mph or greater), as are traffic volumes.

Landscaping quality is a mix of low to medium quality. Private properties such as office parks and townhouse complexes have formal landscaping, with medium-size trees, some shrubbery, etc. However, there are also numerous "lots" or expanses that have minimal or no landscaping.

The general environs appear to be of mixed quality for pedestrians. While sidewalks are present on all streets, the distances between major destinations (often 0.25 miles or more) may discourage pedestrian activity. The distances within the BART property itself (across building and parking lot) are often 0.25 miles or more. Crosswalks are present at major intersections, but high volumes of traffic on the wider arterials may also discourage pedestrian activity. The general scale of buildings and physical appearance in the area is large, with little detail or fine-grained texture. Several mall properties, as well as the BART station, display a bleak visual appearance, with virtually no vegetation and large, unbroken expanses of surface parking.

Comparison of General Environs Among the Case Studies

The surveys described above indicate some immediate similarities and differences among the four case study areas. All four case study areas are upper-middle income, with a predominantly white racial composition. All four case study neighborhoods are regionally accessible, both in their proximity to major highways, as well as their proximity to BART and other regional transportation systems (e.g. AC Transit bus system). All case studies display mixed uses in the centers, although in Walnut Creek and Fremont these uses are fairly segregated. A summary of urban form similarities and differences between the general environs of the four case studies is presented in Table 4-6.

Table 4-6. Case Studies' Comparison of Land Use and Street Characteristics*

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Land Use: Mixed Use		Yes	Yes	Yes	Yes
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Residential Street	SFR	SFR	SFR	SFR,MUR
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Special Features/Sites		Yes	No	Yes	Yes
[illegible]	Only Small (<= 3 stories)	No	No	No	No
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Varied Sizes	Yes	Yes	Yes	No
Street Characteristics:					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Main Street II	Arterial	Arterial	Arterial	Arterial
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Residential Street	Minor	Minor	Minor	Minor
Traffic Levels	Main Streets	High	High	High	High
	Residential Street	Medium	Low	Low	Low
Sidewalks	Main Streets	Yes	Yes	Yes	Yes
	Residential Street	Yes	Yes	Yes	Yes
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Residential Street	Medium	High	High	Medium

* Data of note is highlighted in gray.
** Land Use Coding: SFR=Single Family Residential; MUR=Multi-Unit Residential; RS=Small Retail; RL=Large Retail; I=Institutional; O/C=Office/Commercial

Housing (and population) densities differ among the four neighborhoods, with Fremont and Walnut Creek being low-to moderate density (2 to 6 units per acre), while Albany and Rockridge are denser, with most tracts ranging from 5 to 11 units per acre. Walnut Creek and Fremont also possess several major arterials running through the study area centers, while Albany and Rockridge are confined to smaller, narrower collector streets, which at peak traffic hours act as arterials. Landscaping is generally of medium to high quality in all of the case studies except for Fremont, where the lack of vegetation can be quite noticeable. The centers of Rockridge, Albany, and Walnut Creek all appear to be more "pedestrian friendly" than Fremont's center, due to smaller-scale buildings, narrower streets, and distances between destinations.

Case Studies' Detailed Urban Form Profiles

The detailed urban form studies focused on the "site area" of each study area - i.e. the area within one-quarter to one-half mile of the each case study's center. A discussion of the results of these surveys is presented below. The results were entered into an Excel spreadsheet for comparison among the four case studies. A full series of photographs of each case study area were also prepared as part of the detailed urban form survey. As part of the analysis, specific photographs were selected for final presentation in the discussion below.

The data gathered covered extensive, detailed urban form features of the site area, as has been summarized in Tables 4-1a and 4-1b, which present the general data categories and the specific variables included. The data listed was gathered for the "main street" in each case study center, and for a typical residential street as well. Where there were several main streets, the primary shopping streets, or area, were used to define the "main street" or streets, and data was gathered for other major streets as appropriate for comparisons.

A summary and comparison of the full data collected for the four case study site areas is presented in Tables 4-7a through 4-7g, and in the discussion below. Highlighted lines (gray) in the data summary tables indicate variables of highest contrast among the four case studies. Measurement thresholds for each variable have been indicated where appropriate. In several cases, the measurement threshold is cited as "judgement." In these cases, the assessment being made was of a subjective quality, and non-measurable in traditional terms. The surveyor's judgement was considered an indicator of this measurement threshold, and in these cases, was supported by independent assessments from other surveyors (from previous BART survey research, etc.)

Table 4-7a. Summary Comparison of Urban Form Surveys in Case Study Site Areas*

[redacted]					
Land Use Mix:					
Single Use Areas		Yes	Yes	Yes	Yes
[redacted]		Yes	Yes	Yes	Yes
	Horizontal Mixing	Yes	Yes	Yes	Yes
	[redacted]				
Land Use Type:					
Residential		Yes	Yes	Yes	Yes
Office		Yes	Yes	Yes	Yes
Small Retail		Yes	Yes	Yes	Yes
Large Retail		Yes	Yes	Yes	Yes
Heavy Industrial		No	No	No	No
Light Industrial		Yes	No	No	No
Auto-related		Yes	Yes	Yes	Yes
Institutional		Yes	Yes	Yes	Yes
[redacted]					
Parking (off street)		Yes	Yes	Yes	Yes
Personal Services		Yes	Yes	Yes	Yes
Business Services		Yes	Yes	Yes	Yes
Food Services		Yes	Yes	Yes	Yes
Other		No	Yes	No	No
Grain:					
[redacted]					
Fine Only	(surveyor judgement)	Yes	Yes	No	No
Mixed	(surveyor judgement)	No	No	Yes	No
Services:					
Restaurants/Cafes		Yes	Yes	Yes	Yes
Groceries		Yes	Yes	Yes	Yes
[redacted]					
Banks/ATMs		Yes	Yes	Yes	Yes
[redacted]					
Dry Cleaning/Laundry		Yes	Yes	Yes	Yes
Drug Stores		Yes	Yes	Yes	Yes
Entertainment (Movie/Video)		Yes	Yes	Yes	Yes
Hair/Beauty Salons		Yes	Yes	Yes	Yes
Health Club/Dance		Yes	Yes	Yes	Yes
Copies		No	Yes	Yes	Yes
Post Office		No	Yes	Yes	Yes
Travel Agent		Yes	Yes	Yes	Yes
Parking Lot		Yes	Yes	Yes	Yes
[redacted]					
Other		Yes	Yes	No	No

*Data of note highlighted in gray

Table 4-7b. Summary Comparison of Urban Form Surveys in Case Study Site Areas*

[redacted]					
MAIN STREET CHARACTERISTICS (Shop. Area) **General Characteristics:**					
[redacted]	Minor Street				
	[redacted]				
	Freeway				
[redacted]					
	[redacted]				
	Other	Yes	Yes	Yes	Yes
Traffic Volumes	Light(<60 cars/hr)	No	No	No	No
(at 5 pm, midweek)	Medium(60-120 car/hr)	No	No	No	No
	Heavy (>120 cars/hr)	Yes	Yes	Yes	Yes
[redacted]					
	One Way	No	No	No	No
	Two Way	Yes	Yes	Yes	Yes
	[redacted]				
Public Transit	Bus Lines	Yes	Yes	Yes	Yes
	BART	Yes	No	Yes	Yes
	Other	No	No	No	No
[redacted]	Quiet (judgement)	No	No	No	No
	[redacted]				
	Fragmented(many breaks)	Yes	No	No	Yes
	[redacted]				
[redacted]	Open	Yes	Yes	Yes	Yes
	Fenced	No	Yes	No	No
	[redacted]				
Signage-For Parcel Use	Small	Yes	Yes	Yes	Yes
	Large	No	No	Yes	Yes
	Attached to Building	Yes	Yes	Yes	Yes
	Free-Standing	No	No	No	Yes
	Neon	No	No	No	Yes
Signage-Unrelated to Parcels	Billboards	Yes	No	No	No
	Graffiti	Yes	No	No	No
	Other	No	Yes	No	No
General Block Characteristics:					
[redacted]	Empty (no buildings)	No	No	No	No
	[redacted]				
	Block with Alley	No	No	Yes	No
	Mid-Block Connection	No	No	No	No
	Internal Public Way	No	No	No	No

* Data of note highlighted in gray

Table 4-7c. Summary Comparison of Urban Form Surveys in Case Study Site Areas*

[redacted]					
MAIN STREET CHARACTERISTICS: **General Building Characteristics:**					
[redacted]					
	[redacted]				
	High-rise (8+ stories)	No	No	No	No
Distinctive Arch. Style		No	No	No	No
[redacted]					
	Medium (judgement)	No	Yes	No	No
	High (judgment)	Yes	No	Yes	No
[redacted]	Stucco	Yes	Yes	Yes	[redacted]
	Glass	Yes	Yes	Yes	
	Brick	Yes	Yes	Yes	
	Concrete	Yes	Yes	Yes	
	Timber	Yes	Yes	No	
	Stone	No	No	Yes	
	Tile	No	Yes	Yes	
	Other	No	No	No	
[redacted]					
	Outward(face to street; open)	Yes	Yes	Yes	No
[redacted]					
	[redacted]				
Maintenance	Low (dirty,graffiti,decaying)	No	No	No	No
	Medium (some dirt,graffiti,etc.)	No	No	No	No
	High (clean, no graffiti, etc.)	Yes	Yes	Yes	Yes
Sidewalk Characteristics:					
Formal	(paved, concrete, brick)	Yes	Yes	Yes	Yes
[redacted]					
Pavement Type	Unpaved (dirt/gravel)	No	No	No	No
	Asphalt	No	No	No	No
	Concrete	Yes	Yes	Yes	Yes
	Brick/Tile/Stone	No	No	Yes	No
Maintenance Quality	Smooth Pavement	Yes	Yes	Yes	Yes
	Poor/Broken/Tilted	No	No	No	No
	Clean	Yes	Yes	Yes	Yes
	Littered	No	No	No	No
[redacted]					
	Arcades/Awnings	Yes	Yes	Yes	No
	Other	Yes	Yes	No	No
[redacted]					
	Kiosks	No	No	Yes	No
	Newspaper Boxes	Yes	Yes	Yes	Yes
	Mailboxes	Yes	Yes	Yes	Yes
	Public Phones	Yes	Yes	Yes	Yes
	Street Lighting	Yes	Yes	Yes	Yes

* Data of note highlighted in gray

Table 4-7d. Summary Comparison of Urban Form Surveys in Case Study Site Areas*

[redacted]					
MAIN STREET CHARACTERISTICS:					
Pedestrian Characteristics:					
Any Pedestrian Activity		Yes	Yes	Yes	Yes
[redacted]	Businesspeople	Yes	Yes	Yes	Yes
	[redacted]				
	Shoppers	Yes	Yes	Yes	Yes
[redacted]	[redacted]				
	Varies by Time of Day	Yes	Yes	Yes	Yes
Landscaping Quality:					
[redacted]	Deciduous	Yes	Yes	Yes	Yes
[redacted]	[redacted]				
	Medium (8-20 ft. tall)	Yes	Yes	Yes	Yes
	[redacted]				
[redacted]	Minimal (<30%)	No	No	No	No
	Moderate (30-60%)	Yes	No	No	Yes
[redacted]	[redacted]				
	Interrupted (irregular spacing)	Yes	Yes	Yes	Yes
	Uniform (regular spacing)	No	No	No	No

* Data of note highlighted in gray

** Pedestrian Activity Level" was determined through actual pedestrian counts, presented in Table 4-8.

Table 4-7e. Summary Comparison of Urban Form Surveys in Case Study Site Areas*

[redacted]					
RESIDENTIAL STREET CHARACTERISTICS					
General Characteristics:					
Street Type	Minor Street	Yes	Yes	Yes	Yes
	Collector				
	Arterial				
	Freeway				
[redacted]	Median	No	No	No	No
	[redacted]				
	Other	No	No	No	No
[redacted]	Light(<60 cars/hr)	Yes	Yes	Yes	No
(at 5 pm, midweek)	[redacted]				
	Heavy (>120 cars/hr)	No	No	No	No
[redacted]					
	One Way	No	No	No	No
	Two Way	Yes	Yes	Yes	Yes
	[redacted]				
	Special Turn Lanes	No	No	No	No
Public Transit	Bus Lines	No	No	No	No
	BART	No	No	No	No
	Other	No	No	No	No
Noise	Quiet (judgement)	No	Yes	Yes	Yes
	Moderate (judgment)	Yes	No	No	No
	Loud (judgment)	No	No	No	No
[redacted]	Buildings Set Back	Yes	Yes	Yes	Yes
	Vacant Lots	No	No	No	No
	[redacted]				
[redacted]	Continuous (few breaks)	No	No	No	No
	Fragmented (many breaks)	Yes	Yes	Yes	Yes
	[redacted]				
	Blank Wall	No	No	No	No
[redacted]	[redacted]				
[redacted]	Small	No	No	Yes	No
	Large	No	No	No	Yes
	[redacted]				
	Free-Standing	No	No	No	No
	Neon	No	No	No	No
Signage-Unrelated to Parcels	Billboards	No	No	No	No
	Graffiti	No	No	No	No
	Other	No	No	No	No

* Data of note highlighted in gray

Table 4-71. Summary Comparison of Urban Form Surveys in Case Study Site Areas*

[redacted]					
RESIDENTIAL STREET CHARACTERISTICS					
Sidewalk Characteristics:					
Formal	(paved, concrete, brick - not dirt)	Yes	Yes	Yes	Yes
Avg. Width (ft)		10	10	10	10
Pavement Type	Unpaved (dirt/gravel)	No	No	No	No
	Asphalt	No	No	No	No
	Concrete	Yes	Yes	Yes	Yes
	Brick/Tile/Stone	No	No	No	No
Maintenance Quality	Smooth Pavement	Yes	Yes	Yes	Yes
	Poor/Broken/Tilted	No	No	No	No
	Clean	Yes	Yes	Yes	Yes
	Littered	No	No	No	No
Sidewalk Zones	Tree/Shrub/Etc. Strip	Yes	Yes	Yes	Yes
	Arcades/Awnings	No	No	No	No
	Other	No	No	No	No
Street Furniture	Benches	No	No	Yes	No
	Kiosks	No	No	No	No
	Newspaper Boxes	No	No	No	No
	Mailboxes	Yes	Yes	Yes	Yes
	Public Phones	No	No	No	No
	Street Lighting	Yes	Yes	Yes	Yes
Pedestrian Characteristics:					
[redacted]					
Pedestrian Characteristics	Businesspeople	Yes	No	No	No
	Blue-Collar/Labor	Yes	No	No	No
	Shoppers	No	No	No	No
	Street People	No	No	No	No
	Other	Yes	Yes	No	No
[redacted]					
	Static	No	No	No	No
	Concentrated	No	No	No	No
	Scattered	Yes	Yes	Yes	Yes
	[redacted]				

* Data of note highlighted in gray

Table 4-7g. Summary Comparison of Urban Form Surveys in Case Study Site Areas*

[redacted]					
RESIDENTIAL STREET CHARACTERISTICS					
Landscaping Quality:					
Trees	Deciduous	Yes	Yes	Yes	Yes
	Leafy	Yes	Yes	Yes	Yes
[redacted]					
	Average (1 tree/20-30 feet)	Yes	No	No	No
	Dense (1 tree/20 ft. or less)	No	Yes	Yes	No
	Interrupted (irregular spacing)	No	No	Yes	Yes
	Uniform (regular spacing)	Yes	Yes	No	No
Tree Size	Small (<8 ft. tall)	Yes	Yes	No	Yes
	Medium (8-20 ft. tall)	Yes	Yes	Yes	Yes
	Large (>20 ft. tall)	Yes	Yes	Yes	No
[redacted]					
	Moderate (30-60%)	Yes	No	No	Yes
	Heavy (>60%)	No	Yes	Yes	No
[redacted]					
	Interrupted (irregular spacing)	Yes	Yes	Yes	Yes
	Uniform (regular spacing)	No	No	No	No

* Data of note highlighted in gray

Pedestrian counts were conducted in each of the four neighborhood centers to determine actual pedestrian activity levels in the shopping areas, and to determine a ranking for the neighborhoods site areas with respect to pedestrian activity (Table 4-8). The pedestrian counts were conducted on both weekdays (Tuesday, Wednesday, or Thursday), and on weekends (Saturday). Official counts were taken at both mid-day (noon to one o'clock), and late afternoon (four to five o'clock). In addition, repeated site visits to each neighborhood center over the course of the research, were used to supplement and confirm the trends described by the actual count data.

Table 4-8. Actual Pedestrian Counts in Neighborhood Shopping Centers*

Rockridge (College Ave/Shafter Ave)	61	39	50	High
Albany (Solano Ave/Colusa Ave)	30	18	24	High
Walnut Creek (N. Main St/Mt Diablo Blvd)	45	22	34	High
Fremont (Mowry Ave/Fremont Blvd)	6	1	4	Low

* Figures are the number of pedestrians crossing a line on the sidewalk over a 5-minute period. "Highest" count is the highest figure recorded over all count days/times; "Lowest" count is the lowest figure recorded over all count days/times. "Average" is (Highest+Lowest)/2.

** Low= <10 pedestrians/5 mins., Med= 10 to 20 pedestrians/5 mins., High= 20 (or +) pedestrians/5 mins

The pedestrian counts indicate that within the neighborhood shopping cores, pedestrian activity levels are high for Rockridge, Albany/North Berkeley, and more surprisingly, Walnut Creek, with average pedestrian counts of 50 pedestrians per five-minute period, 24, and 34, respectively for the three neighborhoods. By contrast, Fremont pedestrian counts were extremely low, at an average of 4 pedestrians per five-minute period. These pedestrian count results will be discussed more fully in the detailed site area analysis that follows, and in Chapter Five.

Rockridge

The Rockridge "site area" encompasses a mixed-use core, surrounded by predominantly residential streets, possessing a moderately dense mix of single-family and multi-unit housing. The site area is bounded by the intersection of Claremont and College Avenues to the north, Broadway and College Avenues to the south, Broadway to the east, and Claremont and Pleasant Valley Avenues to the west and southwest. On the main street, College Avenue, land uses are both horizontally and vertically mixed, with small retail businesses (including restaurants) predominating. There is a wide variety of services and land use types present within a very small area, providing numerous destinations in close proximity to each other. The land use mix is predominantly fine-grained.

Figure 4-6. Horizontal and Vertical Mixing of Land Uses in Rockridge

The main street, College Avenue, is a two-way collector-type street, with one through lane in each direction, and on-street parallel parking. There are additional turn lanes at only a few intersections. There is no median strip, and intersections are signalized, with crosswalks, nearly every two or three blocks. The street is approximately 44 feet wide from curb to curb, and formal sidewalks are present everywhere. Traffic levels are high at nearly all times of day, although traffic speeds are slow due to the relatively narrow street configuration. There is a BART station directly in the center of the area, and there are bus stops every two blocks or so, with a mini bus "hub" located under the BART station on College Avenue. Noise levels are moderate. Most buildings have no setback from the sidewalk edge, and the overall block density is fully built out. Blocks are of average length, bisected by residential side streets at regular intervals.

Figure 4-7. Rockridge Site Area Streetform

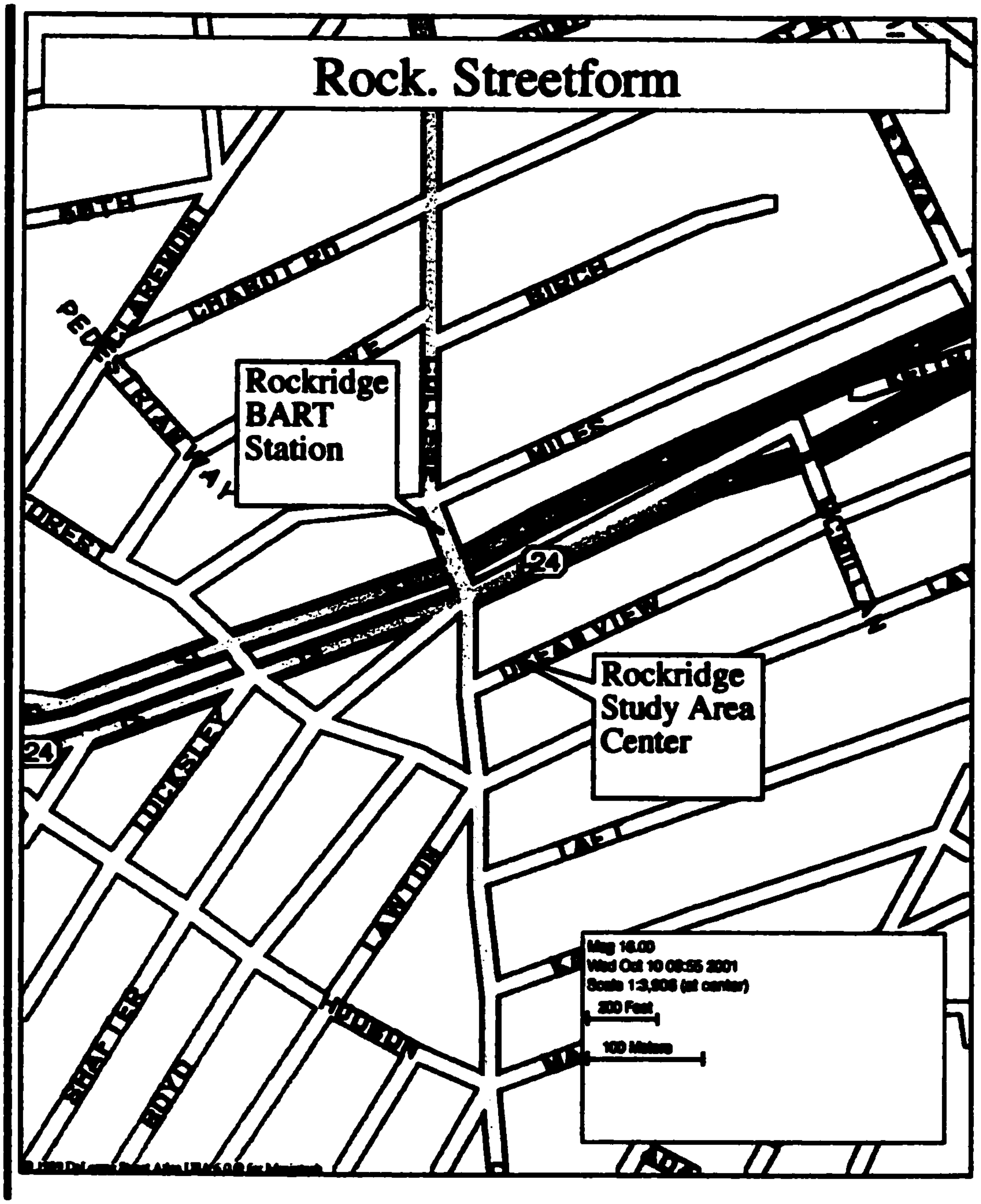


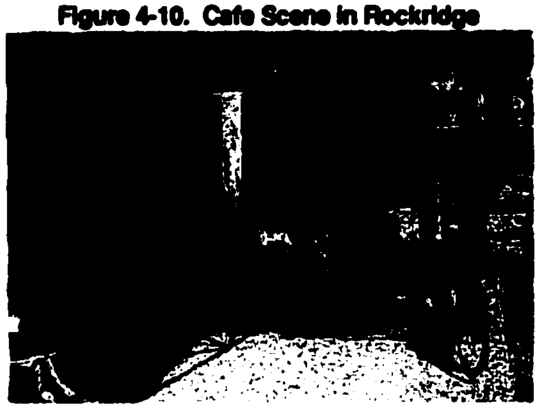
Figure 4-8. Street and Sidewalk Form in Rockridge

The building types are predominantly low-rise (one to two stories), although there are occasional three-story structures present. The architectural style is highly varied, and uses a wide array of building materials. Buildings are very transparent, with large or numerous windows, and a distinctly "open" feel that is oriented towards the sidewalks and street. While the streetwall is not completely continuous, it is small-scaled, and is both aesthetically pleasing and visually stimulating. There is small signage associated with particular stores and businesses, which is generally parallel to the face of the building itself. Overall street maintenance is good, with clean sidewalks and relatively well-maintained landscaping.

Figure 4-9. Typical Storefront Details in Rockridge

The sidewalks on College Avenue are standard at roughly ten feet wide, with some areas expanding to 14 feet wide, allowing room for both pedestrians and café furniture, which is present outside a number of food businesses (Figure 4-10). While public street furniture (e.g. public benches, seating areas) is very limited, the high number of cafes and associated tables and chairs leads to a lively sidewalk scene, particularly outside of such spaces as Market Hall (at College and Shafter Avenues). Pedestrian activity levels are high, and while they vary somewhat over the course of the day, there is always a dynamic pedestrian scene, with a variety of shoppers, commuters, parents-and-babies, and numerous people simply "hanging out" at the cafes.

Figure 4-10. Cafe Scene in Rockridge



While the architectural quality of the neighborhood center is high, the landscape quality along College Avenue is only average. Trees are of mixed sizes with large variations in leafiness, leading to the impression that there are areas of sparse coverage, even though tree spacing is technically uniform. There are no sections along College Avenue where there is any "canopy effect" at all. Moreover, the lack of building setbacks on College Avenue results in very few "garden" areas, and the street does not have a full tree or shrub planting strip. Therefore vegetation other than trees is minimal. There are no local parks in the site area vicinity.

The residential streets in the site area are nearly all minor streets, with a mixture of single-family residences and multi-unit homes. Average street width from curb to curb is slightly less than the main streets, at approximately 38 feet; several residential streets are noticeably narrower, at about 28 feet wide. Traffic levels are generally low, although streets such as Shafter Avenue (which is used to connect between the highway and College Avenue) display moderate traffic volumes at peak commute hours. Parcel sizes are relatively small, averaging around 0.10 acres each, and the architecture is again varied and attractive, with a wide variety of building materials and styles. Houses are all one or two-stories, and are set back between 15 and 20 feet from the sidewalk. In contrast to College Avenue, landscape quality on the residential streets is high, with many attractive, varied gardens, and mature trees lining most of the streets. All streets have formal sidewalks of roughly ten feet in width. Pedestrian activity levels are low to moderate, depending on the time of day; peak commute hours, and the evening dining hours see a distinct rise in pedestrian (and bicycle) activity on the streets surrounding College Avenue.

Figure 4-11. Typical Residential Street Form in Rockridge

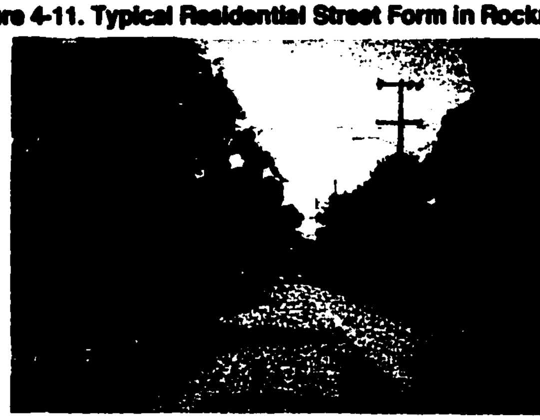


Figure 4-12. Residential Housing Examples in Rockridge

Albany/North Berkeley

The Albany/North Berkeley "site area" encompasses a mixed-use core along the eastern half of Solano Avenue (between Curtis Street to the west, and The Alameda to the east), surrounded by residential streets possessing a moderately dense selection of primarily single-family housing. On the main street, Solano Avenue, land uses are both horizontally and vertically mixed (although there are a large number of single-story buildings in the area), with small retail businesses (including restaurants) and small offices predominating. There is a fairly wide variety of services and land use types present within a one-quarter mile length of Solano Avenue, providing numerous destinations in close proximity to each other. The land use mix is predominantly fine-grained.

Figure 4-13. Typical Land Use Mix Along Solano Avenue

The main street, Solano Avenue, is a two-way collector-type street, with one through lane in each direction, and on-street diagonal parking. There are no additional turn lanes at intersections. There is no median strip, and intersections are signalized, with crosswalks, nearly every three or four blocks. The street is approximately 58 feet wide from curb to curb, and formal sidewalks are present everywhere. The diagonal parking extends twelve feet into the street on each side, resulting in a total through-lane width (both directions) of roughly 34 feet. Many of the crosswalks use a "pinch point" mechanism; the sidewalk widens into the main street at the crossing area, so that the actual crossing distance is 30 feet, not 58 feet.

Traffic levels are moderate to high at nearly all times of day, although traffic speeds are slow due to the relatively narrow street configuration. The closest BART station is approximately one mile south of this core area (the North Berkeley BART station). However, Alameda County Transit runs frequent, steady bus services through this area, including its main line, the #51 bus, which acts as a major link from Oakland to El Cerrito. There are bus stops every two blocks or so, with benches at some of these. Noise levels are moderate. Most buildings have no setback from the sidewalk edge, and the overall block density is fully built out. Blocks are of average length, bisected by residential side streets at regular intervals.

Figure 4-14. Albany/North Berkeley Site Area Streetform

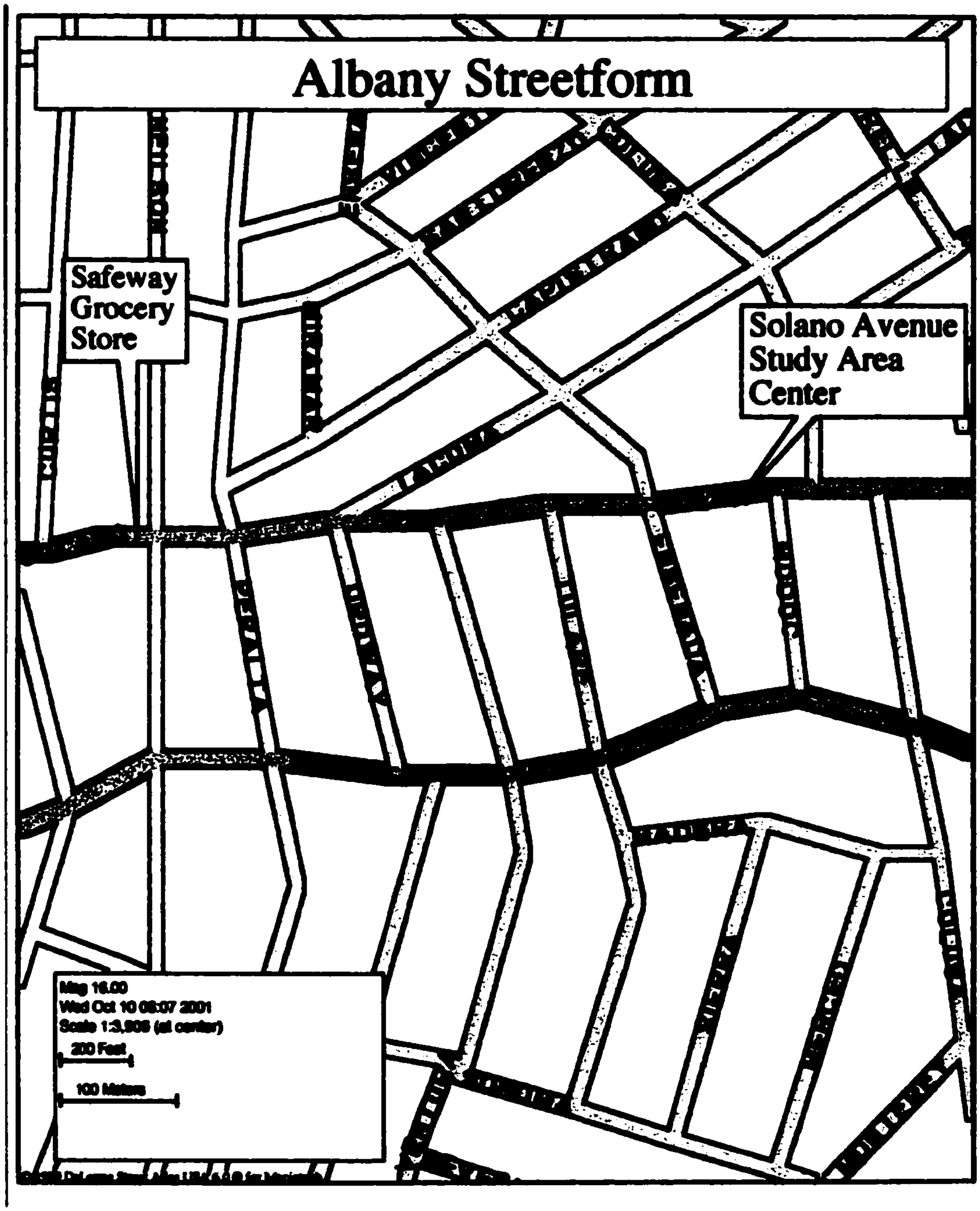


Figure 4-15. Street and Sidewalk Form Along Solano Avenue

The building types are predominantly low-rise (one to two stories), although there are occasional three-story structures present. The architectural style is varied, although not particularly striking for beauty or special design features. Buildings along Solano Avenue tend towards more contemporary styles, and use materials such as stucco, concrete, and glass. Retail buildings are very transparent, with large or numerous windows, and a distinctly "open" feel that is oriented towards the sidewalks and street. Small office buildings range from two to three stories, and also display varied architectural styles and materials. While the streetwall is not completely continuous, it is small-scaled. There is small signage associated with particular stores and businesses, which varies from being parallel to the face of the building itself, or perpendicular to it. Overall street maintenance is good, with clean sidewalks and relatively well maintained landscaping.

Figure 4-16. Typical Storefronts on Solano Avnue

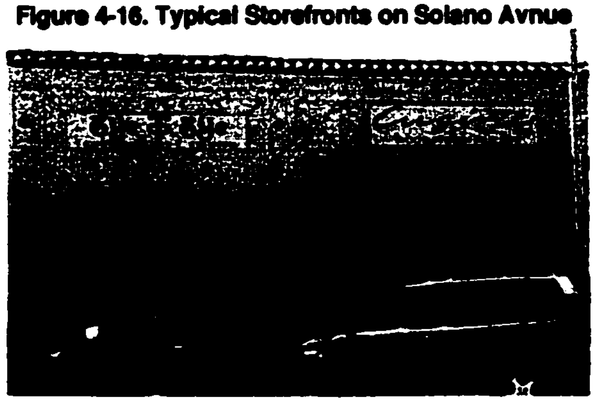


Figure 4-17. Small Office Space on Solano Avenue

The sidewalks on Solano Avenue are of average width at roughly ten feet, with room for both pedestrians and minimal street furniture. Public street furniture (e.g. public benches, seating areas) is very limited, and only a small scattering of restaurants and cafes have outdoor seating. Pedestrian activity levels are concentrated at several nodes along Solano Avenue (e.g. Solano and Colusa Avenue intersection), and are moderate to high in these areas all day long. Pedestrians display a wide range of characteristics, from shoppers, to parents with children, to junior high and high school students, to local businesspeople. There is a strong family presence within the pedestrian scene, with a constant flow of people using the neighborhood restaurants, the Oaks movie theater, and the bookstores along the streets.

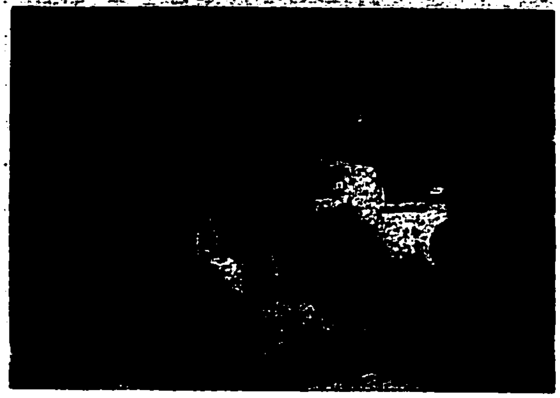
Figure 4-18. Sidewalk on Solano Avenue

The landscape quality along Solano Avenue is mixed, ranging from low in some areas (such as the eastern end of Solano Avenue) to medium (around Solano and Tulare Avenues). Trees are not uniformly distributed, and are of mixed sizes with large variations in leafiness. As a result, there are sections of Solano Avenue that appear to be nearly absent of vegetation, while other sections have a true tree canopy. The lack of building setbacks on Solano Avenue results in very few "garden" areas, and the street does not have a full tree or shrub planting strip. Therefore vegetation other than trees is minimal. There are no local parks in the site area vicinity.

The residential streets in the site area are nearly all minor streets, comprised predominantly of single-family residences. Average street width is 38 feet, curb to curb, although the narrowest streets measure only 24 feet wide, with barely enough room for two cars to pass if cars are parked on both sides. The quality of these narrower streets is very intimate, feeling more like a village "lane" than a full street. Traffic levels are generally low, although streets such as The Alameda and Colusa Avenue (which are used as connectors between central Berkeley and El Cerrito) display high traffic volumes at peak commute hours. Parcel sizes are relatively small, averaging around 0.10 acres each, and the architecture is varied and attractive, with a fairly wide variety of building materials and styles. Houses are all one or two-stories, and are set back between 15 and 20 feet from the sidewalk. In contrast to Solano Avenue, landscape quality on the residential streets is high, with many attractive, varied gardens, and mature trees lining most of the streets. All streets have formal sidewalks of roughly ten feet in width. Pedestrian activity levels are low to moderate, depending on the time of day. As with the Rockridge area, peak commute hours and the evening dining hours see a distinct rise in pedestrian activity on the residential streets surrounding Solano Avenue.

Figure 4-19. Residential Street Form in Albany/North Berkeley Site Area

Figure 4-20. Residential Housing Examples In Albany/North Berkeley Site Area



Walnut Creek

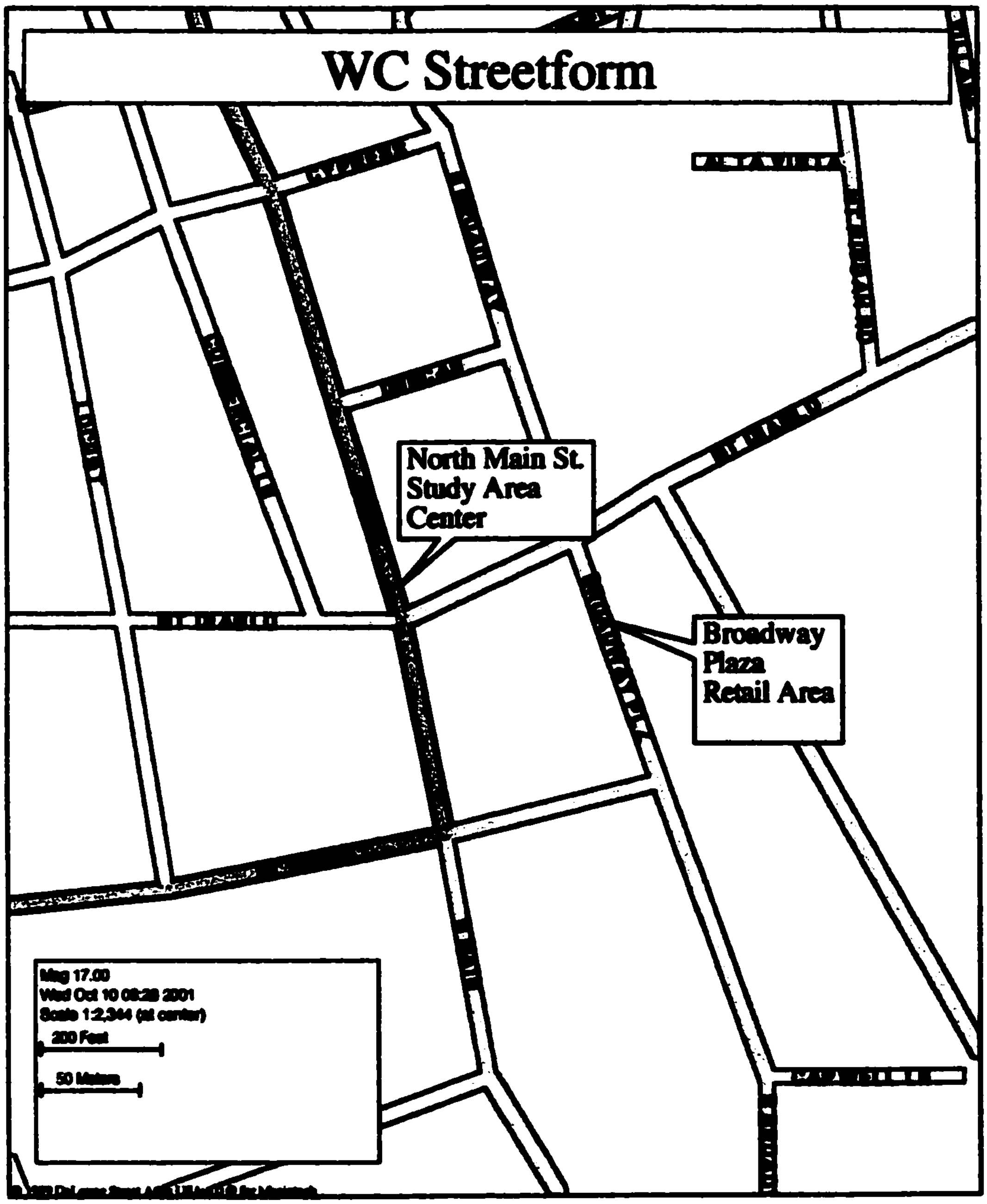
The Walnut Creek "site area" encompasses a mixed-use downtown core, surrounded by a mix of arterial and residential streets, possessing retail, office, and single and multi-family residences. The downtown core area (bounded by Cypress Street to the north, Broadway on the east, Newell Avenue to the south, and Main Street to the west) is comprised of both smaller streets and larger arterials running through this area. On the smaller streets (e.g. Main Street and Broadway Plaza), land uses are primarily horizontally mixed, with small and large upscale retail businesses (including restaurants) predominating. There is a wide variety of services and land use types present within this core area, providing numerous destinations in close proximity to each other. The land use mix ranges from fine-grained (smaller boutique businesses) to larger-scale (Macy's, Restoration Hardware, etc.), although design features of the streetscape minimize the massing effect of the larger buildings.

There are three "main" streets anchoring the downtown core: Broadway Plaza, Main Street, and Mt. Diablo Boulevard. Broadway Plaza is a two-way minor street, with one through lane in each direction, and on-street parallel parking. There is no median strip, and there are crosswalks nearly every one hundred feet. The street is only about two blocks in total length, and acts primarily as an outdoor plaza street for the many retail businesses lining its length. The street is approximately 48 feet wide from curb to curb, and formal sidewalks are present everywhere. Traffic levels are low to moderate at nearly all times of day, and traffic speeds are slow due to the relatively narrow street configuration and the numerous crosswalks with steady pedestrian traffic. There are bus stops at several of the major retail points. Noise levels are moderate. Most buildings have no setback from the sidewalk edge, and the overall block density is fully built out.

Figure 4-21. Broadway Plaza Street Form

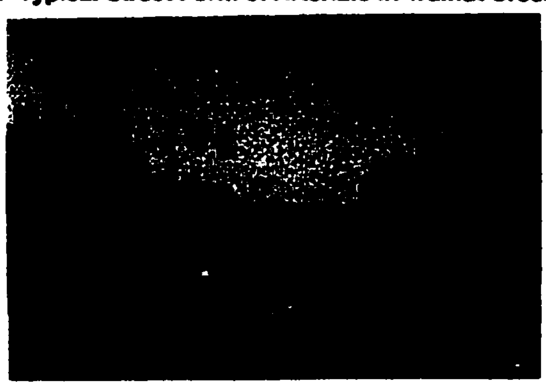
Main Street is a two way collector-type street, with one through lane in each direction, and on-street parallel parking. There are additional turning lanes at several of the major intersections (e.g. Main Street and Mt. Diablo Boulevard). There is no median strip, and there are crosswalks at every intersection, as well as several mid-block crosswalks. The street is approximately 40 feet wide from curb to curb, and formal sidewalks are present everywhere. Traffic levels are moderate to high at nearly all times of day, although traffic speeds are slow due to the relatively narrow street configuration and high traffic levels. Noise levels are moderate. Most buildings have no setback from the sidewalk edge, and the overall block density is fully built out.

Figure 4-22. Walnut Creek Site Area Streetform



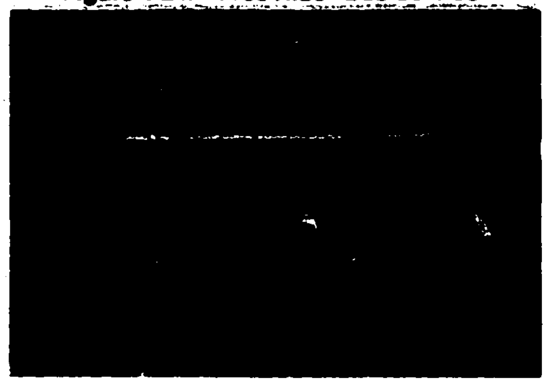
Mount Diablo Boulevard, which crosses both Broadway Plaza and Main Street, is a major arterial linking Highway 680 and Route 24 to the eastern portions of Walnut Creek. It is two through lanes in each direction, with additional on-street parallel parking, and turning lanes at all major intersections. There are no median strips, but instead painted median areas or turning lanes. Some sections of Mount Diablo Boulevard possess a turning lane that exists for the full block length; others do not. In the core downtown area, between Main Street and Broadway, the street character changes, with two through lanes in each direction and no on-street parking. At this section, there is a full, landscaped median strip and mid-block crosswalks. At its widest sections, the street is approximately 60 feet wide from curb to curb. In its narrowest section (between Main and Broadway), the street is 40 feet wide from curb to curb. Formal sidewalks are present everywhere.

Figure 4-23. Typical Street Form of Arterials in Walnut Creek Site Area



The Walnut Creek BART station is approximately one-half mile northwest of this core area, and acts as a major transit line for commuters working in San Francisco and Oakland. There are several bus lines that run through the downtown area, operated by The County Connection; service is moderately frequent, with buses running approximately every fifteen minutes. There is a free bus service ("Free Ride") offered in the downtown core area, to serve shoppers, visitors, and businesspeople.

Figure 4-24. "Free Ride" Bus Service



The building types in the site area generally range from one to four stories, although some of the larger office buildings are five or six stories high. The architectural style is somewhat varied, and heavily oriented towards more contemporary architectural styles, as well as towards new buildings with classic detailing (e.g. the Restoration Hardware/Pottery Barn/Eddie Bauer complex on Mount Diablo Boulevard). Building materials are varied, and range from wood to brick to stucco and concrete. Buildings along the smaller streets (Main and Broadway) are very transparent, with large or numerous windows, and a distinctly "open" feel that is oriented towards the sidewalks and street. The only exceptions to these styles are the Nordstrom's and Macy's buildings on Broadway Plaza. The streetwall is primarily continuous, but broken up by occasional alleyways or open plazas. Again, on the smaller streets, buildings are small-scaled, and aesthetically pleasing, if not exactly exciting. There is small signage associated with particular stores and businesses, which is generally parallel to the face of the building itself. Overall street maintenance is high, with clean sidewalks and well-maintained landscaping.

Figure 4-25. Storefront Architecture on Main Street

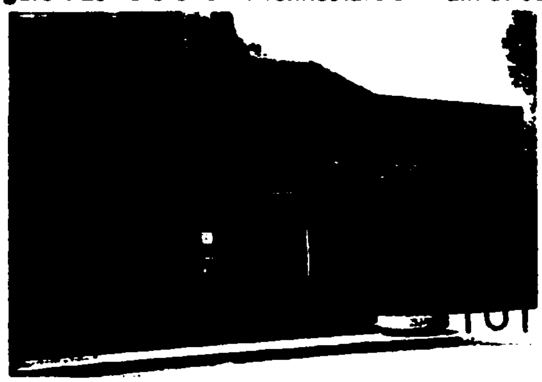
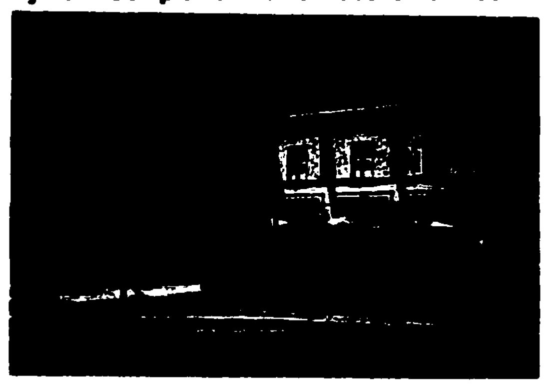


Figure 4-26. Pottery Barn Complex on Narrow Section of Mount Diablo Boulevard



By contrast, the larger arterials (Mount Diablo Boulevard, California Boulevard) show a predominance of the stereotypically monolithic, featureless contemporary buildings attributed to many modern cities. Building and streetwall scale is much larger, with five and six-story office structures, and large, boxy franchise stores set back behind large surface parking lots. Architectural styles are contemporary, with a predominance of glass and concrete building materials.

Figure 4-27. Large Office Building Example on California Boulevard

The sidewalks on all streets are at least ten feet wide. Again, however, there is a large contrast between the design and use of the sidewalks on the smaller streets, as compared to the large arterials. On Main Street and Broadway Plaza, the sidewalks are often expansive (up to twenty feet wide), with ample room for café furniture, public seating, landscaping, and more. In many areas, the sidewalks meld into larger pedestrian plazas with flowers, fountains, and the like. On these smaller streets, street furniture is present everywhere, provided both by the city (benches, seating areas around fountains, etc.), as well as by private businesses (the Nordstrom's sidewalk café, Oakville Grocery café, etc.). There is constant activity along the sidewalks and plazas, ranging from people eating lunch and dinner outdoors, to parents with children and strollers playing at the fountains, to shoppers sitting to take a break from their purchasing. The large fountain and plaza on Broadway Plaza seems to be a particular attractant for a wide range of individuals and groups, and is practically never empty across the course of weekdays and weekends alike. Pedestrian activity levels on these streets are high, and while they vary somewhat over the course of the day, there is always a lively, gregarious pedestrian scene.

Figure 4-28. Café Scene on Main Street

Figure 4-29. Family Playing at a Fountain on Broadway Plaza

By contrast, the sidewalk design on the large arterials surrounding the core downtown area is unremarkable, with minor landscaping, and few small retail businesses. The pedestrian scene is more sporadic, ranging from moderate to low pedestrian activity the further one moves from the downtown core. Street furniture is also sparse along the major arterials.

The landscape quality of the Walnut Creek downtown core area is high. Trees are of mixed sizes, but are leafy, and spaced both uniformly and close together. As a result, there are many pleasantly shaded street sections, particularly on the smaller streets where the effect of the trees is more noticeable due to the narrower street configuration. The large pedestrian plazas and wide sidewalks add more opportunities for landscaping and small gardens, which have been fully taken advantage of. Colorful flowers and potted plants are present everywhere. There is a small local park, and bike route, approximately one-quarter mile east of Broadway Plaza, as well as San Ramon Creek, which flows year-round.

Figure 4-30. Fountain Area at Broadway Plaza

Figure 4-31. Bike Route Along San Ramon Creek

The residential streets in the site area are a mix of minor streets and collector streets, with segregated areas of single-family detached residences and larger apartment complexes. Street widths average 40 feet from curb to curb, with some minor streets slightly narrower, while the collector-type streets are slightly wider. Traffic levels are on the minor streets are generally low, while several of the collector streets display moderate to high traffic volumes, particularly at peak commute hours. Parcel sizes for single-family homes are moderate, averaging around 0.5 acres each, while apartment and condominium complexes sit on larger parcels of one acre or more. The architecture is not technically uniform, but trends in a very similar direction for most homes. Single family residences are one to two stories high, with the "ranch" style predominating, and some variation in building materials. Multi-unit complexes are nearly all contemporary in style, with little detailing or unique features. Landscape quality on the residential streets is again high, with many attractive, varied gardens, and mature trees lining most of the streets. All streets have formal sidewalks of roughly ten feet in width. Pedestrian activity levels are low to moderate, depending on the time of day.

Figure 4-32. Typical Residential Street Form in Walnut Creek Site Area

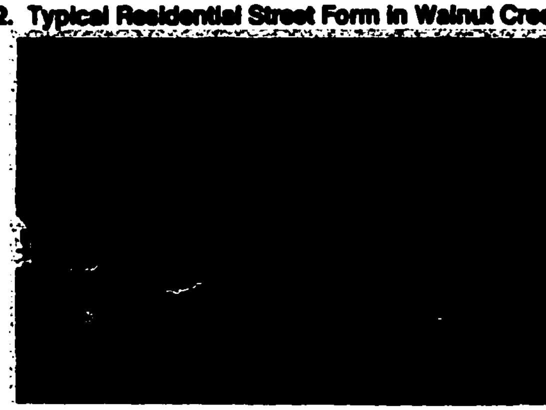
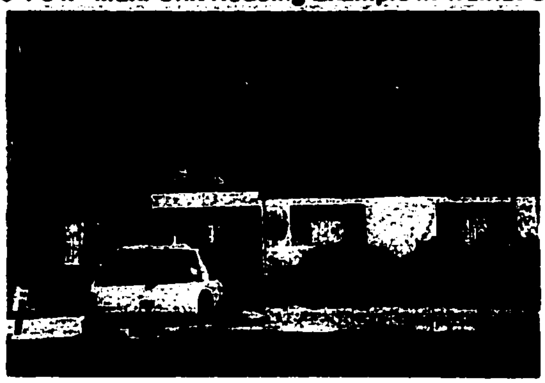


Figure 4-33. Single-Family Housing Example in Walnut Creek

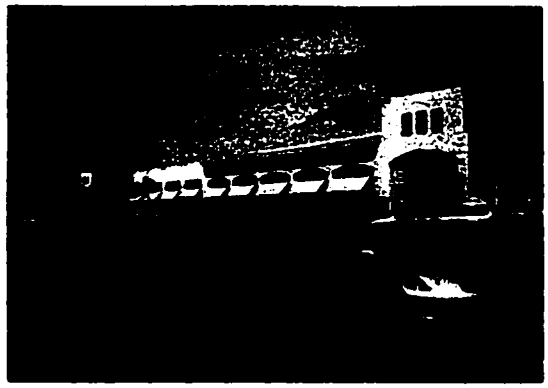
Figure 4-34. Multi-Unit Housing Example in Walnut Creek



Fremont

The Fremont "site area" encompasses a multiple-but-segregated use core (bounded by Mowry Avenue to the north, Paseo Padre Parkway to the east, Walnut Avenue to the south, and Fremont Boulevard to the west), surrounded by a mix of commercial and residential streets. The residential streets posses a moderate to low density mix of single-family and multi-unit housing. Along the main streets - Mowry Avenue, Fremont Boulevard, and Paseo Padre Parkway - land uses are horizontally mixed, with larger businesses (franchises), large offices, and large institutional facilities predominating. While there is a wide variety of services and land use types present within the core area, uses are segregated and fragmented. Notably, there are very few restaurants or cafes in evidence; of those that do exist, nearly all are fast-food franchises (e.g. McDonald's) or franchise restaurants (e.g. Chevy's). Many of the retail uses are confined to separated malls or "mini-mall" areas, which are set apart from the main streets. The land use mix is mainly coarse-grained.

Figure 4-35. Example of Mini-Mall Land Use in Fremont Site Area

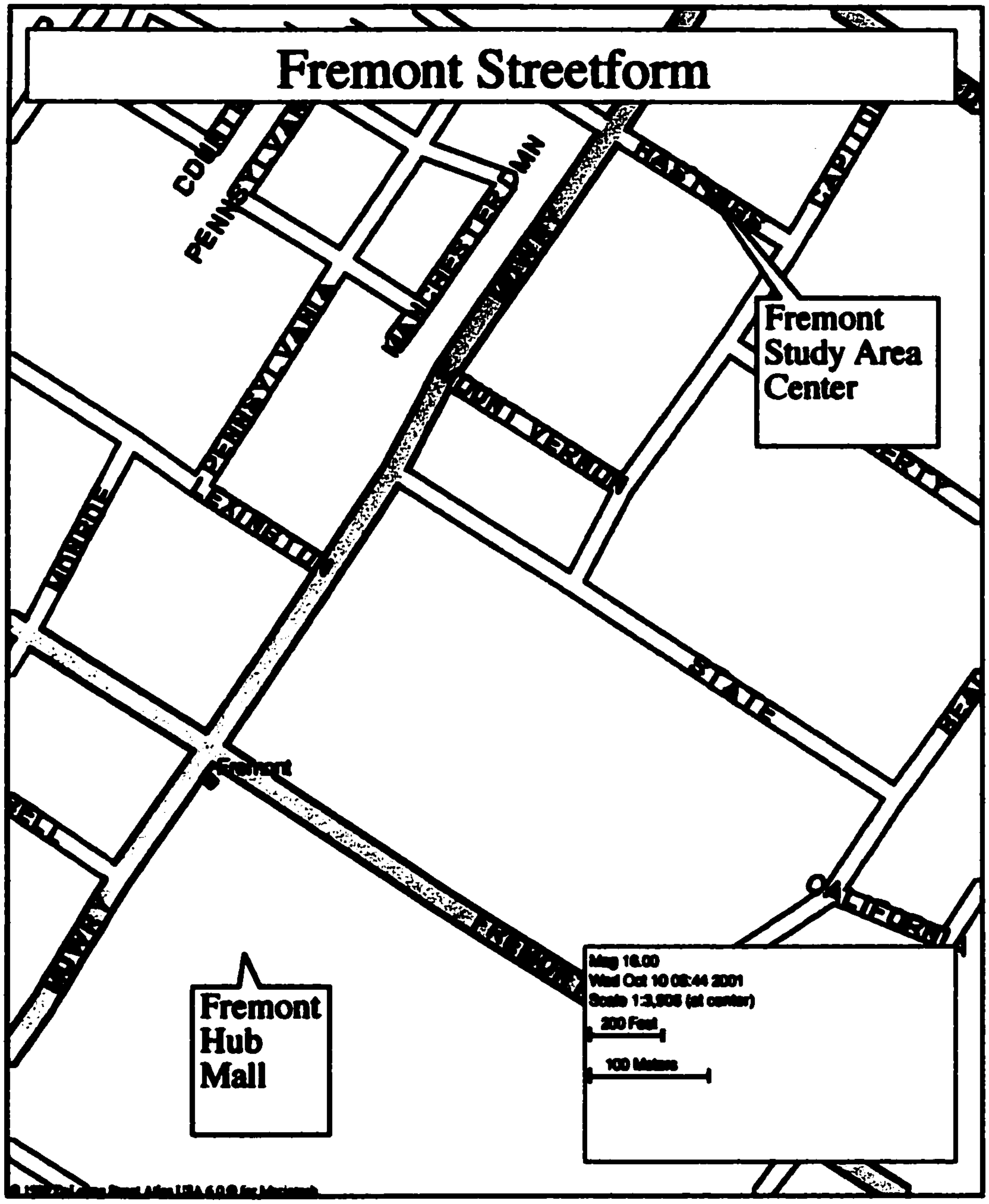


The main streets - Mowry Avenue, Fremont Boulevard, and Paseo Padre Parkway - are all two-way arterials, with at least three lanes in each direction, and no on-street parking. There are additional turn lanes at nearly every intersection. There are median strips on most of these streets, and intersections are signalized, with crosswalks, nearly every three or four blocks. These streets average approximately 74 feet wide from curb to curb, and formal sidewalks are present everywhere. Traffic levels are high at nearly all times of day, and traffic speeds are high (45 miles per hour and more), except at peak commute hours, when the sheer volume of traffic may slow speeds somewhat. There is a BART station within one-quarter mile of the site area core, at Civic Center Drive and BART Way, directly in the center of the area, with a major bus "hub" located at the BART station, providing connecting lines to Fremont and all neighboring cities. Noise levels are high. Buildings are generally set back from the sidewalk edge, usually with a surface parking lot in the intervening space. Overall block density is partially built out. Notably, block lengths are significantly larger than in the other case study neighborhoods (two to three times the average block length of those site areas), following the more common definition of "superblocks."

Figure 4-36. Arterial Street Form in Fremont Site Area

Figure 4-37. Typical Streetscape in Central Fremont

Figure 4-38. Fremont Site Area Streetform



The building types range from one-to-two story retail structures, to three-plus story large office and institutional structures. The architectural style is homogenous, and employs similar building materials throughout - mainly concrete, stucco, and glass. Buildings are not transparent, with few or no windows, and a distinctly "closed" or inward feel oriented away from the sidewalks and parking lots. The streetwall is very fragmented and large-scaled. There is little visual or aesthetic appeal to the streetwall and streetscapes in general. A striking feature of the Fremont site area is the presence of extensive surface parking lots around most buildings and structures. There is large signage associated with particular stores and businesses, which is generally parallel to the face of the building itself, or located on the entrance sign to the mini-mall or retail center. Overall street maintenance is good, with clean sidewalks and relatively well maintained landscaping.

Figure 4-39. Example of Surface Parking Lot in Fremont Site Area

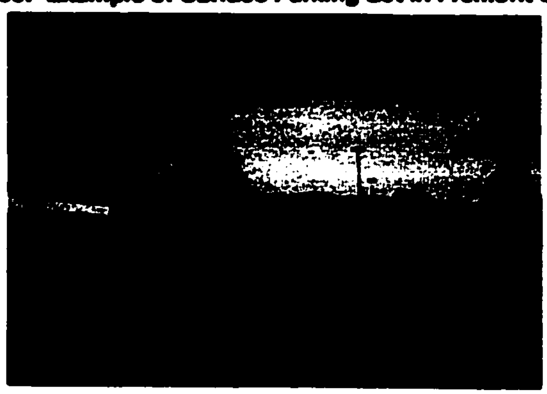


Figure 4-40. Retail Signage at Entrance to Hub Mall

The sidewalks on all of the main streets are standard at ten feet wide. There is virtually no street furniture on the main streets, and since most businesses are set back substantially from the street, there are no café tables, or private business seating areas visible anywhere. Within the mini-malls and retail centers, sidewalks and sidewalk space is variable, with some malls possessing distinct pedestrian walkways, and others limited to the bare minimum of sidewalk space along building entrances. Pedestrian activity levels are low, with no sense of pedestrian life or engagement. Even within the "pedestrian zones" of malls (such as the central Fremont Hub), pedestrian activity levels were negligible at peak lunch hour times weekdays, and minimal at peak commute hours.

Figure 4-41. Retail Building Examples in Fremont Hub Mall

Figure 4-42. Pedestrian Mall Area of Fremont Hub at Noon on a Weekday

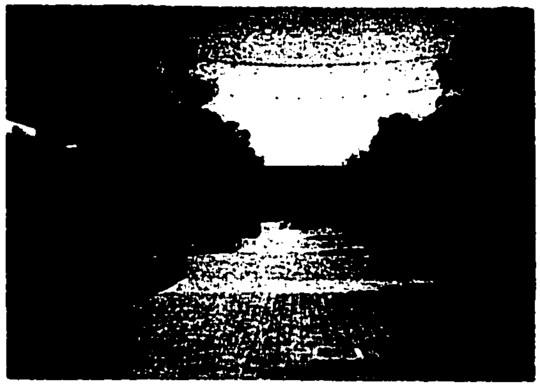


Figure 4-43. Fremont Hub Mall Pedestrian Crossing Through Parking Lot

The landscape quality along the main streets is low to moderate. Trees are often sparse, and of small to medium size, with minimal shading quality. The width of the streets exaggerates the spare landscaping feel. There are no sections any of the main streets where there is any "canopy effect" at all. The main streets do have a planting strip between the sidewalk and street, which is usually grass. There is no planting area on the median strips. Many of the surface parking lots are virtually absent of any vegetation, which again heightens the sense of lack of landscaping, even when small vegetated areas are present. In general, vegetation other than trees is minimal. Landscaping directly around the institutional buildings (hospitals, civic buildings, etc.) is of higher quality, but again separated by stretches of poorly landscaped streetscapes. There is a large, well-used public park (Fremont Central Park) within one mile of the central Fremont core area.

Figure 4-44. Typical Landscaping on Fremont Arterials

The residential streets in the site area are a mix of wide collector-type streets and minor streets, with a mixture of single-family residences and multi-unit homes. There are several residential streets that have no on-street parking. The residential streets are wide, at an average of 48 feet from curb to curb. Traffic levels are highly variable, depending on the particular location of the street, with some streets appearing to act as major throughways between arterials, while others are located outside of the central commute paths.

Figure 4-45. Residential Street in Fremont Site Area

Parcel sizes are moderate for single family residences, ranging from 0.25 to 0.5 acres each, while multi-unit complexes sit on much larger tracts and are generally separated into individual - mostly gated - apartment communities. The architecture is predominantly homogenous and unremarkable, although several of the newer, upscale townhouse complexes display more varied detailing and architectural style. Building materials tend towards stucco, concrete, and wood trims, with an overall trend towards contemporary architectural styles. Houses are generally one or two-stories, and are set back between 15 and 20 feet from the sidewalk. Multi-unit complexes are set back similarly, but are generally contained behind walled, or gated-in areas, and may range up to three or four stories high. Landscape quality on the residential streets is again variable, ranging from low to moderate, with some areas exhibiting well-maintained, albeit sparse, vegetation, while others are lacking in nearly any vegetation other than grass. All streets have formal sidewalks of roughly ten feet in width. Pedestrian activity levels are low or non-existent, no matter what time of day. Bicycle activity is low or non-existent as well.

Figure 4-46. Multi-Unit Apartment Housing Example in Fremont Site Area

Figure 4-47. Upscale Townhouses in Fremont Site Area

Analysis of Detailed Urban Form Among the Case Study Site Areas

Although the general environs urban form and demographic profiles of the four case study neighborhoods show many parallels and similarities between the study areas (as was required in selecting the case studies), analysis of the detailed urban form data highlights critical differences and contrasts among the four site areas. Given that the socio-demographic variables were held relatively constant across the four case studies, and that many of the surveyed urban form variables were also determined to be constant across the four case studies, the differences, or contrasts, in detailed urban form may indicate variables of particular importance in further correlations on impacts of neighborhood urban form on travel behavior and choices, as well as on general neighborhood livability within each case study.

The urban form data categories in which the greatest contrasts are seen among the case study site areas are: land use (including variables of distance, mix, and types); street characteristics (including variables of types, layout, design, streetwall quality, and sidewalk-built edge); block characteristics; building characteristics; sidewalk characteristics; pedestrian characteristics; and landscaping quality. Summaries of an analysis of the contrasting data categories and specific variable data are presented below in Tables 4-9, 4-10, and 4-11, along with discussions of these comparisons. These tables differ from the original urban form data tables (Tables 4-7a through 4-7g) in that not all variables are presented, only those which are contrasting across the four case studies. For example, for the data category, "land use types," there are a number of specific land use variables listed in the original data (Table 4-7a); however, "open space" and "light industrial" are the only land use type variables that are contrasting in their presence or absence across the four case studies. Therefore they are the only variables listed in the tables below.

General Land Use Contrasts

Overall, while land uses are technically "mixed" in all four case study site areas, there are clear differences in the quality, compactness, and degree of mixing. First, distances between land use types - and destinations in general - are lower in Rockridge, Albany/North Berkeley, and Walnut Creek (particularly in the downtown retail zone), than in Fremont. A variety of land uses are present in the first three neighborhoods within any one-to-two block area, as contrasted with Fremont, where any given mini-mall may present a set of uses, but traveling from one mall to the next involves stretches of at least one "superblock," if not more. Moreover, the central core of Fremont has segregated its multiple uses, so that institutional facilities are concentrated in one area, residential facilities in other areas, and retail businesses in yet another set of nodes, as opposed to true mixing of land uses.

Table 4-9. Summary of General Land Use Contrasting Urban Form Data

Land Use:					
Land Uses Close Together		Yes	Yes	Yes	No
Residential and Comm'l. Close		Yes	Yes	No	No
Building Types	Only Large	No	No	No	Yes
Land Use Mix:					
Mixed Use Areas	Vertical Mixing	Yes	Yes	No	No
Land Use Type:					
Light Industrial		Yes	No	No	No
Open Space		No	No	Yes	Yes
Grain:					
Coarse Only		No	No	No	Yes
Services:					
Specialty Foods		Yes	Yes	Yes	No
Parks/Open Space		No	No	Yes	Yes
Child Care		Yes	Yes	No	No
Parking Structure		No	No	Yes	Yes

Both Walnut Creek and Fremont exhibit less vertical mixing than Rockridge and Albany/North Berkeley, again detracting from a sense of the full mixing that one sees in the latter two neighborhoods. Walnut Creek has occasional examples of vertical mixing; for example one striking instance of a mixed use building in the downtown core, with retail on the first floor, and multi-unit housing on the upper floors. However, such examples are clearly very recent constructions, and far and few in between. Fremont simply does not have any examples of this type of vertical mixing in its central area, or in the greater general environs.

Equally notable, residential uses are generally separated from other uses (commercial, retail, institutional, etc.) by greater distances in Walnut Creek and Fremont, than in Rockridge and Albany/North Berkeley. Partially this is a result of the lack of vertical mixing noted above (Rockridge, for example, has upper-story housing and office units sitting above first-floor retail, all along its main street, College Avenue). However, it is also a function of absolute distance. Nearly all of Walnut Creek's "downtown" housing is located several blocks away from the downtown core. Fremont's residential housing areas are located next to retail areas (e.g. across from the Fremont Hub mall), but the superblock configuration in the Fremont area, and the presence of large surface parking lots may mean that walking distance to these residential areas is the equivalent of several regular blocks. In contrast, as noted above, Rockridge and Albany have numerous housing units directly on the main streets. Moreover, residential streets run directly off of these main streets, so that walking distances are less than a block, in many cases, from these main retail thoroughfares.

All four case studies exhibit a remarkably wide variety of land use types and services contained in their respective site areas, ranging from single and mulit-family residential to commercial to institutional, and so on. Moreover, the availability of services is extensive, ranging from restaurants to utilitarian businesses (dry cleaning, etc.) to hair and beauty salons to entertainment facilities. What is striking, then, is what is *lacking* in land use types and services in several of the case study site areas. Rockridge, despite its plethora of residential, retail and business attractions, lacks a hardware store - as does Albany/North Berkeley and Walnut Creek. Rockridge and Albany/North Berkeley also have no open space, or parks, within one-quarter mile of their core areas. Finally, neither of these site areas has a built parking structure (i.e. a multi-level structure, either underground or above ground), although Rockridge is currently constructing such a facility. Fremont, on the other hand, sports open space and parking structures (and surface lots) galore, but lacks specialty food services or independent cafes and restaurants. Moreover, it has virtually no outdoor dining services (e.g. outdoor cafes, restaurants, etc.).

The final striking contrast among the four case study areas is in the grain of land uses and mix. Only Fremont exhibits a consistent pattern of entirely coarse-grained buildings and land use mix. Rockridge, Albany/North Berkeley, and Walnut Creek all possess either a trend towards fine-grained land use mix, or at least a mix of coarse and fine-grained, leading to a greater variety of land uses in any given area.

Main Street Characteristics

The differences in urban form across the four case studies are highlighted in the characteristics of the main streets in the four site areas, and lead to an overall conclusion that Fremont is a true anomaly in the case study set, in terms of detailed urban form (Table 4-10). Thus the first part of this discussion will focus on Rockridge, Solano Avenue, and Walnut Creek, with a discussion of Fremont following.

In all but Fremont, the main street (or streets) of the core area are collector-type streets of 58 feet in width or less, with one through lane in each direction, and on-street parallel or diagonal parking. Walnut Creek has one main arterial (Mount Diablo Boulevard) running through the downtown core, but it narrows in absolute width in the core area, providing not only a visual signal that it is no longer a wide arterial, but also results in the practical effect of slowing traffic substantially in this zone. These street configurations lead to a relatively narrow street form, and to the perception of a more intimately scaled streetscape, even though the streets may carry high volumes of traffic. Moreover, on streets with the single through lane configuration, frequent signalized intersections and crosswalks, and cars pulling in and out of on-street parking spaces, traffic speeds are almost guaranteed to remain slow (20 miles per hour or less), simply because so many vehicles are being forced through a narrow space.

Table 4-10. Summary of Main Streets' Contrasting Urban Form Data

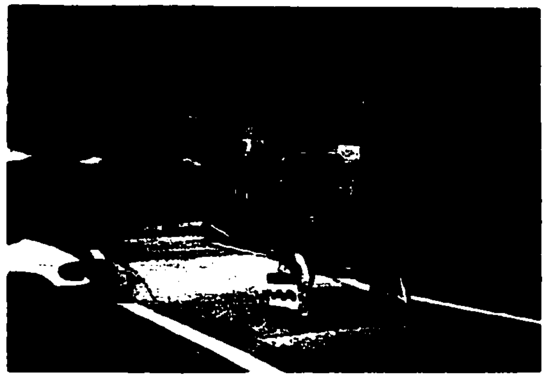
General Characteristics:					
Street Type	Collector	Yes	Yes	Yes	No
	Arterial	No	No	No	Yes
Design Features	Median	No	No	No	Yes
	On-Street Parking	Yes	Yes	Yes	No
Street Layout	Avg. Width (ft)	44	58	44	74
	Total # Through Lns	2	2	2	6
	Special Turn Lns	Yes	No	No	Yes
Sidewalk Edge-Built Edge	Buildings Set Back	No	No	No	Yes
	Vacant Lots	Yes	No	No	Yes
	Parking Along Sdwlk.	Yes	Yes	Yes	No
Streetwall Quality	Continuous	No	Yes	Yes	No
	Fragmented	Yes	No	No	Yes
	Transparent	Yes	Yes	Yes	No
	Blank Wall	No	No	No	Yes
	Monotonous	No	No	No	Yes
	Interesting	Yes	Yes	Yes	No
General Block Characteristics:					
Block Density	Partially Built	No	No	No	Yes
	Fully Built	Yes	Yes	Yes	No
Block Form	Superblock	No	No	No	Yes
General Building Characteristics:					
Size	Low-rise (1-2 stories)	Yes	Yes	Yes	Yes
	Med-rise (3-7 stories)	No	No	Yes	Yes
Overall Aesthetics	Poor	No	No	No	Yes
Orientation?	Inward	No	No	No	Yes
Scale	Small	Yes	Yes	Yes	No
	Medium	No	Yes	Yes	No
	Large	No	No	Yes	Yes
Sidewalk Characteristics:					
Avg. Width (ft.)		10	10	14	10
Sidewalk Zones	Tree/Shrub/Etc. Strip	Yes	No	Yes	Yes
Street Furniture	Benches	Yes	Yes	Yes	No
Pedestrianization Characteristics:					
Pedestrian Activity Level		High	Med	High	Low
Pedestrian Activity	Dynamic	Yes	Yes	Yes	No
	Static	No	No	No	Yes
	Concentrated	Yes	Yes	Yes	Yes
	Scattered	No	Yes	No	No
	Varies by Time of Day	Yes	Yes	Yes	Yes
Landscaping Quality:					
Trees	Leafy	Yes	Yes	Yes	No
Tree Spacing	Sparse	No	Yes	No	No
	Average	Yes	No	No	Yes
	Dense	No	No	Yes	No
	Interrupted	No	Yes	No	Yes
	Uniform	Yes	No	Yes	No
Tree Size	Small	Yes	Yes	No	No
	Large	Yes	No	Yes	No
Shade	Heavy (>60%)	No	Yes	Yes	No
Any Canopy Effect		No	No	Yes	No
Other Vegetation	Sparse	Yes	Yes	No	Yes
	Dense	No	No	Yes	No

The design features of the main streets in these three neighborhoods further emphasize their small-scale nature. Buildings are directly up against the sidewalk, in a nearly continuous configuration in all three site areas. Buildings are fine-grained and generally one to three stories in height, with the ground-level design always at a distinctly human scale. The architectural styles in all three site areas range from moderately pleasant to truly attractive, with Rockridge and Solano Avenue exhibiting a slightly older feel, while Walnut Creek possesses many new buildings with more traditional detailing. Storefronts are transparent and outward-oriented, drawing pedestrian traffic to look in to windows and enter. Signage on storefronts is often lively and colorful, with creative banners and illustrations, further increasing not only visual interaction between passers-by and the buildings, but encouraging human interaction and the experience of pedestrian sequences that Raymond Isaac's has discussed as well (Isaacs 1998).

Figure 4-48. Signage on Solano Avenue Storefront

While all of these main street design elements lead to an appearance of a more human-scaled environment in these three site areas - which presumably may encourage more human activity in these areas - there are a number of design features targeted specifically to pedestrians that further enhance this overall quality. Sidewalks - by themselves - are not the defining pedestrian feature; all *four* site areas (including Fremont) have formal sidewalks on all main streets, of at least ten feet in width. However, the presence or absence of a number of additional features appears to determine how much these sidewalks are used. In the Rockridge, Albany/North Berkeley, and Walnut Creek shopping area centers, crosswalks are present at every block, and often mid-block as well. In Albany, on Solano Avenue, "pinch points" are used at many crosswalks, to narrow the street and decrease the pedestrian crossing distances. In Walnut Creek, the downtown core crosswalks are paved with brick, to strengthen the pedestrian sense and visual impact of this amenity. In several instances, the crosswalks are signalized specifically for pedestrian traffic - i.e. there is no traffic light, but instead the crosswalk lights up immediately after a pedestrian pushes the crosswalk button, and flashing lights embedded in the street signal all vehicles to stop. It is striking that one of these types of crosswalks has been located directly on Mount Diablo Boulevard - the major downtown arterial and thoroughfare - in addition to the signalized intersections that already exist. The message is clear: in this zone, pedestrians come first.

Figure 4-49. Traffic Stopped for Pedestrians Crossing Arterial in Walnut Creek



Other pedestrian amenities, such as street furniture and attractive landscaping, also distinguish the main streets of these three neighborhoods (although Solano Avenue less successfully so than Rockridge and Walnut Creek). Rockridge sidewalks, while lacking somewhat in extensive public street furniture, offer numerous outdoor seating areas provided by the private businesses lining College Avenue. There is almost no time of day (or evening) that these seating areas are not being used; they are gathering points for shoppers, diners, students, businesspeople, and parents, both at odd hours during the day, and at peak dining hours such as lunch and dinner. Even further along the spectrum, Walnut Creek simply overflows with street furniture, seating areas, and little pedestrian plazas. It is nearly impossible to venture through the downtown core without taking advantage of an attractive bench near a fountain, or resting on a wide planter wall under a tree. The fountains themselves act as entertainment for children and their parents, and outdoor dining areas are present wherever and whenever possible. Notably, Walnut Creek's sidewalks in the downtown core are often double the standard ten-foot width, and are detailed with brick and pavers of different designs and patterns, simply to be more attractive.

Landscaping is of only moderate quality on Rockridge and Albany/North Berkeley's main streets, but evident enough to at least provide a sense of trees and vegetation. Along both site areas' main streets, the variation in tree size, spacing, and leafiness results in equally varying patterns of landscaping quality, ranging from pleasant to a sense of little vegetation whatsoever. In addition, the standard ten-foot sidewalk width leaves little room for extra vegetation or planting strips, and even inhibits the size of trees that can be planted in any given area. By contrast, Walnut Creek's downtown core is the shadiest of all four site areas, despite its location in a hot, inland micro-climate. Large, leafy trees line every block of the non-arterial main streets, and are supplemented by flowers, planters, and small gardens everywhere. Venturing onto the surrounding arterials presents a different scene, however; trees are noticeably absent along many blocks, and supplemental plantings are virtually non-existent, except outside of a few office complexes. The difference in attractiveness between these areas is striking, and certainly due in part to the landscaping quality, although the blander, larger-scale architecture (both office buildings and large retail stores) on these arterials is a major contributor as well.

Ultimately, the effectiveness of these urban form details should impact the level of pedestrian activity in these three site areas, if in fact urban form has any correlation with pedestrian activity or use. Based on actual pedestrian counts (as presented earlier in Table 4-8), and on additional observations of pedestrian activity in the three site areas[4], a correlation does seem to exist. Or at least, pedestrian activity levels are high in the zones that offer the greatest pedestrian amenities. For example, pedestrian

[4] In addition to the formal pedestrian counts, numerous visits to the four case study areas, over many weekdays and weekends, at a wide variety of times across the day, confirmed the general trends indicated by the official counts.

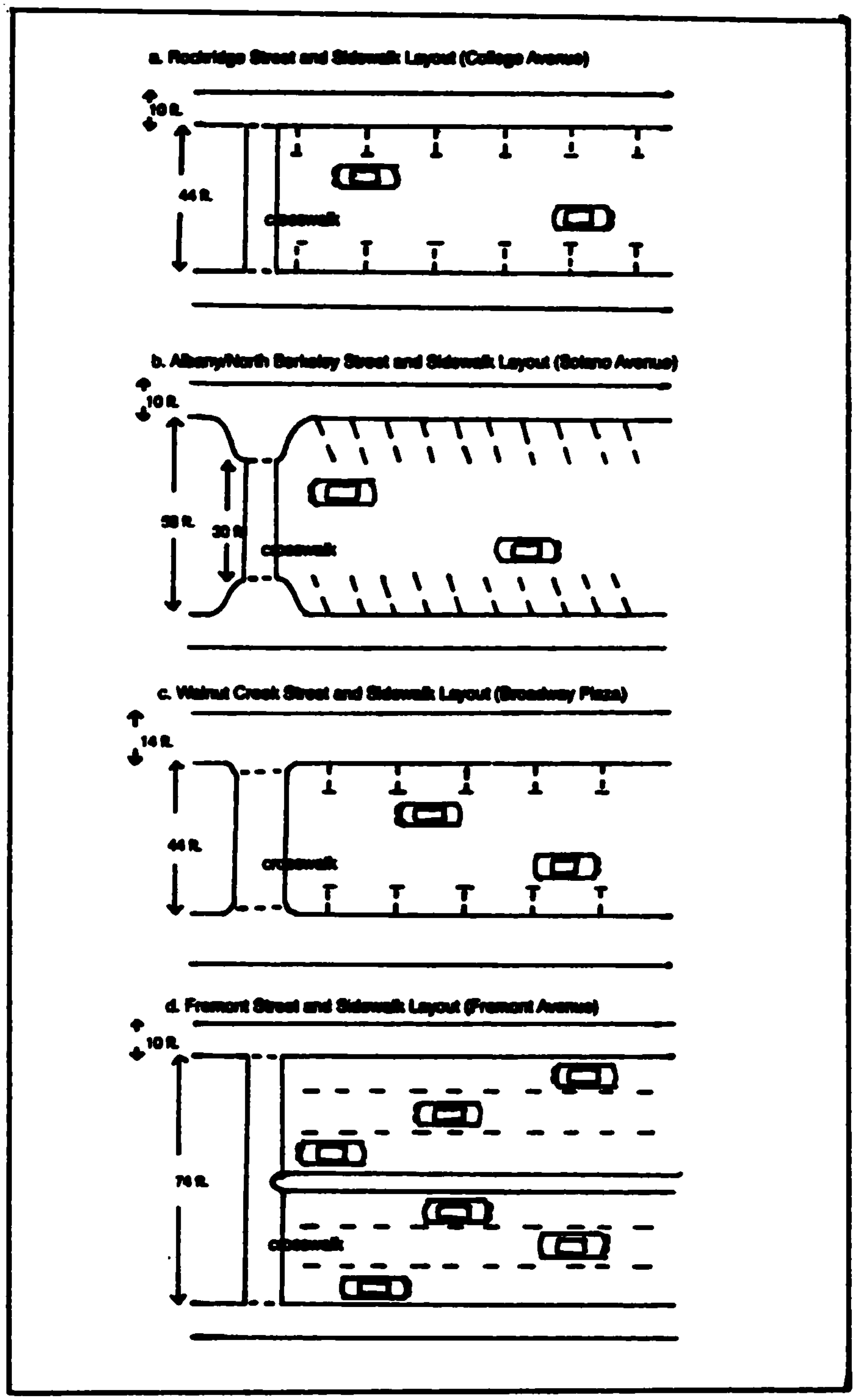
counts at mid-day on a weekday on Broadway Plaza in Walnut Creek showed upwards of 85 pedestrians crossing the counting point over a 15-minute period, with Solano Avenue counts falling slightly under this level, and Rockridge counts falling above it.

The influence of pedestrian amenities on walking behavior is further illustrated by the contrast offered in Walnut Creek alone. In its downtown core - the human-scaled environment along Broadway Plaza, Main, and Locust Streets - the streets (or sidewalks, more precisely) are filled with a wide variety of pedestrians from late morning onwards, all of whom are variously strolling, sitting, chatting, dining, reading newspapers, and so on. Beyond this downtown core in Walnut Creek, as one moves to the wider arterials bounding it, pedestrian activity levels drop off acutely, and equally importantly, include no pedestrians who are simply "hanging out" or sitting around. There are few places to do that on these arterials, and no incentive to do so, since the experience would be relatively unpleasant. Likewise, on Solano Avenue, pedestrian activity is concentrated around nodes that offer even simple street furniture, and appears more scattered in the areas where amenities don't exist.

Fremont presents an entirely different model of urban form along its main streets than the three case studies described above (see Figure 4-50). In spite of its macro-scale similarities to the other neighborhoods - socio-demographic matches, multiple land uses, transit hub location, a mixture of single-family and multi-unit residential housing close to retail areas, and so on - it is the *details* of that urban form that describe a very different place. All of its main streets - Mowry and Fremont Avenues, and Paseo Padre Parkway - are wide, multi-lane arterials measuring at least 74 feet from curb to curb. A narrow median strip divides several of the main streets, and there are additional turning lanes at nearly every major intersection. Traffic volumes are high, as are traffic speeds;

posted signs indicate a 45 miles-per-hour speed limit on all of these major streets, and it is clear that this limit is often exceeded. Notably, there is no on-street parking available anywhere on the main streets. It is literally impossible to pull over in a vehicle and stop - to look at a map, search for a particular store sign, or simply to get out and walk around - anywhere on the streets themselves. One must pull into an off-street parking lot and proceed from there. The immediate impacts of this street layout and design are clear: traffic rushes by at dizzying speeds, and the visual effect is one of wide roadway expanse everywhere one looks.

Figure 4- 50. Comparison of "Main Street" Street Layouts



This perception is only heightened by the superblock layout of the central Fremont streets, with large-scale buildings set far back from the sidewalks, usually on the far side of a surface parking lot. The streetwall presents itself as a fragmented, coarse-grained aggregation of large structures, designed to be seen from twenty, thirty - or more - feet away, not viewed close-up and personally as in Rockridge or Walnut Creek. While most buildings are not transparent, with few (or no) windows and doors, even those that are sit so far back from the sidewalk that this transparency is rendered meaningless. Essentially, immediate interaction between the sidewalk zone and the buildings is simply impossible, and therefore non-existent. The architectural styles of the buildings are blocky and bland, again catering to distant identification rather than to the details that successful smaller-scale architecture demands. Not surprisingly, signage is large and impersonal, often located at the entrance to a mini-mall or retail center, in addition to its placement on the storefront itself.

Figure 4-51. View into Gateway Plaza Mall in Fremont from Sidewalk/Street

The urban form of the retail centers (the malls and mini-malls) does little or nothing to counteract the lack of human scale and possibilities for interaction on the main streets. The mini-malls are fragmented and self-contained, and while the Fremont

Central Hub mall is often cited as the main retail center for this area, its inward orientation prevents easy access (physical and visual) from any of the streets surrounding it. Moreover, the huge expanse of surface parking surrounding this mall is a pure discouragement to anything but vehicle access to the site. In a typification of this problem, the main entrance to the mall from Mowry Avenue simply does not have *any* sidewalk or pedestrian access pathways (see Figure 4-52). In other words, a pedestrian walking along the Mowry Avenue sidewalk wanting access to the mall, cannot walk in by the main entrance. One has to either high-jump bushes and cross the landscaping around the entrance, or walk in the roadway itself along the edge of the driveway entrance. This situation is replicated at nearly every mini-mall entrance in central Fremont.

Figure 4-52. Lack of Pedestrian Access at Main Entrance to Mall

Lack of supplemental pedestrian amenities that might encourage pedestrian activity is evident throughout central Fremont, again in contrast to the other three case study centers. While standard-width sidewalks are present everywhere in the Fremont site area, their function appears to be one of transportation corridor only: no street furniture, no pedestrian plazas, no places or reasons to stop and engage. And even their function as a route alternative is highly circumscribed by the street design and layout. Crosswalks only exist at signalized intersections, which means that one must walk the full length of a superblock to reach a crossing point - or else risk crossing in the midst of speeding traffic. Even the signalized intersections are problematic from a human standpoint; crossing a six-lane wide arterial requires foot-speed and timing, if one is to match the 20 seconds of crossing time allotted by the crossing signals. If a pedestrian starts out late, or moves too slowly (elderly, parents with baby strollers, anyone without grim purpose it seems), he or she is bound to be stranded on the narrow median strip, waiting for the next crossing cycle. Certainly there is no opportunity to simply cross streets on a whim, or because one may see a friend on the other side, so one just doesn't do it. The difference between Fremont's main streets and the main streets of the other case studies is the downtown illustration of Donald Appleyard's livable streets concept.

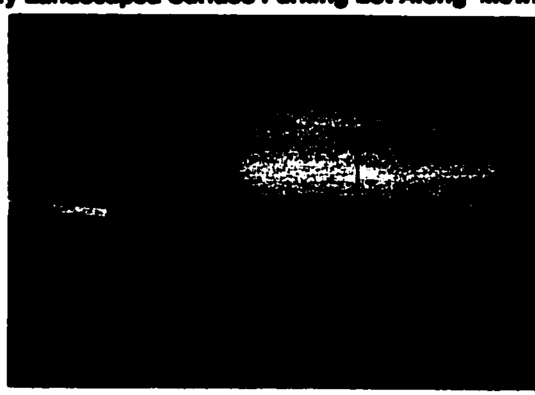
Figure 4-53. Pedestrian Stranded on Paseo Padre Parkway in Fremont

An additional consequence of the lack of human scale, and pedestrian orientation, anywhere in Fremont's main street urban form is that - unlike Rockridge, Solano Avenue, and Walnut Creek - there is no easily recognizable "center" to this area

- i.e. a public commons or central street where people gather. The urban form of the streets themselves flatly prevents this, as noted above. Moreover, the urban form of the malls, while clearly intending to attract human activity in some cases (e.g. Fremont Central Hub), appears to fail in large part because casual, spontaneous access and interaction are not possible, as they are in the other case study centers.

Landscaping along the main streets in Fremont is of low to moderate quality, varying considerably from one place to another. Areas of higher landscape quality are unquestionably more attractive, as the vegetation softens the visual effect of the wide roads and large-scale architecture. Ironically, however, even along main street sections where the actual tree count is greater than in Rockridge or Albany, and trees are spaced more tightly or uniformly, the wide main street configuration in Fremont does not always make this fact apparent. Moreover, areas such as large surface parking lots, which are generally lacking in trees or other vegetation, detract significantly from the impact of any surrounding vegetation.

Figure 4-54. Minimally Landscaped Surface Parking Lot Along Mowry Avenue in Fremont



As with the Rockridge, Solano Avenue, and Walnut Creek site areas, the urban form details should impact the level of pedestrian activity in the Fremont site area, if urban form has any correlation with pedestrian activity or use. Pedestrian counts in the Fremont site area (both on Mowry Avenue *and* within the Fremont Central Hub mall) suggest that the lack of pedestrian-oriented amenities and design features, as well as the overall detailed urban form of the area, may be negatively impacting the levels of pedestrian activity (see Table 4-8). Pedestrian counts at noon on weekdays showed an average of four pedestrians crossing the counting points over any given 5-minute period. Contrast this level of activity with Solano Avenue - which at an average of 24 pedestrians per five-minute period, had the lowest pedestrian count out of any of the other three case studies - and it is clear that walking activity in the Fremont site area is significantly lower than in the other three case study centers.

Residential Street Characteristics

The residential street comparisons of urban form among the four case study neighborhoods are less striking than those of the main streets in some respects, but significant nevertheless (Table 4-11). Again, street width is an immediate differentiation point between the case studies, with both Rockridge and Albany/North Berkeley possessing residential streets averaging 37 feet wide or less, with one through lane in each direction and on-street parallel parking. This narrow configuration results in a very intimately-scaled street feel, particularly when matched with the heavy vegetation and tree cover present on many of these residential streets. On the narrowest streets (ranging from 24 to 28 feet wide), it is difficult - if not impossible - for traffic to move at speeds over 20 miles per hour, since merely passing a car moving in the other direction can be a tight squeeze. The average residential street width in Walnut Creek and Fremont is higher, with Walnut Creek ranging from 38-foot widths on the its narrower streets to up to 44 feet on the collector-type residential streets. Fremont averages an even higher 48-foot width, which is exaggerated by the lack of on-street parking on many of its residential streets, leading in effect to a two through-lane configuration in each direction. In fact, Fremont prohibits *stopping* on a number of residential streets (as with its main streets), resulting - again - in higher traffic speeds and the inability to get out and walk around if one isn't pulling into a particular house or gated community.

Table 4-11. Summary of Residential Streets' Contrasting Urban Form Data

General Characteristics:					
Design Features	On-Street Parking	Yes	Yes	Yes	No
Street Layout	Avg. Width (ft., curb-to-curb)	37	37	40	48
	Total # Through Lns	2	2	2	4
Sidewalk Edge-Built Edge	Parking Along Sdwlk.	Yes	Yes	Yes	No
Streetwall Quality	Transparent	Yes	Yes	No	No
	Monotonous	No	No	No	Yes
	Interesting	Yes	Yes	Yes	No
Adjacent Uses Are:	Open	Yes	Yes	Yes	No
	Fenced	Yes	Yes	Yes	No
	Walled	No	No	Yes	Yes
Pedestrianization Characteristics:					
Tree Spacing	Sparse	No	No	No	Yes
	Average	Yes	No	No	No
	Dense	No	Yes	Yes	No
	Interrupted	No	No	Yes	Yes
	Uniform	Yes	Yes	No	No
Tree Size	Small	Yes	Yes	No	Yes
	Large	Yes	Yes	Yes	No
Shade	Minimal (<30%)	No	No	No	Yes
Any Canopy Effect		Yes	Yes	Yes	No
Other Vegetation	Sparse	No	No	No	Yes
	Average	Yes	No	No	No
	Dense	No	Yes	Yes	No

Residential streetwall quality in Rockridge and Albany/North Berkeley is generally oriented towards the sidewalk, and is both attractive architecturally and transparent to some degree. Neither neighborhood possesses gated communities of any type. Walnut Creek's residential streets show more streetwall variation, with areas of greater interest than others, and occasional gated multi-unit housing. Residential landscaping in all three case study areas is of high quality, with leafy trees and a number of attractive gardens maintained by homeowners. By contrast, Fremont's residential streets tend to range from architecturally dull to moderately pleasant, and have a noticeably non-transparent and inward orientation due to the high proportion of gated communities and apartment complexes in the area. Landscaping also varies from low to moderate quality, with tree cover effect diminished by the wiser residential street configuration.

Conclusions

In sum, the urban form analysis presented above suggests that the four case study neighborhoods display not only differing urban form configurations as a whole, but differ on specific characteristics which may directly impact pedestrian activity levels within those neighborhoods. Rockridge and Albany/North Berkeley are studies of smaller mixed-use neighborhoods centered around one main street that acts as the draw for the local community, and a place where people gather to shop, meet, dine, and conduct a variety of activities. Pedestrian activity levels are high, and the street atmosphere is lively. Walnut Creek is a bigger downtown center, but has countered its bigger-city feel by building a successful, and intimately scaled downtown core, centered around several streets which form a large, dynamic, pedestrian-oriented common area. Fremont, on the other end of the spectrum, contains most of the macro-scale elements required in the mixed-use transit village concept - and in fact has been labeled one of the first "transit villages" in the Bay Area (Cervero 1998) - but has articulated them on the ground in such a way as to preclude the emergence of any center - or core - at all, while discouraging pedestrian activity and interaction.

Overall, results of the urban form surveys lead to the conclusion that these four case studies define a clear "walkability" spectrum for the "general environs" of each neighborhood, with Rockridge at the most walkable, followed by Albany/North Berkeley, Walnut Creek, and after a much larger gap, Fremont. The neighborhood centers (the "site area"), fall out somewhat differently, with Rockridge and Walnut Creek sharing a position as "most walkable," followed again by Albany/North Berkeley, and at the far end of the spectrum, Fremont.

The mail-back survey conducted in the four case study areas was designed to complement, and further explore conclusions reached in the urban form survey, and in particular, to flesh out details of neighborhood residents' travel behavior and neighborhood use. The results of this survey are presented in Chapter Five, and form the basis for final conclusions about the overall impacts of urban form on pedestrian activity and neighborhood livability.

Chapter 5: Travel Behavior and Neighborhood Livability Mail-back Survey and Analysis

Overview of Mail-back Survey

A detailed mail-back survey targeting residents' travel behavior and use of their local neighborhoods was prepared and implemented in each of the four case study areas. This survey was constructed to provide data that could be linked to the analysis of urban form in each of the case studies, and potentially provide insights and conclusions about the impacts of urban form on local travel behavior and neighborhood livability. The survey was approved by the University of California's Committee for Protection of Human Subjects (CPHS) in August 1996.[1]

Mail-back survey data was analyzed with respect to linkages to urban form data and conclusions (discussed in Chapter Four), and both univariate and multivariate statistical analysis were employed to characterize patterns of travel behavior and use of the four case study neighborhoods. Multivariate statistics were also used to develop a general predictive model of walking frequency across the four neighborhoods.

Survey Design and Implementation

Survey Design and Content

A full copy of the mail-back survey is presented in Appendix VI, including the cover letter that was sent to each potential respondent. The mail-back survey was developed by the researcher in conjunction with extensive, continuing input and commentary from survey expert Associate Professor Elizabeth Deakin[2] (who has been

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[1] CPHS approval letter for project #96-6-28, dated August 5, 1996.
[2] Associate Professor of City and Regional Planning, University of California, Berkeley; Director, University of California Transportation Center.

an advisor in the design of several major regional travel and activity surveys) in order to ensure the implementation of a robust methodology. Additional survey design recommendations and survey methods were incorporated from respected texts (Dillman 1978; Salant and Dillman 1994), and through consultation with the University of California at Berkeley's Survey Research Center. The survey was designed to identify general household travel behavior, and the factors influencing residential location choice in the four case study neighborhoods. The survey is six pages in length, with questions focusing specifically on:

1) identifying the factors that have influenced residential choices in these neighborhoods (e.g. how have people selected to live in their neighborhoods, and to what degree was/is pedestrian-friendly urban form a factor in that decision? To what degree does the existence/absence of walking opportunities impact the individual's choice of neighborhoods?);

2) characterizing general patterns of automobile use, transit use, and pedestrian activity within the neighborhood by residents;

3) characterizing specific patterns of travel behavior through a one-day trip diary; and

4) assessing respondents' overall perceptions about usage of, and satisfaction with, their neighborhoods.

Known techniques for ensuring a more robust survey methodology were employed in the survey design. First, the design of the survey itself (e.g. length, types of questions, flow of questions, etc.) can influence the likelihood of potential respondents to participate. This survey was designed (and tested) to require no more than 20 minutes in length for total question-and-answer time, with the intent of increasing the overall response rate. Second, by putting quick and general questions up-front in the survey (e.g. age, household size, etc.), even if respondents do not complete the full survey once they have started, key data has still been gathered, which can be used for some general levels of analysis. Thus, in this survey, critical identifying information was located up-front, and supplemented by more general socio-demographic questions placed at the end of the survey. Finally, a "blank" database (Excel spreadsheet) was created in parallel with the actual survey development, to ensure that all questions and responses would be easily code-able (when received) for future analysis.

The survey is divided into six sections, five of which are targeted at gathering specific data about travel behavior and perceptions about the study area neighborhoods, which correlates with the general environs - the roughly one-to-two-mile radius - around the study area center. A summary of the types of questions and data gathered in the survey is presented in Table 5-1, below. Section One focuses on household information (e.g. location, size, housing type, etc.), and includes a mixture of simple yes/no questions and quantitative data gathering about age, household size, and other socio-demographic information. Section Two targets attitudes about the study area (e.g. overall satisfaction with the neighborhood, main reasons for choosing to live there, housing selection, quality, and price, services available in the neighborhood, degree of pedestrian access, community qualities of the neighborhood, etc.). It is comprised predominantly of Likert-scaled statements,[3] in which respondents are asked to answer using five levels of agreement ranging from "strongly disagree" to "strongly agree."

Section Three addresses the respondent's travel behavior (e.g. distance from home to job, travel mode from home to job, etc.), including the completion of a one-day trip diary. It combines specific questions regarding household vehicle use with traditional travel mode and frequency questions. Section Four focuses on respondents' behavior and use associated with the study area's "center" (i.e. the center that comprises the "site area" and main streets of the urban form analysis), including a range of questions about types of activities conducted there, frequency of use of the area, travel mode from home to the study area center, etc. Question structures range from open-ended, to defined choices (e.g. mark the proper answer from the range given), to Likert-scaled statements, as in Section Two. Section Five gathers additional socio-demographic information about the respondents (e.g. gender, household income, etc.). The sixth section - general comments - is an open-ended question, and is included to accommodate any additional comments or thoughts that respondents may have generated while completing the survey.

The survey also included a cover letter describing the purpose of the survey, guaranteeing the anonymity of all respondents and responses, and providing general instructions as to how to complete the survey. A map of the case study area was

[3] The Likert scale refers to a survey analysis technique developed by R. Likert (Likert et al. 1993), in which respondents are asked to express agreement or disagreement with a set of attitude statements. The scale is a five-point scale, and generally includes the range "strongly disagree," "agree," "neutral" (or "partially agree"), "agree," and "strongly agree." This particular survey also included a sixth option, labeled "don't know/not applicable," to include any respondents who did not feel able to answer the question, and/or respondents who did not circle any other options. Each level of agreement is assigned a numerical value (from one to five), in order to allow for numerical analysis of the responses. In this survey, the "don't know/not applicable" option was assigned a value of six.

attached to each survey, to allow respondents to locate their own residences visually, and also to act as a visual reference for questions throughout the survey.

Table 5-1. Summary of Mail-back Survey Questions

Section Number and Category	General Data Types Gathered
1. Household Information	Home Location, Address Household Size Age(s) of Household Members Housing Type Own or Rent Length of Residence at Home Employment Status
2. Attitudes About Study Area	Length of Residence in Neighborhood Overall Satisfaction with Neighborhood Top 3 Reasons for Choosing Neighborhood Top 3 Things Disliked When Choosing Neighborhood Housing Selection/Price/Quality Automobile Access Around Neighborhood Pedestrian/Bicycle/Transit Access Around Neighborhood Quality of Neighborhood Services Visual/Aesthetic Quality of Neighborhood Community Qualities of Neighborhood Quality of Neighborhood for Children
3. Travel Behavior Around Study Area	Number of Vehicles Owned Number of Bicycles Owned Distance from Home to Job Travel Mode from Home to Job One-Day Trip Diary (all trips made)
4. Shopping and Services in Study Area	Location of Most Frequent Grocery Shopping Location of Most Frequent Other Shopping Frequency of Shopping at Study Area Center Types of Activities Conducted at Study Area Center What is Liked Most About Study Area Center What is Liked Least About Study Area Center Ease of Walking to Study Area Center Frequency of Travel modes to Study Area Center Overall Attractiveness of Study Area Center Overall Sociability of Study Area Center Design Aspects of Study Area Center Traffic Aspects of Study Area Center
5. Socio-Demographic Information	Gender Marital Status Educational Level Household Income Race
6. General Comments	(open-ended question)

Survey Samples and Implementation

The original aim of the sampling strategy was to generate fully random respondent samples for each case study, to allow for the most robust statistical analysis possible. A minimum of 30 completed surveys per case study neighborhood was deemed necessary to perform any statistical analysis. The *ideal* sample number per neighborhood, however, was hoped to be at least 120 completed surveys, to reduce possibilities of statistical bias. Therefore, using an anticipated final survey response rate of roughly 35%[4], each case study sample was targeted to include 350 addresses (potential respondents), for an overall total of 1400 surveys across the four case studies.

The mail-back survey addresses were selected at random from zip code areas correlating with the census tracts within a one-to-two mile radius of case study centers (i.e. encompassing both the "general environs" of the case study area, and the smaller "site area"). The respondent database (1400 addresses) was provided by Survey Sampling Incorporated (SSI), a professional statistical survey consulting firm based in Connecticut.[5] The database of addresses was constructed based on parameters that were submitted to the firm, including the targeted zip codes, the requirement that this was to be a randomized database, and the requirement that the addresses must represent all zip codes within each study area as equally as possible (i.e. the sample could not come from only one small area within the study area census tracts, but must represent all census tracts in each case study area).

Implementation of the survey included two test phases:

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[4] The 35% response rate was calculated based on an anticipated 20-25% response rate to a first survey mailing (the standard that is generally cited for mailback surveys), with the additional response rate of 10-15% to be generated by two follow-up mailings.
[5] Survey Sampling, Inc., One Post Road, Fairfield Connecticut, 06430.

- a one-on-one pre-test phase (January - February 1998), in which pre-selected respondents were asked to fill out the survey, and then would discuss the survey with the researcher afterwards, to determine problem areas and clarity of questions; and

- a sample survey phase (April - June 1998), in which surveys were sent out to seven residents in each case study neighborhood, randomly selected from the larger databases of 350 addresses per neighborhood. As in phase one, this was done to determine the adequacy, clarity, etc., of questions on the survey, and to estimate response rates. However, there was no personal contact between the researcher and the respondents in this phase; feedback on the survey was determined through trends such as failure to answer particular questions (e.g. if five out of the 28 respondents failed to answer one particular question, the question was thrown out of the final survey as being unclear, uninteresting, or unanswerable); confusion in how to answer questions (e.g. if several respondents had difficulty understanding the instructions to a particular question, the instructions were then modified in the final survey); and so on.

Final implementation of the survey included three mailings:

1) May 1999 - an initial mailing of 1372 surveys (343 to each neighborhood[6]) to a randomly selected sample of residents in each case study neighborhood;
2) October 1999 - a follow-up mailing to non-respondents of the first mailing to increase the total response rate; and

3) May 2000 - a final follow-up mailing to address the low response rate of Fremont residents.

Throughout the survey mailing and response phases, responses were coded and entered into the survey spreadsheet database constructed during survey development.

While the survey sampling strategy, and survey itself, were designed to assure the randomness of the survey samples and responses, there are several significant issues related to the sampling strategy and response rates that may have impacted the analyses performed on these surveys, and must be acknowledged here.

First, Survey Sampling Incorporated (SSI) develops its "random" sample address databases by selecting from telephone listings in any given area (this is a standard and accepted method of constructing address databases). However, the Bay Area includes a large number of unlisted telephone numbers, which means that this group of respondents is categorically excluded from the sample. Typically, this group of respondents includes a higher fraction of single women, and may also include a larger fraction of individuals with higher education levels. Therefore, one must be aware of the potential exclusion of such respondent categories in performing any analysis, and if the bias appears to be large (e.g. no single women respond to the survey), this absence must be noted in the analysis, and/or statistical post-weighting can be employed to address the bias. In the case of this survey, post-weighting was not employed in any analyses, because either trends were so clear in some instances as not to require it (e.g. walking trips), or it was simply impossible to determine exactly what post-weighting would have to be done.

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[6] The figure of 343 is simply the original sample of 350 in each case study area, minus the seven surveys (per case study) that were sent out in test phase two.

A second issue is that the final response rate in all four case study areas was less than the 35% anticipated, even with extensive pre-testing, and two follow-up mailings to the initial full sample mailing (see Table 5-2).

Table 5-2. Total Number and Percentages of Survey Respondents for Each Case Study

	Absolute Number Completed	Fraction of Case Study Total
Rockridge	84	24%
Albany/No. Berkeley	91	26%
Walnut Creek	76	22%
Fremont	48	14%

In particular, Fremont had an unusually low response rate (relative to the other case study areas) of 14%, or only 48 completed surveys.[7] While this is greater than the 30 minimum surveys required by the research sampling strategy, it is well short of the 120 completed surveys that would have been considered ideal for statistical purposes, and therefore may result in skews in analysis related to socio-demographic representation. The other case study neighborhoods, while not reaching the 120 completed survey ideal target, included a wide range of respondent types (e.g. age, gender, education levels), and the respondent pool also matched the general socio-demographics of each study area, as determined from census data. Therefore, the skews in those case studies are

[7] It is unclear why Fremont had such a low response rate, although several issues may have contributed to this. First, Fremont hired a consulting firm - Design, Community, and Environment (Berkeley, CA) - over the last several years, to assist them in redesigning their central area to be more "livable." It is likely that this consulting firm conducted surveys, focus groups, etc., in order to assess and analyze the planning context. Therefore, the surveys sent out for these dissertation may have been competing with the consulting firm's more extensive efforts, and residents would probably not have answered both sets of surveys. Second, Fremont not only has a substantial Asian population, but has a substantial non-native-English-speaking population as well (as opposed to Albany, where the Asian population tends to be more bi-lingual). Since the survey, at six pages, would be a difficult enterprise for a non-native English speaker, it is possible that another set of respondents were lost here, although this seems less likely since the respondent analysis indicated a relatively high percentage of Asian respondents in Fremont. Third, it may simply be that a community such as Fremont is less familiar with, or used to, completing surveys in general. Rockridge and Albany/ North Berkeley in particular, are subject to numerous and continuous surveys implemented by various departments at the University of California, Berkeley. While this presents more "competition" for any given survey, as noted above, it also conditions residents to responding, and residents are thus more willing to take time out for the surveys. And finally, a community such as Fremont may simply be less interested in this type of issue than other communities, as I discuss in the main text.

generally not considered to be as significant from a socio-demographic standpoint. Again, post-weighting is sometimes used to address low response rates (such as in Fremont), but in this case both the strength of trends analyzed in Fremont precluded the necessity for this, and the basic issues related to the "randomness" of the original sample appeared to be greater factors in impacting the survey analyses.

A final, less tangible, factor potentially impacting the analysis of the mail-back surveys is the acknowledgement that one general weakness of mail-back surveys is that respondents may tend to be individuals who are interested in the issue at hand (Dillman 1978). Therefore, the respondent group may exhibit general trends in their responses that are different from individuals who are less interested in these issues. Since this latter category of individuals is de facto excluded from the survey analysis (i.e. these individuals don't complete the survey), their viewpoints are simply absent from the analysis (this may, for example, be one reason contributing to the low response rate in Fremont). However, as stated above, this problem is inherent in all mail-back survey research, and simply cannot be addressed in any perfect manner.

Having acknowledged these potential limitations related to the statistical analysis portion of this dissertation research, it is important to note that the research performed in this dissertation was not intended to be a complete and perfect statistical analysis. The statistical portion of the research is intended to supplement the overall project, not stand as its only element. Moreover, the strength of several statistical trends in the responses (as will be described below) is so significant as to negate the statistical issues noted above. In cases where trends do appear to be impacted by data biases (e.g. socio-demographic skews), I have noted this in the specific analysis itself. Finally, all conclusions are assumed to be based only on the survey responses received in this research project, and are not assumed to represent the full population. Thus, while I will discuss the implications that my research conclusions have on the wider population, and on planning in general, these should not be taken as definitive statistical statements, although the methods I have used are intended for inference to the larger population.

Mailback Survey Results

General Descriptive Statistics

The general characteristics of the mail-back survey respondents in each of the four case study neighborhoods (Questions 1-1 through 1-10 of survey) indicate a relatively diverse pool of residents in everything but racial composition. All four neighborhoods show some strong similarities in the respondent characteristics, as well as several distinct differences (Table 5-3). Respondents in all four study areas are split nearly equally between men and women. Over half of the respondents in every neighborhood are married, with another 27% to 37% identifying themselves as single, and between four and 12 percent listing themselves as divorced, widowed, or in long-term partnerships. The racial composition of the four respondent groups is also similar, and reflects the census data for these areas, with a predominance of Caucasians (70% or more), and in Albany and Fremont, a substantial Asian population as well (over ten percent).

Table 5- 3. Mailback Survey Respondent Socio-Demographic Characteristics

Respondent Characteristics	Rockridge (% of total Rockridge)	Albany/ No. Berkeley (% of total Albany/ No. Berkeley)	Walnut Creek (% of total Walnut Creek)	Fremont (% of total Fremont)
Gender				
Male	48%	53%	49%	54%
Female	52%	47%	51%	46%
Marital Status				
Married	51%	66%	58%	67%
Single	37%	28%	32%	29%
Other	12%	7%	11%	4%
Education Level				
Junior High	0%	1%	0%	0%
High School	10%	6%	5%	13%
2 Years College	2%	8%	23%	35%
4 Years College	40%	26%	41%	25%
Graduate School	48%	56%	31%	25%
Other	0%	3%	0%	2%
1998 HH Income				
< $20K	5%	6%	3%	0%
$20K to $40K	19%	15%	13%	30%
$40K to $60K	20%	8%	23%	17%
$60K to $80K	14%	11%	17%	17%
$80K to $100K	9%	21%	16%	11%
$100K or >	35%	39%	29%	24%
Race				
African-American	4%	0%	1%	0%
Asian	5%	14%	4%	15%
Caucasian	88%	83%	85%	71%
Hispanic	2%	1%	4%	4%
Native American Indian	0%	0%	1%	2%
Other	1%	2%	4%	8%

Education and income levels show greater differences between the respondent pools in each case study area. In Rockridge and Albany, over 80% of the respondents have received at least a full four-year college education, and about 50% have received graduate levels degrees. Walnut Creek comes in close behind, with 72% of the respondents receiving four years of college, while about 31% have received graduate degrees. By contrast, in Fremont 35% of the respondents have only received two years of college education, and respondents with graduate degrees comprise only 25% of the total pool.

In all four neighborhoods, respondents represent a wide range of income levels; only very low income levels (less than $20K) are minimally represented, which would be expected given the upper-middle income census profile for these case study areas. One-third or more of respondents in Rockridge and Albany have a 1998 household income of $100K or more, while Walnut Creek is again close behind with nearly 29% of the respondents at this income level, and Fremont following at about 24%. The most striking difference among the income levels is in the $20K to $40K range, where Fremont shows a relatively high 30% in this category, with Rockridge the next-highest figure at about 19%. In Fremont, this income group is comprised almost exclusively of retirees (age profiles for the neighborhoods are discussed below, in Table 5-4), while in Rockridge, a portion of this group is attributable to recent graduates in addition to retirees. In both Albany and Rockridge, the higher fraction (though still small) of under-$20K incomes is comprised primarily of students, again as would be expected for these neighborhoods.

The age characteristics of respondents in all four case study areas are remarkably similar in some respects, with a median age of around 50, and minimum and maximum ages ranging from twenty-two years old to eighty-eight years old (Table 5-4). However, a breakdown of age categories indicates some differences in the respondent pools. Rockridge possesses the highest fraction of eighteen-to-thirty-year-olds, at a full 19% of the total for the neighborhood. Given this area's proximity to the University of California at Berkeley, this statistic is not surprising, as this area pulls in many college students, graduate students, and recent graduates. At the other end of the spectrum, Fremont has the highest fraction of respondents who are 66 or more years old, at roughly 31% of its neighborhood total. In all four neighborhoods, however, the bulk of respondents (nearly 60% or more) fall into the "middle age" and "aging" categories of 31 to 65 years old.

Table 5-4. Respondent Age Statistics

Age Data	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Median Age	50	53	50	52
Range	64	66	50	56
Minimum Age	23	22	28	25
Maximum Age	87	88	78	81
Age Categories (% of Tot)				
18-30	19%	8%	5%	10%
31-50	30%	37%	47%	35%
51-65	38%	32%	28%	23%
66 or older	21%	23%	20%	31%

A wide variety of household and housing type characteristics are represented in the respondent pools of all four neighborhoods (Table 5-5). While all four neighborhood respondent pools show over 60% of respondents owning their homes (as opposed to renting), Rockridge is well below the others, with roughly 62% homeowners, compared to 73%, 82% and 83% in Fremont, Albany, and Walnut Creek, respectively. The fraction of respondents living in single-family detached homes is also relatively high in all four neighborhoods, with Albany at nearly 85%, Fremont at roughly 71%, and Walnut Creek and Rockridge around 62%. Walnut Creek has the highest fraction of one-person households, at about 30% of the total respondents for that study area, while Fremont possesses by far the highest fraction of households with four or more persons, at roughly 33% of the total, with Albany next at about 20%. This trend is partially explained by the racial profiles of these two neighborhoods, which have a high Asian presence. A number of these larger households are Asian (or Asian-Americans), whose culture encourages multi-generational households. The other factor contributing to this statistic is that both Fremont and Albany have the highest fraction of households with children, at about 33% and 30%, respectively. By contrast, over two-thirds of the respondent households in both Rockridge and Walnut Creek are two persons or less.

Table 5-5. Respondent Household (HH) Characteristics

HH Characteristic	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Household Size (% of Tot)				
One-Person	20%	24%	30%	21%
Two-Person	48%	30%	41%	31%
Three-Person	19%	26%	16%	15%
Four or more	14%	20%	13%	33%
w/Children*	16%	30%	20%	33%
Housing Type (% of Tot)				
SFR**, detached	62%	85%	63%	71%
2-4 Units	16%	4%	17%	6%
5-9 Units	8%	6%	5%	8%
10 or more units	14%	4%	13%	13%
Other	0%	1%	1%	2%
Ownership Status(% of Tot)				
Own	62%	81%	83%	73%
Rent	33%	19%	17%	25%
Other	5%	0%	0%	2%

* "Child" is defined as under 18 years old
** SFR = Single Family Residential

Attitudes About Study Area Neighborhoods

Section Two of the survey addresses a variety of attitudes about the study area neighborhoods, and includes Questions 2-1 through 2-11. Responses to Question 2-1 indicate that a high fraction of respondents in all case study areas are long-term residents, as defined by living in the neighborhood for eleven years or more (Table 5-6). This may be reflective of the inherent "interest" bias for mail-back surveys that was discussed at the beginning of this chapter. For example, long-term residents may feel that they have a greater vested interest in their community and how it operates, and therefore may be more likely to respond to a survey focused on community issues, such as this one. Conversely, the low response rate (under 10%) of respondents living in their residence, and/or the study area, for less than one year, may suggest that this pool is not yet engaged in their community well enough to want to comment on it.

Table 5-6. Respondent Residence History

	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Years at Residence (%)				
< 1 Year	4%	1%	5%	8%
1-2 Years	12%	10%	12%	13%
3-5 Years	29%	21%	16%	10%
6-10 Years	14%	16%	17%	8%
11 Years or More	42%	56%	50%	60%
Years in Study Area (%)				
< 1 Year	4%	0%	4%	4%
1-2 Years	8%	7%	8%	10%
3-5 Years	19%	15%	18%	13%
6-10 Years	20%	14%	15%	10%
11 Years or More	49%	64%	55%	63%

Respondents in all four neighborhoods expressed a high level of overall satisfaction with the neighborhood in which they live (Question 2-2), with roughly 90% or more of the total respondents in each neighborhood saying that they "like" the neighborhood (Table 5-7). This is consistent with previous residential preference research showing that longer residence time leads to greater neighborhood attachment, and greater resident satisfaction (Kasarda and Janowitz 1974; Adams 1992; Talen 2001). Moreover, this trend is logical; individuals who *don't* like the neighborhood are probably more likely to move - or have moved - away at some point, leaving a higher fraction of "satisfied" long-term residents in the neighborhood. As Adams points out, however, the exact nature of this satisfaction can be more complex; while there may be an overall emotional attachment to one's neighborhood, which he terms, "community sentiment," there is more variation in how well a neighborhood meets specific needs and desires of its residents, which he describes as "community evaluation" (Adams 1992). The subsequent variations in respondents' answers to this survey confirm Adams' differentiation between the two aspects of neighborhood satisfaction.

Table 5- 7. Overall Satisfaction with Neighborhood

	Like Neighborhood	Don't Like Neighborhood	Mixed Feelings
Rockridge	89%	0%	11%
Albany/No. Berkeley	91%	9%	0%
Walnut Creek	93%	1%	6%
Fremont	93%	0%	7%

Major Attractants in Respondents' Residential Choices

Respondents displayed much wider variation - from neighborhood to neighborhood - in describing the major reasons they had chosen to live in that area (Question 2-3 of survey). Traditionally, individuals are presumed to base residential location choices on the major factors of price (i.e. affordability) and lot size (Audirac 1999), and to a lesser extent, job proximity (i.e. individuals locate to particular areas due to job location), and the quality of schools (Jeffres and Dobos 1995; Brower 1996). Research focusing on housing prices and suburban preferences have noted that other factors such as safety, proximity to transit, particular neighborhood amenities, etc., may be playing an increasingly important part in individual's residential location decisions (Jeffres and Dobos 1995; Brower 1996; Audirac 1999; Talen 2001).

As I have noted earlier in this research, the case study neighborhoods for this research project were specifically selected out of an upper-middle income pool, in order to target groups that have a greater level of choice in residential location (i.e. not as limited by financial constraints). The assumption underlying that decision was that this greater level of choice would impact the types (and range) of factors influencing individuals' choice of neighborhoods, since affordability would not necessarily be the defining factor.[8] Therefore, if other factors do influence the choice of residential location, they would be more likely to emerge in this survey. In particular, this research hoped to identify whether pedestrian accessibility, or perceived "pedestrian-friendliness" had any major impact on individuals' choice of neighborhoods. In addition, this research intended to assess to some degree whether the existence of this factor might be leading to self-selection into neighborhoods - i.e. individuals who view pedestrian accessibility as important deliberately choose neighborhoods that offer pedestrian amenities.

The questions targeting this issue, in this survey, were left open-ended, so that respondents were not being prompted to answer in any particular way. The answers to these questions were then grouped according to general "themes" or categories, which comprise the "Top Reasons Attracted to Neighborhood" listed in Table 5-8, and highlighted further in Figures 5-1a through 5-1d. For example, a respondent's answer, "...conveniently close to highways, San Francisco, stores, etc.", would be grouped under the "convenience and central location" category. Answers that referred specifically to pedestrian accessibility were grouped under "pedestrian, bicycle, and transit amenities and access," and so on.

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[8] Talen (2001) assumes a similar logic in her recent analysis of residential preferences of affluent suburbanites.

Table 5- 8. Top Reasons Attracted to Neighborhood

Top Reasons Attracted to Neighborhood	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Affordability	36%	25%	33%	40%
Housing Stock/Amenities/Physical Features	20%	41%	28%	25%
Job Proximity	11%	16%	24%	23%
Schools	17%	27%	28%	46%
Neighborhood Amenities (Good Neighborhood)	35%	34%	26%	42%
Convenience/Access/Central Location	71%	43%	53%	46%
Open Space/Ruralness/Landscaping/Vegetation	19%	42%	39%	15%
Pedestrian/Bike/Transit Amenities and Access	52%	18%	21%	6%
Culture/Diversity/Politics/Activities	15%	10%	3%	0%
Family/Friends	8%	10%	11%	8%
Weather	5%	8%	11%	4%
Safe	11%	18%	14%	6%

* Figures are given as percentage of total respondents in each neighborhood; since respondents could list more than one item, the figures add up to more than 100% in each neighborhood.

Notably, of the major reasons identified as attracting respondents to their respective neighborhoods, "affordability" is not the first-ranking factor for *any* of the four neighborhoods (where "rank" is defined, for the purposes of these responses, by frequency of appearance in survey responses). In fact, it is the *third*-ranking factor, or lower, in all four neighborhoods. This result lends support to the hypothesis underlying the choice of case study neighborhoods: that other factors play greater roles in influencing residential choice, if individuals possess some flexibility in residential choice (i.e. are more affluent), and are given a greater number of factors to choose among. Lot size (subsumed under the category of "housing stock, amenities, and physical features") fell even lower on the scale of importance for all but Albany/North Berkeley residents. While Albany/North Berkeley residents identified it as their third-ranking factor, with over 40% of respondents listing it as a key attractant, in Rockridge, Walnut Creek, and Fremont, this factor was listed by less than one-third of the respondents as one of the key attractants for their residential location choice.

Figure 5-1a. Rockridge Respondents' Top Reasons Attracted to Neighborhood

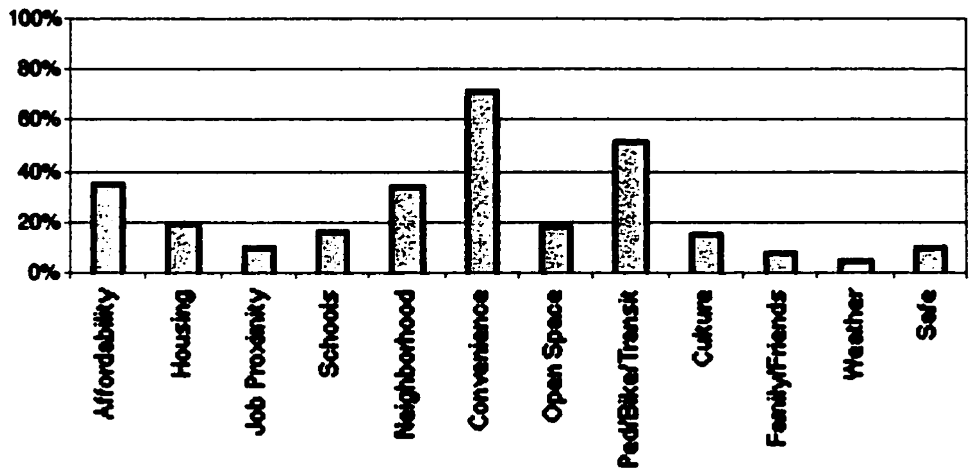


Figure 5-1b. Albany Respondents' Top Reasons Attracted to Neighborhood

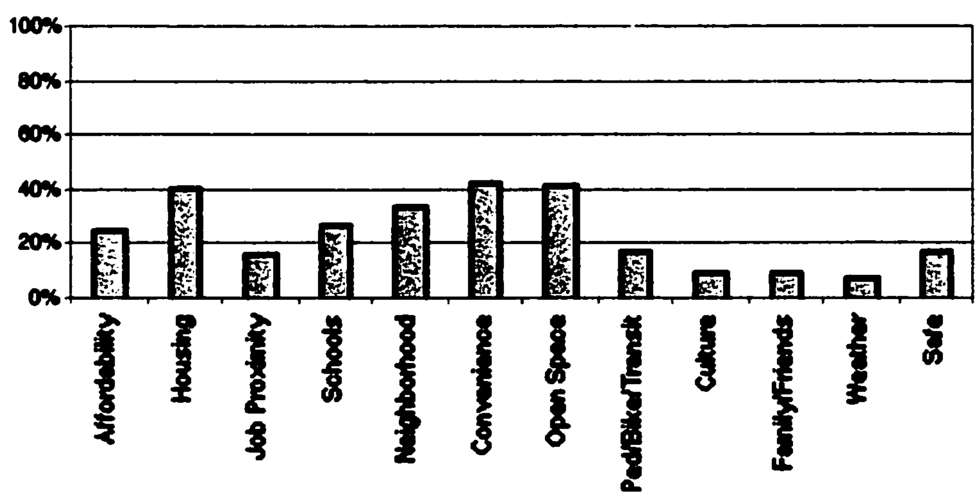


Figure 5-1c. Walnut Creek Respondents' Top Reasons Attracted to Neighborhood

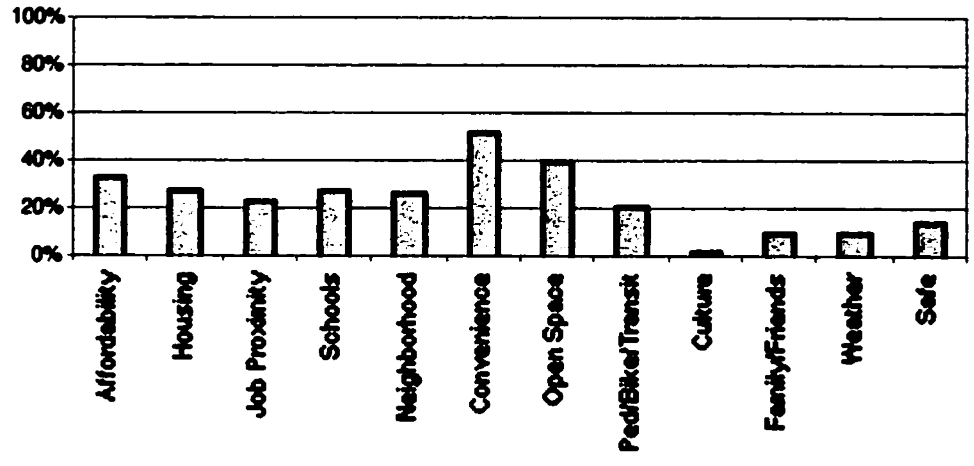
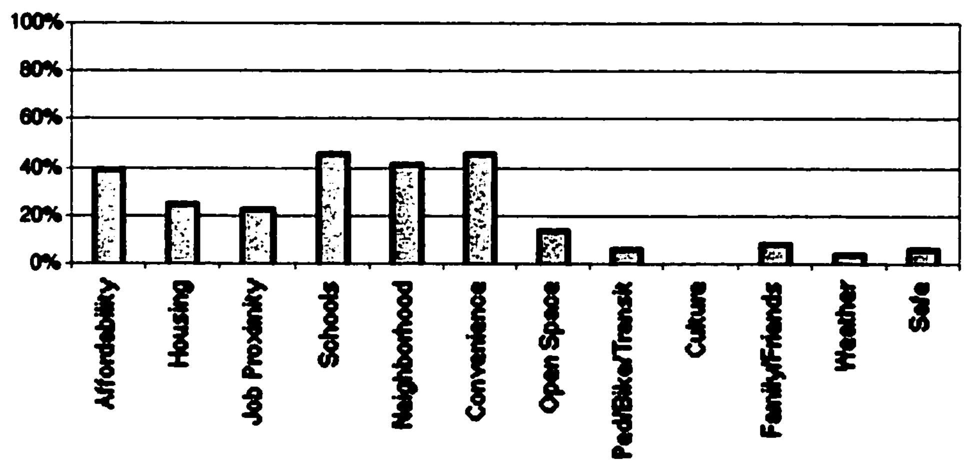


Figure 5-1d. Fremont Respondents' Top Reasons Attracted to Neighborhood



"Job proximity" also ranked relatively low as a major factor in the residential location decision. Walnut Creek and Fremont, which ranked the highest for this factor, had only around 24% of respondents listing this as a top reason for their choice of neighborhoods, while Albany/North Berkeley and Rockridge registered this even lower, at 16% and 11%, respectively. Finally, the existence of good schools differed across the neighborhoods as a major attractant, with Fremont ranking this factor quite highly, at 46% of respondents, while Rockridge placed it low on the list, at only 17% of respondents.[9]

By contrast, convenience - or centrality - to a number of major features (e.g. highways, downtown areas) and locations (e.g. San Francisco city) was identified in all four neighborhoods as the top attractant for respondents. Rockridge respondents, in particular, placed this as an overwhelmingly important factor, with roughly 71% of respondents listing this as one of the top reasons for moving there, while Walnut Creek residents also weighed in heavily, with over 50% stating this was one of the key factors in their residential location decision. General neighborhood amenities and ambiance (e.g. "...it seemed like a good neighborhood") were also listed in all four neighborhoods as a major attractant, with over one-third of respondents in Rockridge, Albany/North Berkeley, and Fremont identifying this as key factor, while Walnut Creek came in slightly lower, at 26% of respondents.

[9] While Albany/North Berkeley's failure to list good schools as one of its higher-ranking attractants might seem surprising - given the high fraction of respondents with children, and the excellent reputation of Albany's school system - this is probably partially explained by the fact that the Albany/North Berkeley respondent group is split among several cities - Albany, Berkeley, El Cerrito, and Kensington - all of which have different school systems. Therefore, while the Albany portion of the respondents felt that their school system was a major attractant in their residential location decision, residents of Berkeley, El Cerrito, and Kensington did not feel this way (and in fact felt quite strongly otherwise, as further results will note).

For less-traditional residential choice factors, the differences among the neighborhoods are greater with respect to the top reasons identified for moving to the areas. Specifically, Fremont displayed much less variation than the other three neighborhoods in terms of the range and extent of factors listed, with categories such as "culture and diversity," "safety," "pedestrian amenities," etc., all registering as important to less than 10% of Fremont respondents, and in several cases, barely registering at all. By contrast, respondents in the other three neighborhoods listed a wide variety of factors as "top reasons" for their residential location choice. Moreover, in entering question answers into the database, it was notable that respondents in these three neighborhoods often listed multiple "top reasons" (e.g. three or more top reasons) for moving to the neighborhood, as compared to Fremont residents, who often only listed one or two major reasons.

Among the broader range of factors, "pedestrian, bicycle, and transit amenities and access" registered as one of the top-ranking factors for Rockridge residents in choosing their neighborhood, with a remarkable 52% of respondents listing this as a key attractant, making it their second-ranking factor just behind centrality of location (discussed above). Albany/North Berkeley and Walnut Creek respondents also viewed it as a noticeable factor, with roughly 20% of their respondents listing this as a "top reason" for moving there. "Most services are within walkable distance," stated one respondent, while another noted the draw of "good quality shopping within walking distance." Fremont is notably absent from this group, with only 6% of its respondents identifying this as a key attractant, and in those cases, the stated influential factor was BART only (i.e. pedestrian and bicycle accessibility were not mentioned at all).

"Open space, parks, and vegetation" was also variable among the neighborhoods, with Albany/North Berkeley and Walnut Creek both ranking this high in importance, with roughly 40% of their respondents listing this as a key attractant. By contrast, less than 20% of Rockridge and Fremont respondents listed this as a key attractant, placing this factor of moderate importance to these two neighborhoods. "Culture, diversity, and politics" was most important to Rockridge respondents, 15% of who listed this as a key attractant. It was of minor or negligible importance in the remaining three neighborhoods, with 10% or less of respondents listing it as a factor.

"Safety" registered of moderate importance to Albany/North Berkeley residents, at 18% of respondents, while Walnut Creek and Rockridge - at 14% and 11% of respondents, respectively - noted it as somewhat less important. Fremont residents barely registered this factor, with only 6% of respondents listing it as a key attractant. Finally, the categories of "family and friends nearby" and "weather" were of relatively low importance in all four neighborhoods, at 11% or less of respondents listing either of these as a key attractant.

In sum, of the major attractants identified by respondents in the four neighborhoods, "convenience and central location" appeared most frequently as a major factor in all four neighborhoods. More traditional suburban preference factors, such as housing amenities (lot size, house size, etc.) and housing price featured less prominently than would be expected, and in fact appeared less frequently in several neighborhoods than factors such as "pedestrian, bike, and transit amenities," "open space, parks, and vegetation," and an overall sense of a "good neighborhood." These results suggest that when offered choices in residential locations, individuals may in fact execute a wider, and non-traditional, range of preferences because they have been given the opportunity to do so. Moreover, the results suggest that for at least some portion of the population, pedestrian, bicycle, and transit amenities are so important as to defy conventional preferences for larger lots and house size (e.g. Rockridge).

Finally, the results mark a clear distinction between Fremont and the other three neighborhoods: Fremont respondents expressed a noticeably narrower range of factors attracting them to their neighborhood, and these factors were primarily concentrated in the more "traditional" suburban preference variables, such as housing amenities, schools, and affordability. By contrast, Rockridge, Albany/North Berkeley, and Walnut Creek respondents identified a wider range of factors as the major attractants in their residential location choices, and these factors included both traditional and non-traditional suburban preference variables.

Major Detractors in Respondents' Residential Choice

While residential preference research is often focused on identifying the major attractants for residential location choices - primarily because these are easier to assess[10] - this research also attempted to identify factors that respondents considered to be detractors in their residential location choice, despite ultimately choosing to live in that particular neighborhood. In other words, the survey asked respondents to identify the main things that they disliked about the neighborhood when they were choosing to

[10] Generally, suburban preference research employs the use of surveys, etc., which are targeted at current residents of an area, and which ask questions about what their current likes/dislikes are, and why they moved there. Since these survey respondents have - by default - chosen to live in these neighborhoods, they are - also by default - expressing an inherent bias towards what attracted them to that particular neighborhood, since those attractants clearly overwhelmed any negative perceptions they might have had about the neighborhood. Therefore, it is simply easier to identify the attractants, as opposed to detractors. Moreover, as Emily Talen (2001) discusses, previous research by Fried (1986), Brower (1988), and Taylor (1996) has shown that the longer that residents remain in a neighborhood, the more likely they are to adapt to the negative aspects of that environment, and thus may not identify these negative factors as readily in surveys.

live there (Question 2-3 of survey). The aim was, in part, to supplement the data gathered in the previous question (the top reasons attracted to neighborhood), but also to identify whether non-traditional factors such as the existence of pedestrian amenities are a notable issue for individuals when assessing their residential choice options. As with the previous question, this answer was left open-ended, to allow respondents to independently determine their responses. And as before, the answers to these questions were then grouped according to general "themes" or categories, which comprise the "Top Things Disliked About Neighborhood When Choosing to Live There" listed in the results in Table 5-9, and displayed in Figures 5-2a through 5-2d.

Table 5-9. Top Things Disliked About Neighborhood When Choosing to Live There*

Top Things Disliked About Neighborhood	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Lack of Affordability	15%	15%	21%	15%
Poor Housing Stock/Amenities/Physical Features	17%	20%	16%	10%
Distance from Job	1%	4%	14%	8%
Poor/Distant Schools	11%	10%	4%	4%
Poor Neighborhood Amenities/Ambiance	13%	7%	14%	19%
Lack of Convenience/Centrality/Access	2%	1%	1%	8%
Lack of Open Space/Parks/Vegetation	8%	4%	3%	6%
Traffic/Parking/Street/Noise Concerns	54%	40%	47%	29%
Poor Pedestrian/Bike/Transit Amenities	13%	16%	16%	8%
Poor Culture/Diversity/Politics	5%	4%	9%	8%
Isolation/Lack of Friends/Family	4%	3%	1%	2%
Weather/Env Hazard Complaints	12%	37%	22%	8%
Unsafe/Crime	38%	2%	3%	2%

* Figures are given as percentage of total respondents in each neighborhood; since respondents could list more than one item, the figures add up to more than 100% in each neighborhood.

Figure 5-2a. Rockridge Respondents' Top Things Disliked About Neighborhood

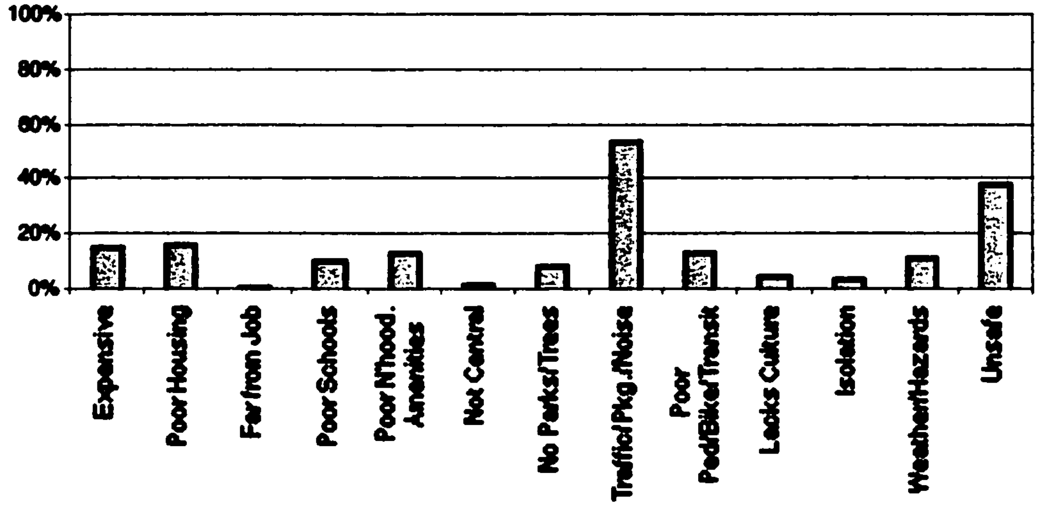


Figure 5-2b. Albany Respondents' Top Things Disliked About Neighborhood

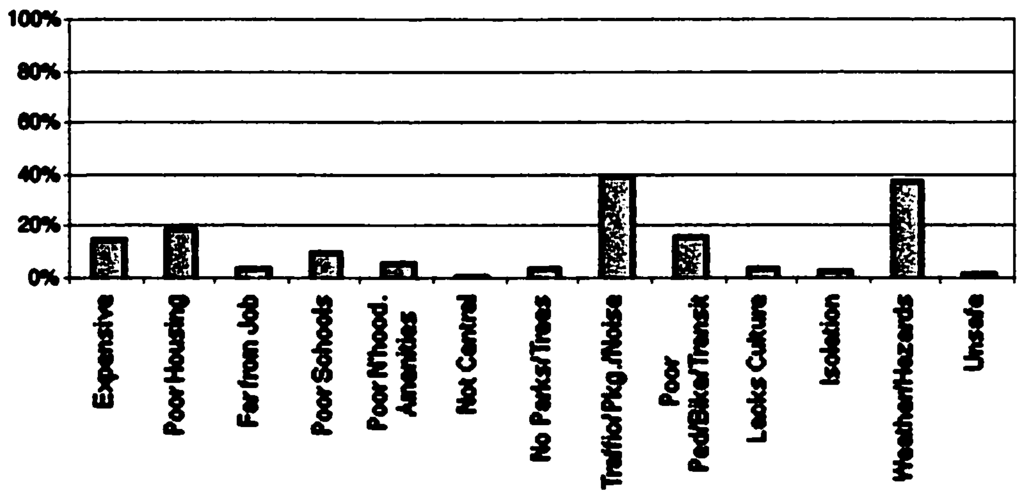


Figure 5-2c. Walnut Creek Respondents' Top Things Disliked About Neighborhood

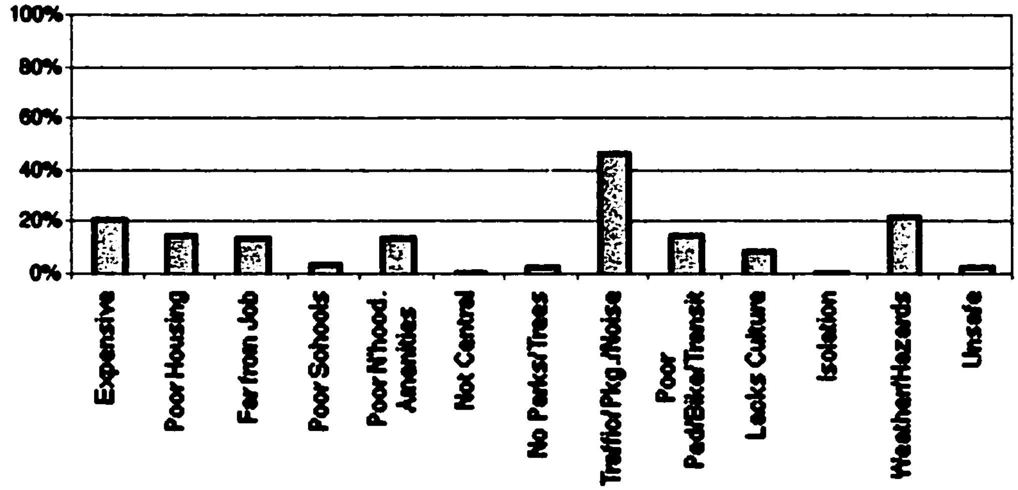
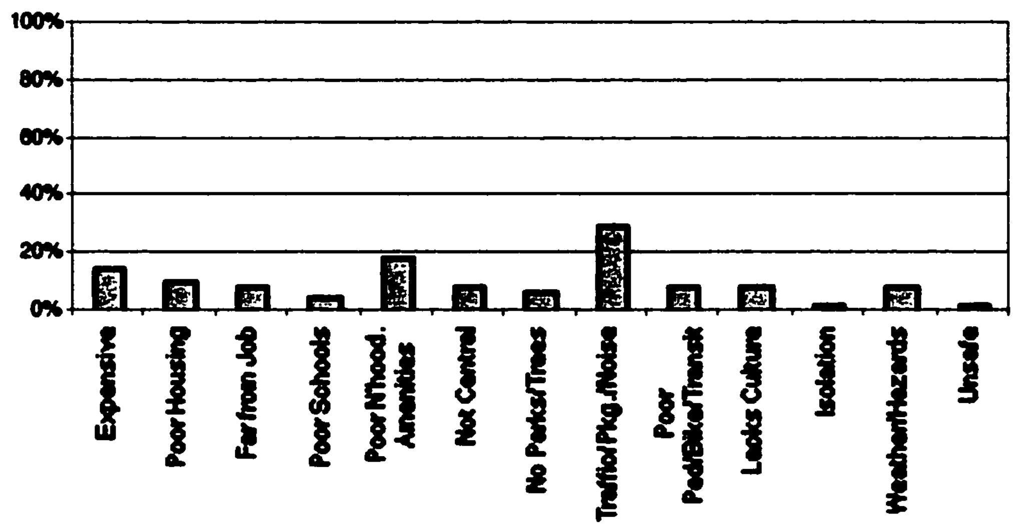


Figure 5-2d. Fremont Respondents' Top Things Disliked About Neighborhood



The most immediate, and notable, conclusion from the results of this question is that - in confirmation of previous research (Fried 1986; Brower 1988; Taylor 1996), and in keeping with the overall high levels of satisfaction that respondents have with their neighborhoods - respondents simply did not identify negative factors (detractors) as readily as attractants. As the data indicates, there were only *two* categories that registered over 25% of respondents in any neighborhood, as contrasted with *seven* categories for neighborhood attractants in which figures of 25% (or greater) showed up. In addition, results indicate that there were greater similarities among the four neighborhoods with respect to detractors, than with the identification of attractants.

Nevertheless, some important trends emerge from this data. First, traffic and parking concerns ("traffic, parking, and street noise" category), stand out as the most frequently identified detractors in all four neighborhoods, ranging from a low of 29% of respondents in Fremont to a high of 54% in Rockridge. The range of these concerns includes: high traffic speeds on nearby roads, traffic congestion on neighborhood streets, lack of parking in residential and commercial areas of the neighborhood, and noise generated by traffic (e.g. highway noise; noise from major arterials, etc.). It is interesting to note how similar the concerns about these issues were in all four neighborhoods, despite the very different urban form characteristics pertaining to these features across the neighborhoods, as described in Chapter Four. One interpretation of this fact is that no matter what a given neighborhood's urban form configuration, its levels of traffic, and/or its parking availability, residents may always view these factors as problematic. These results also support a growing body of research evidence indicating that traffic concerns are becoming a more central issue for many individuals (Downs 1992; Cervero 1996; Newman and Kenworthy 1999; Talen 2001).

Beyond this category, "weather and environmental hazards" were the next most-frequently appearing category of concerns. Albany/North Berkeley respondents ranked this notably high, with 37% of respondents listing this as a major detractor; this is due to a large fraction of respondents in this neighborhood who live in the "hills" area, along the Hayward Fault, and who conveyed their hesitation over moving into an earthquake-prone residential area. Walnut Creek respondents, 22% of who listed this category as a major detractor, focused their concerns primarily on the hot inland climate of their region in the summer.

The more traditional category targeting housing size and features ("poor housing stock and amenities") featured more prominently as a major detractor with Rockridge, Albany/North Berkeley, and Walnut Creek respondents than with those in Fremont, at 17%, 20%, and 16% of respondents, respectively, versus Fremont's 10%. Complaints from Rockridge and Albany/North Berkeley residents focused primarily on dissatisfaction with lot size (e.g. too small), while Walnut Creek respondents - where average lot size is larger - commented on concerns about housing stock quality (e.g. flimsy construction) and particular features and amenities. "Lack of affordability," another more traditional concern, was also cited as a major detractor for 15% of respondents in Rockridge, Albany/North Berkeley, and Fremont, while Walnut Creek respondents cited it slightly more frequently, at 21% of respondents. This result would appear somewhat surprising, given the large body of research (discussed above) which cites this as the defining factor for most individuals, and given the high cost of living associated with the San Francisco Bay Area. However, as with its less-than-expected presence as an attractant (Question 2-3), this survey's respondents simply don't appear to view housing amenities and features with the same degree of importance that it has taken in other studies.

Respondents in all four neighborhoods also expressed some concerns over general neighborhood ambiance and amenities, as shown in the category, "lack of neighborhood amenities and ambiance." In particular, nearly one-fifth of Fremont respondents stated that when first looking at the neighborhood, they were concerned by its overall lack of unique atmosphere, and/or its lack of a wide variety of amenities. Wrote one, "the neighborhood would benefit from more tree-lined streets...a few upscale restaurants and a look that is uniquely its own. Enough already of the homogenized look!" Walnut Creek respondents, 14% of whom listed this as a major detractor, expressed similar concerns over the blandness of the neighborhood, and the lack of some more "urban" amenities that they would like (respondents often listed this in conjunction with a perceived lack of diversity in the neighborhood).

Significantly, a perceived absence, or dissatisfaction, with pedestrian, bicycle, and transit amenities did register as a relatively frequent detractor for respondents in all but Fremont, once again confirming Fremont as the outlier with respect to this issue. Albany/North Berkeley and Walnut Creek respondents, in particular, showed a relatively high degree of concern with their neighborhood's level of transit availability and pedestrian amenities, with 16% of respondents in each neighborhood listing this as a major detractor. While the actual percentages are an indicator of this category's importance, equally significant is that these figures also imply that these respondents placed enough importance on these factors to notice their absence or limitations. Several residents of the North Berkeley hills, for example, complained that it is "too far to walk to stores," while respondents in Walnut Creek noted that, "the buses are so infrequent that I don't use them."

Data for the remaining categories, "distance from job," "poor or distant schools," "lack of centrality and convenience," "lack of parks, open space, and trees," "lack of culture and diversity," and "isolation" suggests that while these issues did register as concerns for some respondents when choosing to live in the neighborhood, they generally did not appear as one of the major detractors identified. Moreover, respondent data for these categories is generally similar across the four neighborhoods, with occasional variations (e.g. "poor and distant schools," and "distance from job").

In sum, traffic and parking concerns (including noise generated by traffic) stand out as the overwhelming detractors for respondents in all four neighborhoods when they were choosing to live there, confirming recent research that points to the growing dissatisfaction that residents express over these issues. The factors traditionally cited as being most important to residential location decisions - lot size and price - did not appear as frequently (either as attractants or detractors) as previous research would have suggested. Moreover, the non-traditional factor of poor pedestrian and transit amenities appeared at significant levels in all but one neighborhood, suggesting that these issues *are* noticed in residential location decisions, and - as results for Question 2-3 indicate - can have a major impact on those decisions.

Apart from the specific responses themselves, both the type of responses across the four neighborhoods and the distribution of those responses across various categories, suggest that Fremont respondents had less complex, or interwoven, reasons for moving to their neighborhood as compared to respondents in Rockridge, Albany/North Berkeley, and to a lesser degree, Walnut Creek. Moreover, Fremont respondents were concentrated in the more traditional categories of attractants and detractors, while respondents in Rockridge, Albany/North Berkeley, and Walnut Creek covered a much broader range of issues.

Residents' Use of Neighborhoods

While Questions 2-3 and 2-4 targeted respondents' perceptions of their neighborhoods prior to moving there, the remaining portion of Section Two of the survey (Questions 2-5 through 2-11) focused on respondents' *current* perceptions about and use of their neighborhoods. The neighborhood area roughly corresponds to the "general environs" area surveyed and analyzed for each case study in Chapter Four.

Data for respondents' perceptions about the quality of services available in the neighborhoods is fairly similar across Rockridge, Albany/North Berkeley, and Walnut Creek, with over two-thirds of the respondents in each neighborhood agreeing (or strongly agreeing) that the adult educational facilities, cultural opportunities, and the mix of local stores are good (Table 5-10). Rockridge deviated from this trend with respect to the availability of parks and open space, about which Rockridge respondents expressed a strong sentiment that these facilities are lacking in their neighborhood. By contrast, Fremont respondents differed from the rest of the group in several areas. Fremont showed a high fraction of respondents indicating that cultural opportunities are limited in their neighborhood, as well as a good mix of local store. Moreover (and perhaps not surprisingly given the perceived lack of certain types of services), the Fremont respondents indicated that they do not use their local facilities as much as respondents do in the other three neighborhoods.

Table 5-10. Perceptions About Use and Services of Neighborhood*

Question Topic	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Adult Educational Facilities are Good				
Strongly Disagree	5%	0%	0%	0%
Disagree	4%	1%	1%	8%
Partially Agree	12%	9%	5%	10%
Agree	35%	42%	54%	44%
Strongly Agree	38%	44%	29%	21%
Don't Know or N/A**	7%	4%	11%	17%
Many Cultural Opportunities Available				
Strongly Disagree	2%	1%	0%	6%
Disagree	6%	11%	9%	23%
Partially Agree	20%	9%	11%	17%
Agree	31%	37%	42%	40%
Strongly Agree	39%	41%	32%	4%
Don't Know or N/A	1%	1%	5%	10%
Good Mix of Local Stores				
Strongly Disagree	2%	5%	1%	2%
Disagree	7%	3%	4%	17%
Partially Agree	23%	15%	17%	25%
Agree	26%	44%	37%	48%
Strongly Agree	40%	32%	39%	8%
Don't Know or N/A	7%	0%	1%	0%
Respondent Uses Many Local Facilities				
Strongly Disagree	2%	1%	0%	2%
Disagree	4%	5%	3%	4%
Partially Agree	15%	11%	7%	23%
Agree	37%	51%	53%	50%
Strongly Agree	42%	32%	36%	21%
Don't Know or N/A	0%	0%	1%	0%
Ample Parks and Open Space				
Strongly Disagree	19%	2%	0%	4%
Disagree	25%	9%	3%	6%
Partially Agree	27%	19%	13%	19%
Agree	17%	43%	38%	44%
Strongly Agree	11%	26%	43%	25%
Don't Know or N/A	1%	1%	3%	2%

* Data areas of note have been highlighted
** N/A = "Not Applicable"

Community Qualities of Neighborhoods

Respondents in all four neighborhoods express a high degree of similarity in overall perceptions about the community qualities of their neighborhoods (Table 5-11). By-and-large, respondents expressed some ambivalence about the degree to which they interact with their neighbors; a majority (over 50%) of the respondents in each neighborhood agreed (or strongly agreed) that they interact with their neighbors, but likewise, a substantial fraction were only in partial agreement (or didn't agree) with this statement. Even more respondents indicated that their home is not near to their friends. However, the vast bulk of respondents affirmed that their neighborhood is a good environment for children, with Rockridge respondents expressing slightly less agreement with this sentiment.

Table 5-11. Perceptions About Community Qualities of Neighborhood

Question Topic	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Respondent Interacts with Neighbors				
Strongly Disagree	1%	1%	1%	6%
Disagree	8%	8%	7%	13%
Partially Agree	25%	32%	18%	29%
Agree	43%	38%	47%	40%
Strongly Agree	23%	20%	25%	13%
Don't Know or N/A**	0%	1%	1%	0%
Respondent is Close to Friends				
Strongly Disagree	12%	5%	1%	6%
Disagree	15%	19%	17%	21%
Partially Agree	36%	36%	33%	25%
Agree	23%	32%	32%	29%
Strongly Agree	14%	5%	14%	8%
Don't Know or N/A	0%	2%	3%	10%
Good Environment for Children				
Strongly Disagree	2%	1%	0%	0%
Disagree	13%	4%	4%	2%
Partially Agree	32%	13%	14%	13%
Agree	27%	47%	43%	44%
Strongly Agree	12%	22%	25%	23%
Don't Know or N/A	13%	13%	13%	19%

* Data areas of note have been highlighted
** N/A = "Not Applicable"

Visual and Aesthetic Qualities of Neighborhoods

A majority of respondents in all four neighborhoods appear, overall, to view their neighborhoods as attractive, both in terms of architecture and landscaping (Table 5-12). With respect to housing, residential landscaping, and residential streets, nearly two-thirds (or more) of respondents in all four neighborhoods agreed (or strongly agreed) that these features are attractive. Even in Rockridge, which had a slightly higher percentage of respondents (11%) than the other neighborhoods disagreeing with this statement vis-à-vis residential landscaping, a full 65% of Rockridge respondents still agreed or strongly agreed with the statement. Commercial streets were viewed somewhat differently; while a majority of Rockridge, Albany/North Berkeley, and Walnut Creek respondents felt that their commercial streets are attractive, Fremont respondents were not so complimentary, with a full 42% of respondents expressing only partial agreement with that statement, and another 10% simply disagreeing. By contrast, Walnut Creek respondents were notably enthusiastic about the streets in their commercial area, with 80% saying that they are attractive.

Table 5-12. Perceptions About Attractiveness of Neighborhood*

Question/ Topic	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Houses Are Attractive				
Strongly Disagree	0%	1%	1%	0%
Disagree	4%	0%	1%	2%
Partially Agree	20%	19%	17%	21%
Agree	33%	42%	55%	33%
Strongly Agree	40%	34%	22%	29%
Don't Know or N/A**	2%	4%	3%	4%
Residential Landscaping Attractive				
Strongly Disagree	0%	1%	1%	0%
Disagree	11%	4%	1%	2%
Partially Agree	21%	26%	24%	23%
Agree	40%	44%	53%	56%
Strongly Agree	25%	24%	20%	19%
Don't Know or N/A	1%	0%	1%	0%
Residential Streets Attractive				
Strongly Disagree	1%	1%	1%	0%
Disagree	6%	4%	4%	6%
Partially Agree	30%	24%	22%	21%
Agree	42%	44%	53%	54%
Strongly Agree	21%	26%	18%	19%
Don't Know or N/A	0%	0%	1%	0%
Commercial Streets Attractive				
Strongly Disagree	4%	2%	1%	0%
Disagree	8%	4%	7%	10%
Partially Agree	27%	35%	11%	42%
Agree	39%	41%	50%	35%
Strongly Agree	19%	15%	30%	8%
Don't Know or N/A	2%	2%	1%	4%

* Data areas of note have been highlighted
** N/A = "Not Applicable"

Overall, Rockridge, Albany/North Berkeley, and Walnut Creek respondents generally agreed that their neighborhoods offer a good mix of services and facilities, and that they use these facilities relatively frequently. By contrast, Fremont respondents stated that they are not as satisfied with the range of neighborhood services and facilities, and use their neighborhood facilities on an infrequent basis. Respondents in all four neighborhoods appeared to have similarly mixed views about the community qualities of their neighborhoods, stating that while they are good environments for children, interactions with neighbors and proximity of friends are less consistent. Respondents in all four neighborhoods also felt that their residential neighborhoods are attractive, both in terms of architecture and landscaping, although Fremont respondents did not feel as keenly about their commercial streets.

Access (Walk/Vehicle) Around Neighborhood

Respondents' perceptions about access around their neighborhood presents some of the greatest differences among the four case study neighborhoods. While the majority of respondents in all four neighborhoods agreed that vehicle access is easy, one-quarter or more of respondents in Albany/North Berkeley, Walnut Creek, and Fremont, felt that non-auto access (which includes walking, bicycling, public transit, scooters, etc.) is *not* easy (Table 5-13). And in both Walnut Creek and Fremont, roughly another one-quarter of respondents was ambivalent about the ease of non-auto access, stating that they only partially agreed with the statement. By contrast, a full three-quarters of Rockridge respondents felt that non-auto access in their neighborhood is easy; most remarkably, of that group, 44% strongly agreed with the statement, indicating that Rockridge respondents view their neighborhood as a highly walkable, bikeable, and transit-friendly environment - a viewpoint which confirms the urban form conclusions reached in Chapter Four.

Table 5-13. Perceptions About Accessibility Around Neighborhood*

Question Topic	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Auto Access is Easy				
Strongly Disagree	1%	2%	1%	0%
Disagree	6%	3%	3%	0%
Partially Agree	13%	11%	12%	6%
Agree	39%	57%	49%	31%
Strongly Agree	36%	25%	34%	63%
Don't Know or N/A**	5%	1%	1%	0%
Non-Auto Access is Easy				
Strongly Disagree	2%	11%	9%	10%
Disagree	11%	15%	24%	17%
Partially Agree	11%	19%	26%	23%
Agree	31%	34%	21%	33%
Strongly Agree	44%	21%	13%	10%
Don't Know or N/A	1%	0%	7%	6%

* Data areas of note have been highlighted
** N/A = "Not Applicable"

A more detailed break-down of respondents' perceptions about specific aspects of non-auto access is also revealing, and presents striking trends among the four neighborhoods (Table 5-14). Respondents in all four neighborhoods basically agreed that their neighborhoods are easy and enjoyable to walk in, with at least two-thirds of respondents in all four neighborhoods falling in the "agree" or "strongly agree" range. Surprisingly, Fremont respondents were no less decisive about this assessment than other respondents, despite the urban form issues discussed in Chapter Four, and some of the survey results discussed earlier in this chapter (although further results presented below may provide an explanation of this point).

Table 5-14. Perceptions About Non-Auto Access Around Neighborhood*

Question Topic	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Easy and Enjoyable to Walk				
Strongly Disagree	1%	1%	0%	4%
Disagree	5%	0%	7%	4%
Partially Agree	21%	17%	12%	17%
Agree	30%	46%	43%	44%
Strongly Agree	42%	37%	37%	29%
Don't Know or N/A**	1%	0%	1%	2%
Easy and Enjoyable to Bicycle				
Strongly Disagree	4%	4%	0%	4%
Disagree	10%	13%	8%	8%
Partially Agree	18%	23%	20%	21%
Agree	17%	33%	37%	27%
Strongly Agree	30%	16%	30%	29%
Don't Know or N/A	21%	10%	5%	10%
Easy to Use Transit				
Strongly Disagree	2%	4%	4%	8%
Disagree	2%	8%	12%	10%
Partially Agree	14%	25%	26%	19%
Agree	30%	46%	26%	29%
Strongly Agree	50%	15%	18%	17%
Don't Know or N/A	1%	1%	13%	17%

* Data areas of note have been highlighted
** N/A = "Not Applicable"

Respondents were somewhat less unanimous in their assessment of the ease of bicycling; in all but Walnut Creek, at least 10% of respondents disagreed or strongly disagreed with the statement that "it is easy and enjoyable to bicycle [there]," and an additional 20% (or more) of respondents only partially agreed with that statement. Walnut Creek respondents were the most approving of the bicycling environment, with over two-thirds agreeing or strongly agreeing that it is easy to bike in their neighborhood. Notably, a full 21% of Rockridge respondents stated that they "don't know," or that the question did "not apply."

Ease of transit use produced a wide variation in responses among the neighborhoods, with Rockridge and Albany/North Berkeley respondents in basically strong agreement (over 60%) that it is easy to use transit in their neighborhoods, while Walnut Creek and Fremont respondents had a much higher concentration of responses (roughly 40%) in the "strongly disagree," "disagree," and "partially agree" ranges. Equally significantly, both of these neighborhoods had a significant fraction of respondents stating that - as with bicycling in Rockridge - they "don't know," or that the question did "not apply."

Travel Behavior Results: Statistical Analysis

Travel behavior, and in particular, walking behavior, in the four neighborhoods (again, roughly the "general environs" of the urban form surveys discussed in Chapter Four) was analyzed through a series of travel behavior questions in the mail-back survey, a one-day trip diary included as part of the mail-back survey, and actual pedestrian counts (as discussed and presented in Chapter Four). These various sets of questions provide a robust set of data relating both to overall travel behavior as well as specific breakdowns in modes of travel, and highlight several significant trends across the four neighborhoods.

Overall Trips and Travel Behavior

An analysis of one-day trip diaries from the mail-back survey (Table 5-15) indicates that Rockridge, Albany/North Berkeley, and Walnut Creek have roughly equal overall trips per individual, at a median of six trips per respondent, while Fremont is significantly lower at four median trips per individual.[11] Median values are more similar (in Rockridge, Albany/North Berkeley, and Walnut Creek), due to the fact that in these

[11] While the absolute values for total trips display wide variations as well, these can be misleading, since the sample sizes across the four neighborhoods were variable as well - e.g. Fremont had significantly fewer respondents than Rockridge, so absolute values for total trips would be expected to be lower. Therefore, this analysis focuses on median values and fractions (percentages) of total trips, which by definition incorporate proportional variations into calculations.

neighborhoods, there were a number of respondents who had far more trips than the median (or mean), and thus accounted for a large fraction of the total trips in those neighborhoods. For example, as indicated in the wide variations of trip ranges, one respondent in Rockridge had a total of seventeen trips in their one-day trip diary; a number of other respondents in that neighborhood also had high numerous total trips at this level. By contrast, only one respondent in Fremont had a high number of total trips (fifteen), while nearly every other respondent in that neighborhood had a much lower number of total trips, resulting in a lower median overall.

Table 5-15. Total Trips Made (from one-day trip diary)

	Total Trips	Range	Mean	Median
Rockridge	500	0-17	6.3	6
Albany/No. Berkeley	414	1-11	5.8	6
Walnut Creek	283	0-17	6.0	6
Fremont	250	2-15	5.4	4

A breakdown of trip modes for the total trips reveals a far more varied scenario, however (Table 5-16). Rockridge, which has a high median total trip value (noted above), has the *lowest* median trip value for *vehicle* trips (defined to be trips by automobile, sport-utility vehicle, truck, etc.), at a median value of three trips per respondent. In other words, of the trips that Rockridge respondents are making, only about *half* of these are vehicle trips. By contrast, Walnut Creek, which has the same median value for total trips as Rockridge (six trips per respondent), also has a high median value for vehicle trips - i.e. Walnut Creek respondents are also making a lot of trips, but these trips are being made primarily by vehicles. The Fremont data, which exhibits a median value of four trips per respondent for *both* total trips and vehicle trips, indicates that Fremont respondents are taking somewhat fewer trips than respondents in the other four neighborhoods, and that nearly all of these trips are vehicle trips.

Albany/North Berkeley rests somewhere in the middle (relative to the four neighborhoods), with a high median value for total trips (six trips per respondent), but a somewhat lower vehicle trip median of four trips per respondents. Hence, of the trips taken by Albany/North Berkeley residents, about two-thirds of those are vehicle trips.

Table 5-16. Trips by Auto/SUV/Van/Pickup (from one-day trip diary)

	Total Trips	Range	Mean	Median
Rockridge	272	0-15	3.4	3
Albany/No. Berkeley	381	0-10	4.4	4
Walnut Creek	245	0-12	5.2	5
Fremont	221	0-15	4.8	4

A more explicit summary of this split between vehicle trips and non-vehicle trips (termed "non-auto" trips in the summary tables), and the significant differences in this behavior across the four neighborhoods, is presented in Table 5-17. As this summary indicates, Rockridge respondents are clearly taking far more non-vehicle trips (46% of total trips) than respondents in the other four neighborhoods, although Albany/North Berkeley respondents are also making a relatively high fraction of non-vehicle trips, at nearly one-third of total trips for that neighborhood. Moreover, the actual fraction of Rockridge non-vehicle trips - 46% - is remarkable in and of itself; it indicates an unusually high level of non-vehicle activity when contrasted with what are considered "typical" travel behavior patterns, as discussed in Chapter Two. In Walnut Creek and Fremont, by comparison, respondents are making the bulk of their trips by vehicle, with non-vehicle trips comprising only 16% and 12% of the total, for Walnut Creek and Fremont, respectively.

Table 5-17. Non-Auto* Trips as Fraction of Total Trips Across Neighborhoods (from one-day trip diary)

	Total Trips	Total Non-Auto Trips	Non-Auto Fraction of Total Trips
Rockridge	500	228	46%
Albany/No. Berkeley	414	125	30%
Walnut Creek	283	44	16%
Fremont	250	29	12%

*"Non-Auto Trips" is the Sum of Walking, Bicycling, and Transit Trips

Significantly, this data correlates - at least in its broad strokes - with the "walkability" spectrum conclusions reached for the four neighborhoods in Chapters Three and Four - i.e. that urban form configurations would suggest a spectrum ranging from Rockridge (most walkable), to Albany/North Berkeley, to Walnut Creek, and finally to Fremont (least walkable). However, the data presented above also suggests, at first pass, a large gap in non-vehicle trips between the first two neighborhoods on the spectrum, and the latter two - i.e. a large shift in travel behavior, rather than another incremental step along the spectrum.

A partial explanation for this trend may be found in the Walnut Creek trip diary data. As actual pedestrian counts for Walnut Creek (presented in Chapter Four) have shown, the central study area of Walnut Creek exhibits a very high level of pedestrian activity. Strikingly, this level of activity is not reflected in the Walnut Creek trip diaries (as evidenced by the data presented above). A review of those trip diaries indicates that Walnut Creek respondents, by-and-large, did not separate out their walking trips within the downtown core, as opposed to residents in Rockridge, Albany/North Berkeley, and Fremont, who appeared to do so. It is unclear why that is the case, since the instructions and sample trip diary were identical for all surveys. Nevertheless, the detailed trip diary descriptions of Walnut Creek respondents' activities conducted while on a particular trip clearly indicate that a number of such "within-downtown" walking trips were omitted from the diary - or more precisely, were encompassed in one *vehicle* trip to and from the downtown core.

As a result of these omissions, the Walnut Creek trip diaries understate the number of walking trips made in that neighborhood. And by extension, the non-vehicle trip figures reported above (as well as specific walking trip data discussed below) are understated, impacting the associated median figures, total trip figures, and the fraction of total trips made by vehicle versus non-vehicle. While the trip diaries could not be altered directly to address this issue (it would be impossible to determine exactly how many walking trips to add to the total Walnut Creek figures), in looking at the data presented, this understatement should be kept in mind, and applied in overall assessments of differences among the four neighborhoods. In the case of the analysis above, the understatement leads to a larger gap between neighborhoods (with respect to non-vehicle trips) than one might have expected. Incorporating this data issue, the non-vehicle trip data would likely exhibit a more consistently incremental pattern across the four neighborhoods. In further analyses below, I have noted where this issue is a concern, and where and how it might impact conclusions.

Walking Trips and Travel Behavior

Walking trip data (from the trip diaries) further elaborate on the trends for vehicle and non-vehicle trip data presented above for the four neighborhoods (Table 5-18). Of the four neighborhoods, only Rockridge has a non-zero median value for walking trips (one trip per respondent), which can lead to the mistaken perception that no walking trips are being made in the remaining neighborhoods. However, the absolute number of total walking trips per neighborhood indicates that Albany/North Berkeley residents are making a significant number of walking trips as well, at 95 total trips. Walnut Creek shows a much lower absolute value for walking trips, although this figure would certainly be higher if all respondents' walking trips downtown had been included in the trip diaries, as discussed above. While at first glance Fremont's total walking trip data would appear to round out the bottom of the spectrum again, it must also be qualified. The Fremont respondent sample size is significantly smaller than the other neighborhood's samples, so the absolute value of total walking trips would be expected to be lower than for the other four neighborhoods, even if walking trip rates are similar. Since the median value must be a whole number, and in this case is zero, the total walking trip data alone is only partially conclusive for Fremont.

Table 5-18. Trips by Walking (from one-day trip diary)

	Total Trips	Range	Mean	Median
Rockridge	163	0-11	2.1	1
Albany/No. Berkeley	95	0-8	1.1	0
Walnut Creek	26	0-6	0.6	0
Fremont	17	0-4	0	0

As with the analysis of vehicle and non-vehicle trips, however, a breakdown of walking trips as a fraction of *total* trips does provide conclusive statements, since by definition, proportional relationships incorporate differences in sample size across the neighborhoods. Through this analysis (Table 5-19), it is again clear that Rockridge, followed by Albany/North Berkeley, exhibit the highest fraction of walking trips as a percentage of total trips, at 33% and 23%, respectively. By contrast, Fremont is, indeed at the low end of the spectrum, with walking trips comprising only 7% of total trips. Walnut Creek, while also low at 9%, can be assumed to be somewhat higher if the omitted downtown walking trip data had been included. Once again, the walking trip data correlates with the hypothesized walkability spectrum for the four neighborhoods outlined in Chapters Three and Four.

Table 5-19. Walking Trips as Fraction of Total Trips Across Neighborhoods (from one-day trip diary)

	Total Trips	Total Walking Trips	Walking Fraction of Total Trips
Rockridge	500	163	33%
Albany/No. Berkeley	414	95	23%
Walnut Creek	283	26	9%
Fremont	250	17	7%

The trip diary data was supplemented by additional questions regarding general respondent travel behavior, including questions about commute travel modes and frequency. Respondents in Rockridge once again displayed the highest frequency of walking trips, with 20% of respondents stating that they walk to their job (or a walk trip is included as part of the total trip) six times or more per month (Table 5-20). Albany/North Berkeley, Walnut Creek, and Fremont all had significantly fewer respondents in that category, at 10%, 8%, and 6%, respectively - although these figures do still reflect the general parameters of the walkability spectrum. The more central point in these figures appears to be that a significant fraction of Rockridge respondents include walk trips on a regular basis as part of their job commute, as opposed to the other three neighborhoods, where walking appears to be a more peripheral aspect of most respondents' job commute.

Table 5-20. Home-Job Travel Mode: Walk Frequency

	0-1 times/month	2-3 times/month	3-5 times/month	6+ times/month
Rockridge	75%	3%	2%	20%
Albany/No. Berkeley	82%	7%	1%	10%
Walnut Creek	88%	3%	0%	8%
Fremont	88%	6%	0%	6%

Bicycling and Transit Trips and Travel Behavior

As discussed in Chapter Two, New Urbanist programs and prescriptions generally include increased use of bicycling and public transit as parallel items to increased pedestrian activity, since a general reduction in automobile use is a primary aim of New Urbanist designs. Moreover, there can be close correlations between transit and pedestrian activity levels, since the two modes are often used in combination with each other in travel behavior (see Chapter Two). In view of these facts, this survey included questions about frequency and modes of bicycle and transit use, as a way to supplement the more central aim of assessing pedestrian behavior and activity levels.

Bicycling activity levels, as analyzed through both the one-day trip diaries (Table 5-21), and frequency of bicycle use in job commutes (Table 5-22), appear to be relatively insignificant across all four neighborhoods. Median values for total bicycle trips is zero for all four neighborhoods, while well under 10% of respondents in all but Rockridge use bicycling as part of their job commute six times or more per month. In Rockridge, this figure was slightly higher, at 13% of the neighborhood's survey respondents, again reiterating Rockridge's position as an environment that promotes non-vehicle travel behavior.

Table 5-21. Trips by Bicycling (from one-day trip diary)

	Total Trips	Range	Mean	Median
Rockridge	27	8	0.3	0
Albany/No. Berkeley	16	3	0.2	0
Walnut Creek	8	2	0.1	0
Fremont	0	0	0	0

Table 5-22. Home-Job Travel Mode: Bicycling Frequency

	0-1 times/month	2-3 times/month	3-5 times/month	6+ times/month
Rockridge	81%	4%	2%	13%
Albany/No. Berkeley	91%	0%	3%	6%
Walnut Creek	97%	1%	0%	1%
Fremont	98%	2%	0%	0%

Use of transit, as analyzed through trip diaries and job commute mode questions, appears to be a more significant travel mode for Rockridge, Albany/North Berkeley, and Walnut Creek respondents. While median values for total transit trips from the one-day trip diaries were zero for these three neighborhoods (Table 5-23), when asked about general frequency of transit use for job commutes, data suggests that a significant fraction of these respondents use transit six or more times per month, with Rockridge at a high of 24%, and Walnut Creek and Albany/North Berkeley roughly equal at about 14% (Table 5-24). Despite the central presence of BART in Fremont, and the associated bus hub, Fremont respondents appear to rarely use transit, as indicated by both the trip diary data, and the job commute mode data.

Table 5-23. Trips by Public Transit (from one-day trip diary)

	Total Trips	Range	Mean	Median
Rockridge	38	4	0.5	0
Albany/No. Berkeley	14	2	0.2	0
Walnut Creek	10	4	0.1	0
Fremont	12	8	0.3	0

Table 5-24. Home-Job Travel Mode: Public Transit Frequency

	0-1 times/month	2-3 times/month	3-5 times/month	6+ times/month
Rockridge	71%	4%	1%	24%
Albany/No. Berkeley	79%	3%	3%	14%
Walnut Creek	86%	1%	0%	13%
Fremont	90%	2%	0%	8%

In conclusion, travel behavior across the four neighborhoods does differ significantly, as analyzed through the survey's one-day trip diaries and supplemental travel behavior questions. Specifically:

1) Rockridge has the highest non-vehicle trip percentage of any of the four case study neighborhoods, and conversely, the lowest fraction of vehicle trips. Detailed

breakdowns of these non-vehicle trips also position Rockridge as having the highest walking, bicycle, and transit activity levels. Finally, Rockridge is the only one of the four neighborhoods that appears to have integrated walking trips into job commutes at a significant level.

2) In all categories of trip levels and travel behavior, Fremont exhibits the lowest fractions of walking, bicycling, and transit trips and frequency of use for those travel modes.

3) In spite of Walnut Creek's highly "walkable" downtown urban form and the high actual pedestrian counts for this central area (see Chapter Four), the neighborhood respondents' trip diaries do not reflect the expected higher number of walking trips that this would produce, because these respondents appear to have included "within downtown" walking trips as part of one overall vehicle trip to the downtown area. Therefore, walking trips are understated for Walnut Creek, which has impacted associated travel behavior trends.

4) Overall, in terms of pedestrian activity levels, the four neighborhoods fall out along the "walkability" spectrum that would be expected from the original case study selection spectrum described in Chapter Three, and the urban form conclusions reached in Chapter Four. Trip diary and travel behavior data both place Rockridge at the high end of the spectrum, with the highest pedestrian activity levels, followed by Albany/North Berkeley, Walnut Creek, and Fremont.

Use and Attitudes About Study Area Center (Shopping Area)

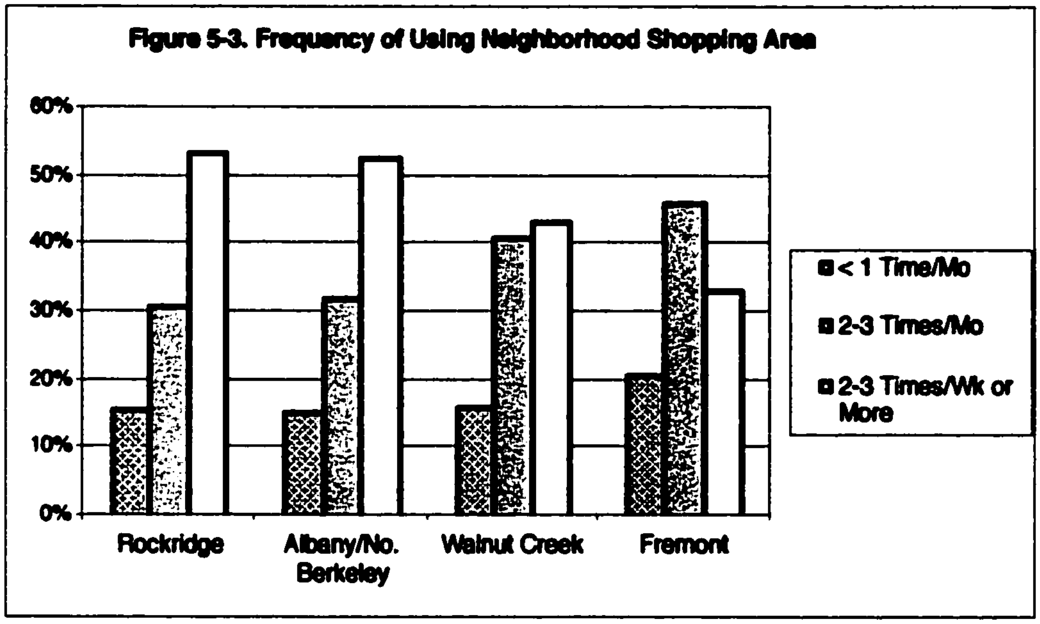
Section Four of the mail-back surveys focused on respondents' use of their neighborhood center, as defined by the roughly one-half mile diameter "site area" analyzed in Chapter Four, centered around the neighborhood shopping, or downtown, core (see Figures 4-2a through 4-2d). The questions in this section targeted respondents' general perceptions about the neighborhood shopping area, frequency of use of the shopping area, activities conducted in the shopping area, perceptions about the attractiveness of the shopping area's design, perceptions about the "walkability" of the shopping area, and finally, specific questions about walking frequencies in the shopping area. The aim of these questions was to link respondents' perceptions of this "site area" with the independent urban form survey and analysis discussed in Chapter Four, and to determine what - if any - conclusions could be reached regarding urban form patterns and their impact on respondents' use of their neighborhood center.

General Perceptions About Neighborhood Shopping Area

Overall, respondents in Rockridge and Albany/North Berkeley use their central shopping areas (centered at College and Shafter Avenues, and the eastern half of Solano Avenue, respectively) the most frequently of the four neighborhoods, and at roughly equal rates (Table 5-25). In fact, just over one-half of the respondents in both neighborhoods use these shopping centers on a regular basis, at two-to-three times per week, or more. Walnut Creek respondents are also regular users of their downtown core, although at slightly lesser frequency, with 43% of respondents in the highest frequency category, and another 41% at the more occasional rate of two-to-three times per month. Fremont respondents, by contrast, use their central shopping area (Fremont Hub to Gateway Plaza area) at a substantially lower rate, with only one-third of respondents using it two-to-three times per week (or more), and a full one-fifth of respondents stating that they use it less than one time per month.

Table 5-25. Frequency of Using Neighborhood Shopping Area

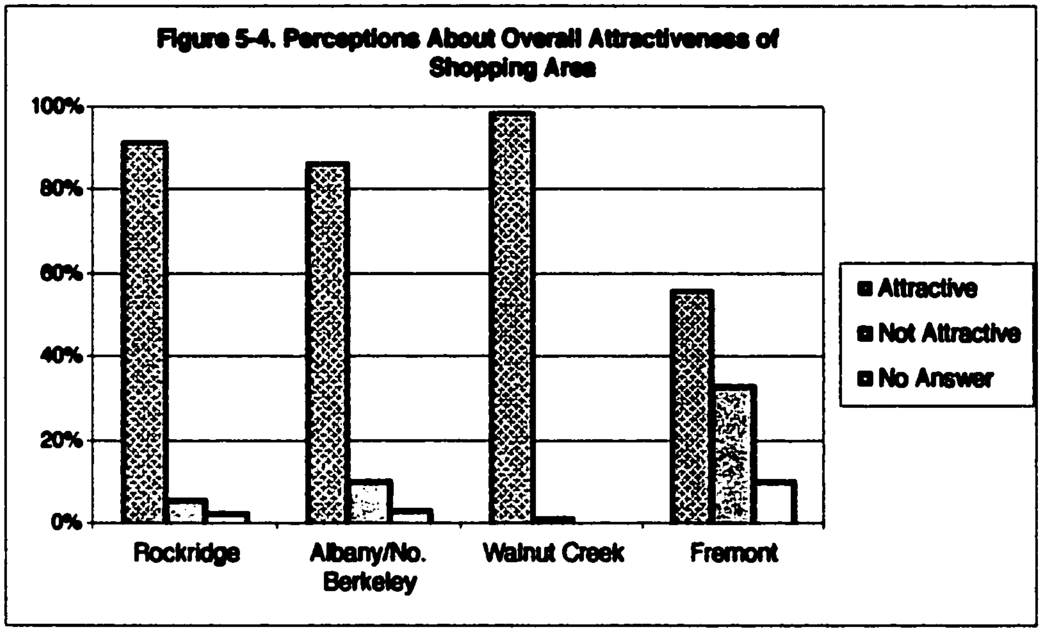
	< 1 time/month	2-3 times/month	2-3 times/week or more
Rockridge	15%	31%	54%
Albany/No. Berkeley	15%	32%	53%
Walnut Creek	16%	41%	43%
Fremont	21%	46%	33%



If the perceived overall attractiveness of a shopping area or neighborhood center has any impact on the frequency of its use, as has been hypothesized in this dissertation (i.e. it is an element of urban form), then respondents' perceptions about their neighborhood centers should show some correlation with the rate of use discussed above. And indeed, this relationship appears to hold for these case studies, as described in Table 5-26, which indicates that an overwhelming majority of respondents (87% or more) in Rockridge, Albany/North Berkeley, and Walnut Creek view their neighborhood center as attractive, as compared to Fremont, where a full one-third of respondents state that their neighborhood center is not attractive (Question 4-9 of survey).

Table 5- 26. Perceptions About Overall Attractiveness of Shopping Area

	Attractive	Not Attractive	No Answer
Rockridge	92%	6%	2%
Albany/No. Berkeley	87%	10%	3%
Walnut Creek	99%	1%	0%
Fremont	56%	33%	10%



Even more illuminating are the results of respondents' perceptions about the general sociability - or in Banerjee's terms, "conviviality"[12] - of the neighborhood center discussed earlier (Table 5-27). When asked if they felt their shopping area was a "...good place to 'hang out,' socialize, etc." (Question 4-10 of the survey), a mere 13% of Fremont respondents answered "yes," while nearly *one-half* of respondents answered "no," leaving the remainder with "mixed feelings" - hardly a ringing endorsement of the interactive qualities of the neighborhood center! By contrast, respondents in the other three neighborhoods expressed much greater satisfaction with the sociability aspects of

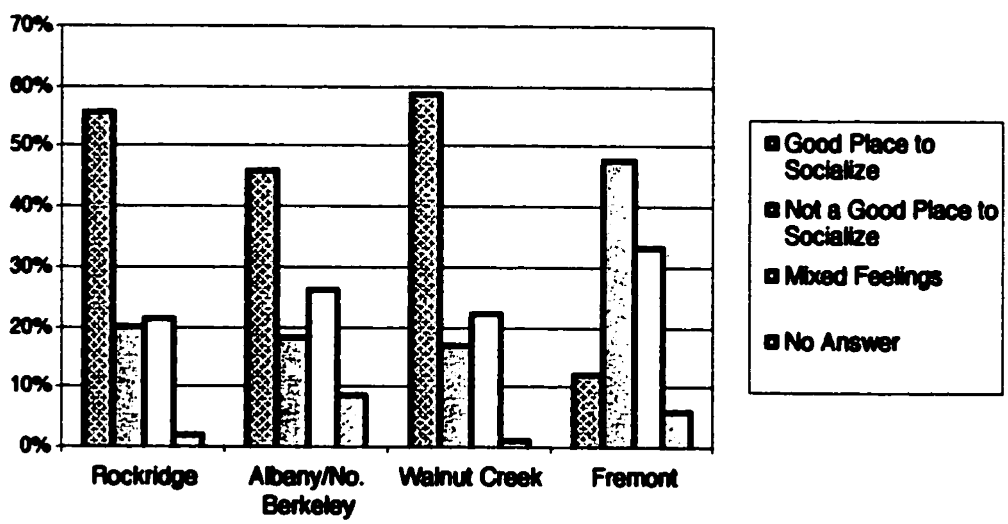
[12] Banerjee, 2001.

their neighborhood centers, with almost 50% (or more) of respondents stating it is a good place to socialize, and only 20% (or less) answering "no" to that question.

Table 5-27. Shopping Area as A Good Place to Socialize

	Good Place to Socialize	Not a Good Place to Socialize	Mixed Feelings	No Answer
Rockridge	56%	20%	21%	2%
Albany/No. Berkeley	46%	19%	26%	9%
Walnut Creek	59%	17%	22%	1%
Fremont	13%	48%	33%	6%

Figure 5-5. Shopping Area as A Good Place to Socialize



In short, Rockridge, Albany/North Berkeley, and Walnut Creek respondents use their neighborhood shopping center relatively frequently, and view it as both visually and socially attractive. By contrast, Fremont respondents patronize their local shopping core much less, with a substantial fraction feeling it is simply not attractive, and only a small percentage feeling that it offers a good social environment.

Activities Conducted in Shopping Area

These overall trends are also reflected in more detailed explorations of the types and breadth of activities conducted in the neighborhood core, as indicated by Table 5-28. As we have seen, all four neighborhoods, as described through their urban form configurations, offer equivalent varieties of land uses in their neighborhood cores, although the density and layout of these services vary (see Chapter Four). However, the activities conducted by respondents in these centers display some key differences among the four neighborhoods.

Table 5-28. Respondents' Activities Conducted in Neighborhood Shopping Area

Activities Conducted in Shopping Area	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Work	11%	2%	11%	2%
School (for self)	2%	0%	0%	0%
School (for children)	8%	1%	3%	4%
Grocery Shopping	74%	78%	49%	79%
General Shopping	50%	41%	82%	56%
Social/Recreational	45%	36%	55%	19%
Medical/Dental/Vet	13%	34%	33%	35%
Dining/Cafes	80%	80%	84%	52%
Entertainment	27%	57%	64%	40%
Personal Business	25%	46%	37%	23%
Other	6%	8%	3%	4%

At first glance, all four neighborhoods generally display a range of activity use consistent with the mixed-use New Urbanist models, as discussed in Chapter Two, with one major omission. "Work" does not appear in substantial fractions in any neighborhood, as one of the activities conducted by respondents. Only eleven percent of respondents in both Rockridge and Walnut Creek work in their neighborhood core, and even fewer in Albany/North Berkeley and Fremont.

Moreover, while Fremont respondents conduct a range of activities in their neighborhood shopping area, there are several activity categories in which the fraction of respondents is noticeably lower than in the other three neighborhoods. In particular, the percentages of respondents engaging in "social and recreational" activities and "dining out" (also a social activity, but separated out in the responses) are both substantially lower in Fremont than in any of the other neighborhoods. Given Fremont's lack of enthusiasm for the sociability of their neighborhood core (discussed in the previous section), this activity trend appears to confirm those general perceptions.

Finally, while each neighborhood has variations (relative to the other neighborhoods) in the levels of respondents engaging in a given category of activities, Fremont respondents appear, overall, to be engaging in the range of activities at lesser levels than respondents in Rockridge, Albany/North Berkeley, and Walnut Creek, with their activities concentrated in the more basic categories such as groceries and general shopping.

Most Attractive Elements of Neighborhood Shopping Area

As with the earlier survey questions regarding major attractants and detractors to the neighborhood as a whole (Questions 2-3 and 2-4), the survey included two open-ended questions asking respondents to identify their primary likes and dislikes of the neighborhood shopping core, in order to assess the degree to which these responses correlated with the independent urban form survey conclusions (regarding each neighborhood's "site area") analyzed and discussed in Chapter Four. As before, the questions were an open-ended structure, to ensure that responses would be independent assessments. Responses were then grouped into categories by general theme; the results are presented in the tables below (Table 5-29 and 5-30).

Table 5-29. Respondents' Views of Things Liked Most About Their Shopping Area

Things Liked Most About Shopping Area	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Good Selection/Variety	48%	48%	67%	25%
Parking Availability	7%	12%	16%	15%
Convenience/Proximity/Access	51%	46%	49%	46%
Affordability	2%	1%	0%	8%
Safety/Security	7%	8%	5%	2%
Good Restaurants/Food/Groceries	43%	26%	21%	6%
Employees/Merchant Friendliness	6%	7%	3%	2%
Shops Close Together	1%	6%	8%	0%
Specialty/Upscale	17%	26%	14%	2%
Attractive/Well-Maintained	10%	13%	42%	2%
Good Walking Area/Streetlife/Atmosphere	27%	27%	12%	0%
Good Parks/Open Space	1%	2%	1%	0%
Walk/Bike/Transit from Home	10%	14%	3%	2%
Entertainment/Movie/Recreation	0%	6%	0%	0%
Bart Access	2%	0%	0%	0%
Few Chain Stores/Unique	1%	1%	0%	0%
Particular Store(s) Liked	6%	17%	5%	17%

With respect to what respondents like *most* about their neighborhood shopping core, one striking trend is that Fremont residents simply don't like very much about it, other than its proximity, or convenience (Table 5-29). In fact, Fremont has less than 10% of respondents appearing in all but four (out of seventeen!) categories. By contrast, respondents in the other three neighborhoods express a wide range of "likes," with the greatest number of responses falling in the categories of "good selection and variety," "convenience and proximity," "good restaurants and specialty foods," "good upscale and specialty stores," and "attractive and well maintained."

Significantly, in addition to the trends listed above, over one-quarter of the respondents in both Rockridge and Albany/North Berkeley specifically stated that the good streetlife and walking atmosphere of their neighborhood center is one of their favorite things about it; twelve percent of Walnut Creek respondents also noted this as one of their favorite aspects of the place. "[You can] go out for coffee and be entertained for hours!" wrote one respondent. And several respondents remarked on the "European feel" of Rockridge's street scene. And, in both Rockridge and Albany/North Berkeley, a noticeable fraction of respondents (10% and 14%, respectively) also stated that the ability to walk, bicycle, or take transit to and from the neighborhood center is one of its major attractions. "[Everything is available on foot - no car usually needed," wrote one Albany respondent.

Elements of Shopping Area Disliked Most

As with overall "neighborhood detractors," discussed previously in this chapter, respondents in all four neighborhoods identified fewer things disliked about their neighborhood centers, than those liked (Table 5-30). Lack of parking was by far the biggest complaint for all four neighborhoods, with over 40% of respondents in Rockridge, Albany/North Berkeley, and Walnut Creek citing this as a major dislike, and nearly one-quarter of Fremont respondents saying the same. Surprisingly, despite widely varying parking availability across the four neighborhood shopping centers, it seems that everyone thinks there isn't enough. "Parking is almost always a difficulty," complained a Walnut Creek respondent. Even Fremont, with its expansive surface parking lots, does not meet a substantial fraction of its respondents' expectations. "It's too crowded...there's not enough parking at peak periods," wrote one Fremont resident.

Table 5-30. Respondents' Views of Things Disliked Most About Their Shopping Area*

Top Things Disliked About Shopping Area	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Traffic	26%	25%	47%	13%
Parking	43%	55%	51%	23%
Poor Quality	0%	1%	0%	8%
Limited Choices	5%	8%	4%	25%
Expensive	27%	8%	29%	2%
Limited Food	1%	2%	0%	8%
No Basic Stores	21%	19%	18%	10%
Poor Walk Access	10%	26%	16%	10%
Rudeness	2%	0%	0%	2%
Unsafe	13%	12%	1%	4%
Poor Landscaping	2%	5%	0%	2%
Crowded	11%	1%	13%	6%
Lack of Diversity	0%	0%	1%	0%
Chain Stores	0%	0%	1%	0%
Design Problems	4%	6%	0%	0%
No Entertainment	6%	5%	0%	2%

Traffic concerns - primarily congestion and slow traffic speeds (from the perspective of respondents trying to drive through the area) - also appeared frequently as a major dislike in all but Fremont, with one-quarter of Rockridge and Albany respondents citing these concerns, and nearly 50% of Walnut Creek respondents noting this as a major complaint. "[Solano Avenue] often has traffic problems - but I'm part of the problem!" wrote a North Berkeley resident. "Too much circling traffic," stated a Rockridge resident, while another fumed, "it's the invasion of the world into Rockridge - don't they have stores where *they* live?"

Contrary to the general neighborhood trend, Fremont respondents complained about poor or limited store choices in their neighborhood shopping area - particularly the lack of specialty stores and good dining options - with over one-third of respondents appearing in aggregate in those two categories. By contrast, while Rockridge, Albany/North Berkeley, and Walnut Creek respondents all praised the wealth of independent, interesting stores in their shopping areas (discussed in the previous section), they lamented over the lack of basic stores - particularly local hardware stores -

with roughly one-fifth of respondents noting this as a major complaint. And in both Rockridge and Walnut Creek, over one-quarter of the respondents complained about the expensiveness of many stores, or the "yuppie" character of the store mix.

With respect to walkability and pedestrian access, a noticeable fraction of respondents in all four neighborhoods (ranging from 10% to 26%) cited this as a major complaint, but for different reasons in each neighborhood. Fremont respondents (10%) generally didn't feel that the neighborhood shopping area was conducive to walking around in - i.e. walking around *within* the neighborhood center was unappealing and/or difficult. "There's nothing to do there," one stated, and "stores are too far away from each other," wrote another.

Albany/North Berkeley respondents in this category (26%) were composed primarily of Berkeley hills residents (east of the intersection of Solano Avenue and The Alameda) who were complaining about the lack of direct transit routes to and from Solano Avenue. As several respondents pointed out, the steep topography means that walking to Solano Avenue might be possible (and enjoyable), but returning uphill with full grocery bags and shopping bags is difficult. Notably, a number of these respondents also indicated that if a direct transit route were available (from the hills to Solano Avenue), they would be inclined to utilize the service, to avoid parking problems. "this area has *always* needed *vertical* bus service. It takes too long to go to Solano by bus - you have to go all the way downtown and back in a big zig-zag," wrote one Berkeley Hills resident.

Walnut Creek respondents (16%) also complained about the lack of transit to and from the downtown core, but primarily that it is so diffuse and infrequent that it is not reasonable to take transit into the downtown area, which also means it is a deterrent for walk trips, since the two would often be combined. One respondent wrote, "the closest bus stop takes 20 minutes to walk to. I would like to use the bus [to go downtown] but it takes too long."

Rockridge respondents (10%) were the most disparate in their complaints about walkability in the neighborhood core, with no one issue taking precedence. Some grumbled about the linear configuration of College Avenue (too far to get from one end to the other, and go to all the stores), others about areas where the sidewalks are too narrow or crowded, and so on.

Pedestrian Amenities and Travel Behavior in Neighborhood Shopping Area

The remaining set of survey questions in Section Four focused on specific links between design aspects of the neighborhood centers, perceived walkability of the neighborhood centers, and actual travel behavior within (or to and from) the neighborhood centers, to supplement the extensive datasets and analyses already gathered and performed on these issues, through the urban form survey and previous sections of the mail-back survey. In addition, the actual pedestrian counts (within the neighborhood shopping core) have been presented again as Table 5-31, since they are highly relevant to the following analysis and discussion.

Table 5-31. Actual Pedestrian Counts in Neighborhood Shopping Centers*

Location of Pedestrian Count	Highest Count	Lowest Count	Average Count	Activity Rating**
Rockridge (College Ave/Shafter Ave)	61	39	50	High
Albany (Solano Ave/Colusa Ave)	30	18	24	High
Walnut Creek (N. Main St/Mt Diablo Blvd)	45	22	34	High
Fremont (Mowry Ave/Fremont Blvd)	6	1	4	Low

* Figures are the number of pedestrians crossing a line on the sidewalk over a 5-minute period. "Highest" count is the highest figure recorded over all count days/times; "Lowest" count is the lowest figure recorded over all count days/times. "Average" is (Highest+Lowest)/2.

** Low= <10 pedestrians/5 mins., Med= 10 to 20 pedestrians/5 mins., High= 20 (or +) pedestrians/5 mins

Questions 4-7 and 4-8 of the survey both focused on non-vehicle travel behavior in and around the neighborhood shopping areas. Respondents were asked whether they felt it is easy to walk from their home to the shopping area, with a simple "Yes/No" response. Results presented in Table 5-32 indicate that responses once again followed the hypothesized walkability spectrum for the four neighborhoods, with the highest percentage of Rockridge respondents (59%) stating that it is easy, followed by Albany/North Berkeley (48%), Walnut Creek (42%), and finally, Fremont (39%), in small to moderate increments. In general, results (other than Fremont) suggest that respondents are split fairly equally in each neighborhood between a perception that walking to the shopping area is easy, versus not.

Table 5- 32. Easy to Walk from Home to Shopping Area

	Yes	No
Rockridge	59%	41%
Albany/No. Berkeley	48%	52%
Walnut Creek	42%	58%
Fremont	39%	61%

However, when asked about the frequency with which this trip was actually *made* by walking, the results were somewhat different (Table 5-33). First, overall percentages of frequent walk trips to the neighborhood center (six times or more per month) were lower in all four neighborhoods than the "yes" figures for the question, " is it easy to walk [there]...?" In other words, a greater fraction of respondents in each neighborhood view the trip as an easily walkable one, than the fraction who actually *make* that walking trip on a frequent basis. Moreover, while the perceived ease of walking to the neighborhood shopping area shows a moderately incremental change pattern from neighborhood to neighborhood, the percentages of respondents making the trip frequently (six times or more per month) shows much larger jumps from neighborhood to neighborhood, with Rockridge at a high of 34% of respondents, to Albany/North Berkeley at 21%, while Walnut Creek registers a low 9%, and Fremont a negligible 2%.

Table 5- 33. Home - Shopping Center Travel Mode: Walk Frequency

	0-1 times/month	2-3 times/month	3-5 times/month	6+ times/month
Rockridge	53%	8%	5%	34%
Albany/No. Berkeley	64%	10%	4%	21%
Walnut Creek	75%	9%	7%	9%
Fremont	87%	7%	4%	2%

The Fremont results are not surprising, and are consistent with prior data patterns analyzed in this chapter. One respondent's comment written in next to this walking frequency question, sums up what appears to be the view of walking in that neighborhood: "[It has] flat terrain, good sidewalks, and it's less than a mile, but at this time there is no reason to walk." In other words, *why* walk?

The Rockridge results also match reasonably well with prior analysis, which have suggested that a significant fraction of Rockridge respondents are walking in their neighborhood. Albany/North Berkeley and Walnut Creek results both suggest a somewhat different pattern: that a large fraction of these respondents are driving to their neighborhood centers, and then walking around within them. In particular, the low figure for Walnut Creek frequent walk trips to the shopping center (9%) appears to confirm- as suggested earlier - that while Walnut Creek respondents are making a high number of within-downtown walking trips (based on actual pedestrian counts, descriptive comments in their trip diaries, and their stated frequencies of usage of their downtown core), they are predominantly driving to that downtown core, rather than walking.

Questions 4-11 and 4-12 used a Likert-scale structure to assess respondents' perceptions about specific design aspects of their neighborhood shopping area, and the perceived "walkability" of that area, targeting key elements of New Urbanist prescriptions such as landscaping, seating adequacy, architecture, mix of stores and services, sidewalk adequacy, and traffic speeds. An analysis of the responses (Tables 5-34 and 5-35) confirm several of the trends noted in the discussions above, as well as several conclusions about urban form stated in Chapter Four. Moreover, it suggests additional conclusions regarding the relationships between urban form, walkability, and overall usage of neighborhood centers.

Specifically, the response data for Question 4-11 confirms that Rockridge, Albany/North Berkeley, and Walnut Creek respondents, by-and-large, find their neighborhood centers enjoyable places to be, with a good mix of stores and services (Table 5-34). In particular, Walnut Creek stacks up as a very successful and appealing shopping area, with nearly two-thirds - or more - of its respondents consistently stating that they agree or strongly agree that it has attractive landscaping, adequate seating, attractive architecture, a good mix of stores and services, and is generally an enjoyable environment. Conversely, as has already been noted through prior analyses, Fremont's respondents don't enjoy their neighborhood center, and express a high level of dissatisfaction with the stores and services that it offers. Moreover, at least 25% of respondents express dissatisfaction with every other element addressed in this question, except for landscaping.

Table 5-34. Perceptions About Design Aspects of Shopping Area*

Question Topic	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Landscaping is Attractive				
Strongly Disagree	0%	1%	0%	2%
Disagree	14%	20%	0%	17%
Partially Agree	36%	30%	4%	25%
Agree	29%	41%	51%	35%
Strongly Agree	13%	3%	43%	6%
Don't Know or N/A**	8%	5%	1%	15%
Seating is Adequate				
Strongly Disagree	4%	5%	0%	6%
Disagree	40%	35%	7%	33%
Partially Agree	25%	30%	24%	27%
Agree	15%	16%	37%	15%
Strongly Agree	2%	1%	26%	2%
Don't Know or N/A	13%	12%	7%	17%
Architecture is Attractive				
Strongly Disagree	1%	4%	0%	0%
Disagree	8%	32%	4%	27%
Partially Agree	27%	31%	9%	35%
Agree	44%	22%	51%	23%
Strongly Agree	12%	2%	33%	2%
Don't Know or N/A	7%	9%	1%	13%
Good Mix of Stores and Services				
Strongly Disagree	2%	0%	3%	6%
Disagree	8%	8%	8%	23%
Partially Agree	33%	23%	16%	27%
Agree	37%	46%	43%	27%
Strongly Agree	15%	14%	29%	2%
Don't Know or N/A	4%	7%	1%	15%
Enjoy Coming Here				
Strongly Disagree	1%	2%	1%	8%
Disagree	8%	9%	5%	21%
Partially Agree	23%	22%	20%	31%
Agree	39%	36%	39%	17%
Strongly Agree	25%	25%	32%	2%
Don't Know or N/A	4%	5%	3%	21%

* Data of note is highlighted in gray
**N/A = "Not Applicable"

Of equal interest in this set of responses, however, is the variation in levels of agreement across the specific design categories for Rockridge and Albany/North Berekely, in spite of the high assessments of the two shopping areas overall. For example, nearly one-third of Albany/North Berkeley respondents (32%) don't agree that Solano Avenue's architecture is attractive. Moreover, more than one-third of both Rockridge and Albany/North Berkeley's respondents don't agree that seating is adequate. Yet more than two-thirds of the respondents in both neighborhoods agreed (or strongly agreed) with the statement that they "enjoy coming here" (in addition to statistics presented earlier - Tables 5-26 and 5-27 - indicating that they view the shopping areas as attractive overall, a good place to socialize, etc.). While it is difficult to assess the precise reason for this "discrepancy," two clear possibilities come to mind, both with implications for urban design.

First, it is possible that these two elements of urban form simply aren't significant in overall design schemes; i.e. people (or at least these respondents) do not rate these factors highly in overall assessments. Previous research (as noted in Chapter Two) would suggest otherwise. Moreover, the mail-back surveys in this research, and comments written on them, would also indicate that this is incorrect. For instance, Albany/North Berkeley respondents over and over again indicated true outrage over the removal of a set of mature, large trees on the western end of Solano Avenue. And to state that architectural features, or attractiveness, are insignificant factors in urban design would undermine the entire field (as well as several others). These factors are not only noticed, they are notable for respondents (and, previous research would suggest, for the wider population).

A second theory, then, is that the "discrepancy" is not a discrepancy at all. More, it is an indication that urban designers don't need to get everything precisely correct - in terms of specific design details - to have an enjoyable, successful environment for pedestrians, but they do have to get a majority of factors in place to make it work. It is not that landscaping, per se, or architectural features, per se, are the insignificant factors; it is that for these two neighborhoods, they are only one or two factors (out of a much larger set) that are problematic - and they are details sitting on top of a fundamentally solid urban form configuration, in terms of density, land use mix, street configuration, etc. This is good news for the New Urbanist program; it suggests that there is flexibility in design schemes, as long as the users are the focus of the designs. And, if the design ranks high in all details, as Walnut Creek does, there is simply more enthusiasm and - based on this research - more use of that area (see Table 5-25).

Respondents' perceptions about specific pedestrian features of the neighborhood shopping areas further highlight previous conclusions about the walkability of these areas (Table 5-35). As noted in the pedestrian counts, Rockridge and Walnut Creek have the highest levels of pedestrian activity among the four neighborhoods, as opposed to the general neighborhood walkability spectrum (and travel data), in which Albany/North Berkeley ranks second behind Rockridge. However, all three neighborhood centers displayed "high" pedestrian activity levels overall (average of 20 or more pedestrians crossing a sidewalk line every five minutes). Not surprisingly, then, respondents' perceptions about the walkability of these neighborhood centers confirms the basis for these high activity levels, with nearly three-quarters or more of respondents in all three neighborhoods agreeing (or strongly agreeing) that it is "...easy to walk around this shopping area." By contrast, Fremont respondents express more ambivalence, with roughly 40% answering that they only partially agree, or disagree, with this statement.

Notably, a large fraction of Fremont respondents (29%) also disagree with the statement that traffic speeds are low, as contrasted with lesser fractions in this category in the other three neighborhoods. Given the differences in street configuration across the four neighborhoods discussed in Chapter Four, and particularly the wide arterials with high speeds noted in the Fremont neighborhood center, there is some indication in respondent perceptions that this urban form configuration *does* deter pedestrian activity, although the relationship is not entirely conclusive. Further hints at this trend are found in comparing Walnut Creek's and Fremont's responses to the statement, "...crossing streets feels safe." As assessed in the urban form surveys of the site areas, both of these centers have major arterials running through their core. But, as is also described in the urban form analysis, Walnut Creek has made extensive design modifications to address the speed and visual impacts of the arterial running through the pedestrian core (Mt. Diablo Boulevard). Responses in the mail-back survey do indicate that these design impacts are tangible to pedestrians, with a slightly higher fraction of Fremont respondents (14%) disagreeing, or strongly disagreeing, with the statement that "crossing streets feels safe," while only 9% of Walnut Creek respondents fall in this category. However, again, the differences are not significant enough to allow for conclusive statements about this aspect of the neighborhood centers, and might present an opportunity for further research.

Table 5-35. Perceptions About Pedestrian and Traffic Aspects of Shopping Area*

Question Topic	Rockridge	Albany/ No. Berkeley	Walnut Creek	Fremont
Sidewalk Space is Adequate				
Strongly Disagree	0%	1%	0%	2%
Disagree	12%	8%	1%	4%
Partially Agree	32%	26%	7%	19%
Agree	39%	54%	53%	56%
Strongly Agree	13%	8%	39%	6%
Don't Know or N/A**	4%	3%	0%	13%
Traffic Speeds Are Slow				
Strongly Disagree	1%	1%	1%	10%
Disagree	17%	12%	17%	19%
Partially Agree	32%	30%	37%	31%
Agree	39%	36%	32%	29%
Strongly Agree	8%	16%	12%	0%
Don't Know or N/A	2%	4%	1%	10%
Crossing Streets Feels Safe				
Strongly Disagree	6%	2%	1%	4%
Disagree	10%	5%	8%	10%
Partially Agree	33%	37%	37%	35%
Agree	38%	46%	43%	25%
Strongly Agree	8%	5%	9%	4%
Don't Know or N/A	5%	3%	1%	21%
Easy to Walk Around				
Strongly Disagree	0%	0%	0%	2%
Disagree	5%	4%	1%	8%
Partially Agree	21%	20%	18%	31%
Agree	54%	52%	54%	48%
Strongly Agree	17%	20%	25%	0%
Don't Know or N/A	4%	4%	1%	10%

* Data of note is highlighted in gray
** N/A = "Not Applicable"

Statistical Relationships Among Mail-back Survey Factors and Neighborhood Walkability

A more in-depth statistical analysis of relationships among factors and data presented above, and neighborhood walkability, suggests a set of key conclusions addressing several hypotheses of this dissertation, including: the degree to which the existence of pedestrian amenities may influence residential location choice, and the variables which most highly impact levels of pedestrian activity. In addition, this analysis has been applied to develop a rough predictive model of walking frequency across the four neighborhoods.

Bivariate Association Analysis of the Relation of Pedestrian Amenities to Residential Location Choice

Results of previous research on pedestrian travel behavior and residential preference suggest that the two factors may be linked. One hypothesis is that pedestrians placing a high value on the walkability of neighborhoods are self-selecting into neighborhoods perceived to possess that quality, and subsequent travel behavior patterns (within those neighborhoods) are simply reflecting this self-selection. One aim of this dissertation research was to test that hypothesis, using the data gathered in this research.

As noted earlier in this chapter, varying fractions of respondents in each neighborhood stated that the existence of good pedestrian (and transit) amenities was a major attractant in choosing to live in the neighborhood (Table 5-8, from Question 2-3 in the survey). Additional survey questions then assessed the frequency with which respondents were making trips via various non-vehicle travel modes (Table 5-33). A "bivariate table" (also called a "two-way table") was constructed to determine what relationship - if any - exists between these two factors for the respondents in each neighborhood.[13] If the existence of pedestrian, bicycle, and transit amenities does correlate with subsequent travel behavior patterns, one would expect to see a high level of association between the respondents who cited this as a key attractant, and the frequency with which they are making walking trips in their neighborhood.

For the purposes of this analysis, Question 4-8 - the frequency with which respondents walk to their neighborhood shopping area - was used as the variable of association with the importance of pedestrian amenities in residential location choice.

The results of the Rockridge analysis are presented below, in Tables 5-36 and 5-37. While similar analyses were conducted for all four neighborhoods, the results (in terms of levels of association) were so similar for the four neighborhoods, that a presentation of the Rockridge tables provides ample basis for discussions and conclusions.

Of the two tables, the first shows the distribution and association of actual respondent counts (Table 5-36), while the second shows the fraction (in percentages) of respondents falling in each category of association (Table 5-37). For example, in Table 5-36, showing analysis results for Rockridge, one can see that of all respondents in the neighborhood who stated that pedestrian amenities were a major attractant to the neighborhood (the "yes" column, totaling 44 respondents), sixteen of these respondents also fall into the walk-to-shopping-area frequency category of six times or more per month. Table 5-37 further describes this relationship as being 36% of all respondents who cited pedestrian amenities as a major attractant for living in Rockridge.

Table 5- 36. Rockridge Walk-to-Shopping-Area Frequency by Ped/Bike/Transit Importance

Walk-to-Shopping-Area Frequency	Pedestrian/Bike/Transit Amenities Are Important		
	Yes	No	Total
Walk 6 or more times/month	16	13	29
Walk 3-5 times/month	2	2	4
Walk 2-3 times/month	4	3	7
Walk 0-1 times/month	22	22	44
Total	44	40	84

NOTE: Figures are absolute values for number of respondents in each bivariate association category

Table 5-37. Rockridge Walk-to-Shopping-Area Frequency by Ped/Bike/Transit Importance (in percentages)

Walk-to-Shopping-Area Frequency	Pedestrian/Bike/Transit Amenities Are Important	
	Yes	No
Walk 6 or more times/month	36%	33%
Walk 3-5 times/month	5%	5%
Walk 2-3 times/month	9%	8%
Walk 0-1 times/month	50%	55%

NOTE: Percentage figures are calculated from total number of respondents in each column

[13] An in-depth description of these statistical tools, as well as multivariate analysis techniques, can be found

Significantly, the Rockridge results indicate that there is almost no association between the two variables of interest, "walk-to-shopping-area frequency" and "pedestrian/bike/transit amenities are important." There is virtually no difference in walking behavior between those who cited pedestrian amenities as important (the left column of the table) and those who did not cite this factor at all (the right column). The results for the other four neighborhoods are similarly non-associative. In other words, while a substantial fraction (41%) of respondents who cited pedestrian amenities as important to their residential location choice also have high (three or more times per month) walk-to-shopping area frequencies, roughly the *same* proportion with high walking frequencies (38%) did *not* cite pedestrian amenities as a major attractant.

From a New Urbanist design perspective, this is a critical result. Although self-selection into more walkable neighborhood typologies may be occurring because the *option* to walk exists there, the self-selection does not guarantee greater walking activity from the individuals who chose neighborhoods for their perceived walkability, as some previous research has hypothesized. In other words, the relationship is not that all people who show higher walking frequencies have deliberately self-selected into more walkable neighborhoods, but rather that a substantial fraction of people may be self-selecting into more walkable neighborhoods where the *option* of walking exists.

Moreover (and good news from a New Urbanist perspective), a significant fraction of respondents in Rockridge who *are* walking frequently did *not* cite this as a major attractant for residential location choice, yet are walking a great deal in this more "walkable" environment. One inference from this pattern is that urban form configurations do promote certain forms of travel behavior. This research has already

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in Joseph F. Healey's excellent text, Statistics: A Tool for Social Research (Healey 1993).

shown that independent urban form surveys, resident perceptions about the neighborhood, and actual travel behavior all confirm Rockridge as being a highly "walkable" neighborhood. The bivariate association analysis just presented above, suggests that, encouragingly (for proponents of pedestrian-friendly design), people who never considered this a major factor in choosing to live in the neighborhood, are *also* walking frequently within it.

Bivariate Association Analysis of the Influence of Specific Variables and Respondent Characteristics on Walking Frequency

Numerous variables have been discussed in this dissertation, as potentially impacting levels of pedestrian activity. Home-to-shopping-area walk frequency data was used to analyze the influence of these variables on individual respondent's walking behavior, and the degree to which there is truly a "neighborhood effect" (i.e. a walkability spectrum) across the four neighborhoods. Bivariate association analyses were constructed to test the influence of a wide range of individual variables on home-to shopping-area walk frequencies within the four neighborhoods. A detailed explanation of the analysis and conclusions is presented below.

Home-to shopping area walk frequencies were used as the indicator of walking behavior for these analyses, focusing on the more frequent walkers within and across the four neighborhoods. For the purposes of statistical computations, "frequent walkers" were defined to be those respondents who fell into categories three and four of the home-to-shopping-are walking frequency tables (survey Question 4-8 and Table 5-33) - i.e. all respondents who stated that they walk to their shopping area three or more times per month.[14] This aggregation of the two walking frequency categories is presented in Table 5-38, with the total percentage for each neighborhood providing the basis for subsequent statistical calculations. As noted earlier in this dissertation, these frequencies correlate with the walkability spectrum hypothesized in Chapters Three and Four. In the following analysis, this relationship - where walking frequencies are highest in Rockridge, followed incrementally by Albany/North Berkeley, Walnut Creek, and Fremont - will be called the "neighborhood effect."

Table 5-38. Home-Shopping Center Travel Mode: Fraction of Respondents in Each Neighborhood Who Walk "Frequently"

Neighborhood	3-5 times/mo.	6 or more times/mo.	Total Frequent Walkers
Rockridge	5%	34%	39%
Albany/No. Berkeley	4%	21%	25%
Walnut Creek	7%	9%	16%
Fremont	4%	2%	6%

* "Frequently" is defined as walking to shopping area three or more times per month. Percentages are fractions of total respondents in each neighborhood.

Previous research has suggested that density - and in particular, its relation to absolute walking distance - has a high influence on walking behavior (Cervero 1996; Cervero and Kockelman 1996; Steiner 1996). In particular, transportation behavior studies claim that most individuals (Americans) will not walk more than one-quarter to one-half mile, which argues for the necessity of compact urban form to promote greater walking activity (see Chapter Two). Therefore, the distance from respondents' homes to the neighborhood shopping area was compared across the four neighborhoods (Table 5-

[14] The aggregation of the two categories was deemed appropriate, because responses to this survey question suggested that most people simply lumped themselves into category 1 (walk zero to one time per month), or category 4 (walk six or more times per month), even though it is likely that the actual walk frequency pattern is more incremental across the four categories.

39), using categories of less than 0.25 miles, 0.25 to 0.5 miles, 0.5 miles to one mile, and one mile or greater.[15]

Table 5-39. Respondents' Distance from Home to Study Area Shopping Center

Neighborhood	Total Number of Respondents	Distance from Home to Shopping Area			
		<1/4 mile	1/4 to 1/2 mi.	1/2 to 1 mi.	1 mi. or >
Rockridge	84	11	15	24	34
Albany/No. Berkeley	91	4	11	29	47
Walnut Creek	76	1	4	13	58
Fremont	48	1	4	11	32

Results indicate that across all four neighborhoods, 16 respondents live within 0.25 miles of their neighborhood shopping area, while another 34 live between 0.25 and 0.5 miles of the neighborhood shopping center. More importantly, only one respondent in both Fremont and Walnut Creek lives within 0.25 miles of the neighborhood shopping area, and another four respondents (for each of the two neighborhoods) within 0.25 to 0.5 miles of the shopping areas. In short, of the total pool of respondents in the four neighborhoods, far fewer respondents (in terms of both absolute values and percentages) are close to the neighborhood shopping area in both Fremont and Walnut Creek, than in Rockridge and Albany/North Berkeley. In fact, Rockridge has by far the highest number of respondents (26) across the four neighborhoods who live within one-half mile of the study area's shopping center.

Using the walking frequency data in Table 5-38, and the distance-to-shopping-area figures (Table 5-39), a simple association reveals that across all four neighborhoods, an overwhelming 94% of respondents who live within 0.25 miles of the neighborhood shopping center are "frequent walkers," walking there three or more times per month (Table 5-40). This is not just a "Rockridge effect" - i.e. that the 94% are

[15] Distances were measured on street maps, using the most direct street route from the respondents' home to the closest point of the neighborhood shopping area - i.e. the most direct route that a walker could take to the shopping area.

simply the 11 respondents from Rockridge who live within 0.25 miles of the shopping area. All six of the respondents in the other three neighborhoods who live within one-quarter mile of their neighborhood shopping areas (Table 5-39) are "frequent walkers." Moreover a full 65% of all respondents living between 0.25 and 0.5 miles of the neighborhood shopping center area also "frequent walkers." This number drops to 34% of all respondents who live 0.5 to one mile away, and a negligible 6% of those who live one or more miles away.

Table 5-40. Walking Frequency as a Function of Distance from Shopping Area

Distance from Home to Shopping Area	Fraction of Respondents Who Are "Frequent Walkers"*
Less than 1/4 mile	94%
1/4 to to 1/2 mile	65%
1/2 to 1 mile	34%
1 or more miles	6%

* "Frequent walkers" = respondents walking to shopping area three or more times per month.

There are several very significant points about these results. First, they indicate that, as previous research has suggested, there is a large "distance effect" in relation to walking behavior, when looking at results across all four neighborhoods, with a high concentration of all "frequent walkers" located within one-half mile of the neighborhood center. But equally significantly, these results also suggest that not only are respondents within 0.5 miles of the neighborhood shopping area more likely to walk there, but in fact they are almost *certain* to walk there with some frequency. In particular, respondents living within *one-quarter* mile of the neighborhood shopping area have an astoundingly high probability of walking there frequently. Finally, these results indicate that a substantial fraction (34%) of respondents living farther than one-half mile from the neighborhood center also walk frequently to the neighborhood center, supporting one hypothesis of this dissertation, that factors *other* than distance may also be impacting walking behavior, contributing to the overall "neighborhood effect" described by the walking frequency trends.

Independent statistical tests for the influence of variables *other* than distance on walking behavior revealed that age may also be playing a large role in walking behavior.[16] In particular, it was hypothesized that respondents in the oldest age category ("over 65") might be less likely to walk frequently to their neighborhood shopping center, independent of walking distance. A bivariate association constructed between age and "frequent walkers" (defined as respondents whose home-to-shopping-area walk frequency is three or more times per month) indicates, at first pass, that this hypothesis is correct, as shown in Table 5-41. In this table, each percentage figure describes the fraction of respondents from any given neighborhood, within a particular age category, who are "frequent walkers." For example, 22% of Rockridge respondents who are over 65 years old, are also "frequent walkers," as compared with 44% of Rockridge respondents who are 18 to 30 years old, who are also "frequent walkers."

Table 5-41. Bivariate Association of Frequent Home-to-Shopping-Area Walkers by Age Category* (in percentages)

Neighborhood	Total Number of Freq. Walkers	Age Category (yrs)			
		18-30	31-50	51-65	Over 65
Rockridge	33	44%	46%	42%	22%
Albany/No. Berkeley	23	28%	38%	28%	5%
Walnut Creek	12	0%	25%	15%	7%
Fremont	3	0%	6%	10%	14%

NOTE: "Frequent walkers" are defined to be respondents who stated home-to-shopping-area walk frequency as 3 or more times per month. Percentages are fractions of respondents from any given neighborhood, within a particular age category, who are categorized as "frequent walkers".

As described here, the percentages of "frequent walkers" in the "over 65" category drops significantly from the other age categories, for all neighborhoods but

[16] The results of these series of explorations are not presented here; only significant results are discussed. In general, statistical explorations are based on hypothesized relationships emerging both from previous research, and - just as importantly - common sense. Tens (or hundreds!) of associations may be tested

Fremont. The Fremont aberration is in large part due to the higher fraction of older respondents in Fremont overall (as a fraction of that neighborhood's total respondents), as well as the simple fact that Fremont has almost no "frequent walkers" at all. Thus, the initial overall conclusion is that there is a significant "age effect" for walking behavior, with a much smaller fraction of older respondents walking to their neighborhood shopping area.

However, combining these "age effects" with a subsequent bivariate association of age category by distance across all four neighborhoods (Table 5-42, below), suggests that most or all of the apparent age effect may be due to the correlation between age and distance. Essentially, the key point of this table is found in the cell associating the highest age category ("over 65") with the greatest distance of the respondent's home from the shopping area (see highlighted cell in Table 5-42). As shown here, 65% of respondents who are over 65 years old *also* live one or more miles away from the neighborhood center, as compared to only 45-58% of respondents in the other age groups. Moreover, only 3% of respondents over 65 years old live within one-quarter mile of the neighborhood center (where the highest walking frequencies are found), compared to 5-10% of other age groups. Thus, this additional bivariate association shows that the "age effect" described previously in Table 5-41 is almost entirely due to the fact that most older respondents in this survey sample simply live farther away; it is a product of distance, not age.[17]

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before determining significant trends and relationships; a full presentation of these is generally unnecessary, would be extremely unwieldy, and detracts from the main conclusions.

[17] It is possible that there may be an actual age effect in addition to the distance effect - i.e. if there had been a greater number of elderly respondents in the survey sample who lived within one-quarter to one-half mile of the neighborhood shopping area, one might be able to determine if age also plays a factor. However, the data gathered in this survey does not allow for that analysis, since so few of the elderly residents who completed the survey live within one mile of the shopping area.

Table 5-42. Bivariate Association of Distance (from Home to Shopping Area) by Age Category* (in percentages)

Distance from Home to Shopping Area	Total Number of Respondents	Age Category (yrs)			
		18-30	31-50	51-65	Over 65
Less than 1/4 mile	17	10%	7%	5%	3%
1/4 to to 1/2 mile	34	26%	6%	14%	10%
1/2 to 1 mile	77	19%	29%	27%	22%
1 or more miles	171	45%	58%	54%	65%

NOTE: Percentages are fractions of respondents from *all four* neighborhoods; i.e. total number of respondents = 299.

Linear Regression Analysis to Develop A Predictive Model of Home-to-Shopping-Area Walking Frequency

The conclusions reached from the bivariate associations presented above, in addition to conclusions made earlier in this dissertation, allow for the construction of a multivariate predictive model of home-to-shopping-area walking frequency. In particular, this model incorporates known relationships (as determined above) between age, distance, the importance of pedestrian amenities in residential location choice, and the overall "neighborhood effect" (i.e. walkability spectrum), and applies these to the construction of a model that predicts who is likely to be a "frequent walker" (walking to the neighborhood shopping area three or more times per month), and who is not.

To start, our basis for comparison (to evaluate the success of a predictive model) is simple guesswork. Looking at all respondents in the study, roughly 25% of these are "frequent walkers" (Table 5-43). Given no information other than these figures, the "best guess" would be that any given respondent *doesn't* walk frequently, since it is known that only one-quarter of respondents *do* walk frequently. Thus, the "best guess" predictive model (Model 1) will lead to a successful prediction roughly 75% of the time, resulting in an error rate of 0.247, or about 25% (i.e. the fraction of respondents who *do* walk frequently). Therefore, a more successful predictive model, constructed using known relationships among variables that have been discussed as potentially influencing walking frequencies, must produce an error rate of less than 0.247, if it is to be useful. Otherwise, the simple "best guess" predictive model is the more successful one.

Table 5-43. Total Numbers and Percentages of "Frequent Walkers"

Neighborhood	Total Number of Respondents	Number of "Frequent Walkers"	% Frequent Walkers
Rockridge	84	33	39%
Albany/No. Berkeley	91	23	25%
Walnut Creek	76	12	16%
Fremont	48	3	6%
Totals	**299**	**71**	**24%**

To develop an alternative (more successful) predictive model, linear regression analysis was used to incorporate the key variables of interest, as determined through prior analysis. Looking at the "neighborhood effect" variable alone - i.e. "frequent walkers" are highest in Rockridge, followed by Albany/North Berkeley, Walnut Creek, and Fremont - one might begin by developing an alternative predictive model that follows the "frequent walker" percentages for each of these neighborhoods (Table 5-43). But in fact, since in all four neighborhoods the "frequent walker" percentages are under 50%, the "best guess" for a given individual is still to guess that they are not a "frequent walker," so this model will still produce an error rate of only 25%.

Likewise, looking *only* at age, "frequent walkers" comprise roughly 28%, 31%, 26% and 12% of each age group category, across all respondents (Table 5-44). Again, with all percentages being less than 50%, and knowing that these percentages have been inherently influenced by distance (as shown in Table 5-42), simply guessing that each respondent does not walk frequently will be just as successful as predictions based on walking frequency as a function of age category.

Table 5-44. Percentages of "Frequent Walkers" as a Function of Age*

Age Category (yrs)	Fraction of Respondents Who Are "Frequent Walkers" *
18-30	28%
31-50	31%
51-65	26%
Over 65	12%

*Percentages are fractions of all respondents; total respondents = 299

Knowing *just* distance, an alternative predictive model becomes more successful than the previous "best guess" predictions. As described in Table 5-40, 94% of respondents within one-quarter mile of the neighborhood shopping area are "frequent walkers," followed by 65% of respondents living one-quarter to one-half mile away, 34% at one-half to one mile, and 6 % at one mile or more. Therefore, knowing nothing else, the "best guess" would now be that respondents who live within one-half mile of the shopping area *are* "frequent walkers," while those living one-half mile or more away are *not* "frequent walkers." This predictive model (Model 2) produces an error rate of 0.164 (roughly 16.4%), which is lower than the 0.247 error rate of the original "best guess" model, and is thus a better model than that first one.

Combining the variables of distance and age does not improve predictive success significantly (the error rate is the same, at 0.164), as would be expected given the age-distance bivariate association presented earlier. Thus, the best predictive model (so far) is still Model 2, based on distance alone.

However, combining the variables of distance, age, and "neighborhood effect" again improves the model's predictive success (Model 3), lowering the error rate to 0.158 (15.8%). In other words, all other things being equal (as has been shown through the analysis of distance and age variables, both alone and in combination), respondents in Rockridge are the most likely to walk frequently, with Albany/North Berkeley and

Walnut Creek roughly equal at 7 percentage points behind, and Fremont a full 15 percentage points behind. That is, even after adjusting for the influence of age and distance, there is still "neighborhood effect" in walking frequency. Basic parameters of the three models analyzed are summarized in Table 5-45, below.

Table 5-45. Summary of Significant "Frequent Walker" Predictive Models

Model Name	Variables Included	Error Rate*
Model 1	None ("best guess")	0.247
Model 2	Distance (from Shopping Area)	0.164
Model 3	Distance, Age, and Neighborhood	0.158

* A lower error rate indicates a more successful predictive model

Multivariate statistics were also used to analyze the influence of one additional variable on the best predictive model, Model 3. Although bivariate association analysis indicated that the existence of good pedestrian, bicycle, and transit amenities as a factor in residential location choice did not appear to significantly impact actual walking frequency (Tables 5-36 and 5-37), this conclusion was further tested through linear regression. Results of this analysis confirmed that the inclusion of this variable (called "pedestrian amenities," for statistical identification purposes) does not have a statistically significant impact on Model 3's predictive success (i.e. the error rate remains the same).

While the results above, based on known relationships among key variables, suggest that Model 3 would be the final "best" simple predictive model, additional statistical explorations identified yet a more accurate model (Model 4), which includes variables not previously identified (through bivariate associations) as having a significant influence on home-to-shopping area walking frequency. This "best" simple predictive model, as determined through linear regression, is presented below in summary form (Table 5-46), with the full range of model parameters presented in Appendix VII. This model includes not only the variables of distance, neighborhood, and age category (18 through 30 years old), but also the two new variables, "frequency of using the neighborhood shopping area" (survey Question 4-3) and employment status, or more specifically, whether or not the respondent is classified as a "student" (survey Question 1-9).

Table 5-46. "Best" Linear Regression Model of Home-to-Shopping-Area Walking Frequency (Model 4)

Variable	Coefficient Estimate	Standard Error
Rockridge	0.71	0.09
Albany	0.69	0.10
Walnut Creek	0.72	0.10
Fremont	0.62	0.10
Age factor (18-30 yrs)	0.07	0.04
Live within 1/4 mile	0 by definition	0 by definition
Live 1/4 to 1/2 mile away	-0.26	0.10
Live 1/2 to 1 mile away	-0.50	0.09
Live 1 mile or more away	-0.75	0.09
Shop in area frequently	0.22	0.04
Student	0.21	0.10
Residual Standard Error:	0.33 on 288 DF (degrees of freedom)	
Multiple R-Squared:	0.59	
Adjusted R-Squared:	0.57	
F-statistic:	41.25 on 10 and 288 DF	
P-value:	0	

Linear regression was used to generate the results above. The "y values" - the values to be predicted - are "1" or "0" for each respondent, indicating that they do (1) or don't (0) walk to the neighborhood shopping area three or more times per month (i.e. that they are, or are not, a "frequent walker"). The "x" variables (listed simply as "Variables" in Table 5-46) include: indicator variables for all four neighborhoods (a representation of "neighborhood effect"); an indicator variable for whether the respondent is under 31 years old (age category 18-30); indicator variables for the four distance categories (representing the "distance effect"); an indicator variable for whether the respondent shops in the neighborhood shopping area frequently (survey Question 4-3, with "frequently" defined as the third category, 2-3 times per week or more); and an indicator variable for whether the respondent is a student (based on survey Question 1-9, "employment status", and counting categories 4, 9, or 10 as students).

In statistical terms, the coefficient estimate values describe the degree of influence that each variable has on the prediction. In this model, the coefficient values describe the specific degree to which each variable influences the overall probability that an individual respondent will be a "frequent walker." Distance is clearly still the most influential variable overall (for purposes of producing a unique regression, the variable, "lives within one-quarter mile of the shopping area," has been used as the necessary "benchmark" for the remaining distance variables, with the remaining distance categories compared to that zero coefficient value). Living 0.25 to 0.5 miles away decreases the chance of a respondent being a "frequent walker" by 0.26 (or 26 percentage points), since the coefficient value is "-0.26." Living 0.5 to one mile away reduces the chance of being a "frequent walker" by an even greater 50 percentage points (0.50), while living one mile or more away reduces the chance of being a "frequent walker" by 0.76, or 76 percentage points.

However, the remaining variables do exert significant influence as well. Shopping frequently in the area (2-3 times or more per week) increases the chance of being a "frequent walker" by 22 percentage points (0.22). Some positive correlation between shopping frequently in the area and walking frequently is almost inevitable: someone who only visits their shopping area one or two times per month cannot walk there frequently even if they walk every time.

Being a student increases the chance of being a frequent walker by about 21 percentage points, though the exact amount is hard to estimate due to the fairly small number of students in the sample: there are only 12 students in the sample, of which 7 are frequent walkers. This "student effect" is a reasonable one; students may be taking more trips overall, due to more flexible and non-traditional schedules, and/or students may feel more comfortable walking because of better fitness levels, etc. Or, it may just be that students like to walk more as a social activity. The student effect is probably not associated with a lack of access to cars: only 3 of the 8 students in one-car households were frequent walkers, but all 4 of the students in multi-car households were frequent walkers.

Taking all of the other variables into account, people in Fremont appear to walk less than those in other areas: the coefficient, or "neighborhood effect" for Fremont is about 9 percentage points lower than for the other three neighborhoods.[18] As with the student effect, the small sample size makes this estimate rather uncertain, and the actual effect might be several percentage points higher or lower.

Finally, being under 31 years old increases the chances of being a "frequent walker" by about 7 percentage points (0.07). This effect may be related fitness (compared to older groups), or perhaps just to the amount of leisure time that people have in different stages of their lives. The effect is not just because people in this age group are more likely to be students, since that is already accounted for by the "student" variable. Because 8 of the 12 students are under 31 years old, the coefficient estimates for the student effect and the "under 31" effect are correlated (r=-0.46): if the student effect is actually higher than estimated (recall that all estimates are uncertain), then the "under 31" effect is probably lower, and vice versa.

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[18] The coefficients for the other three neighborhoods - Rockridge, Albany/North Berkeley, and Walnut Creek - are so close to each other in values that they essentially exert no overall effect on the model prediction. In other words, there is virtually no difference in the three coefficient values, relative to each other, so each one individually has no statistically significant effect on the model, leaving Fremont as the only neighborhood showing a statistically significant influence.

The combined effect of these variables is a model that predicts whether a respondent is a "frequent walker" or not (the "y" value): if the estimated probability that a person is a frequent walker exceeds 50%, we predict that the person is a frequent walker. If the probability is less than 50%, we predict the person is not a frequent walker. The model's predictions have 86.6% accuracy, meaning an error rate of 0.134 (13.4%). In other words, if the model is used to predict whether or not each respondent is a "frequent walker," and this prediction is then compared to that respondents' *actual* "frequent walker" status (i.e. actual survey data), the model predictions are correct for 86.6% of the respondents, and wrong for 13.4%. This error rate (0.134), is lower than the previous best model, Model 3 (error rate of 0.154), and is roughly one-half of the error rate for Model 1 (0.247), which guesses that all respondents are not "frequent walkers." Thus it is not only the best-fitting model developed from all of the parameters tested, but is also a significant improvement over simple guesswork, and a good simple predictive model for home-to-shopping-area walking frequency.

In non-quantitative terminology, what this model describes is that of all of the variables tested through linear regression, the variables that *most influence* respondents' home-to-shopping-area walking frequency are:

- distance (confirming prior bivariate and multivariate analysis);
- whether or not a respondent is under 31 years old;
- the actual neighborhood in which a respondent lives (i.e. the "neighborhood effect," or "walkability" spectrum described by urban form configuration);
- frequency of patronizing the neighborhood shopping area (which, as the mail-back surveys have indicated - appears to be related urban form and the overall appeal of the area); and

- whether or not the respondent is a student (which may also partially correlate with the "under 31" category, above)

Moreover, the variables have differing levels of influence, with distance still taking precedence as the most influential variable, where the greater the distance from the neighborhood shopping area, the less likelihood of respondents being "frequent walkers." A small "neighborhood effect" remains in this model, as well, in which simply being a resident of Fremont decreases the likelihood of being a "frequent walker." Being a student, as well as being under 31 years old (which are likely to variables with a higher degree of association), both increase the likelihood of walking frequently. And finally, being a frequent patron of the neighborhood shopping area also increases the likelihood of higher home-to-shopping-area walking trips.

The implications of these results for urban design and planning are significant. While variables such as the quantity of students in a neighborhood, and the distribution of age categories for residents, are arguably things that urban designers cannot influence to any great degree (although urban planners might), the other variables are within planning and design's scope. First, the "distance effect" evidenced in this dissertation's analysis, confirms the need for compact design, as one factor in encouraging walking activity. Moreover, the added evidence (as described by this research) that walking levels are extraordinarily high within one-half mile of the neighborhood centers, and even significant at three-quarters of a mile, suggests that more compact design may almost *guarantee* higher levels of pedestrian activity.

Second, the "neighborhood effect" remaining in the statistical models, along with the significant influence of frequency of using the local shopping area, suggests that the detailed urban form configurations of neighborhood areas *do* matter. Frequency of use of the shopping areas is clearly associated with respondents' perceptions of overall attractiveness and appeal of those areas, as shown in the mail-back survey analyses described earlier in this chapter. Moreover, respondent perceptions about their neighborhoods (and in particular, their neighborhood shopping areas) closely match the conclusions reached in the independent urban form surveys, described in Chapter Four. Therefore, improving the urban form details of a site, to make it more appealing to neighborhood residents, increases the likelihood that individuals will use that site, and in turn, that a greater number of walking trips will be taken to that site, independent of distance.

Finally, as shown in the survey responses themselves, and the bivariate associations applied to this data, the existence of good pedestrian, bicycle, and transit amenities *does* matter to a significant fraction of individuals in this survey. Many of those individuals specifically looked for, and chose, neighborhoods that offered such amenities, and a significant fraction of these individuals take more frequent walk trips as well (i.e. their travel behavior matches their self-selection pattern). Equally importantly, even individuals who did not choose their neighborhoods for the pedestrian amenities, are walking frequently - *if* they are in the more "walkable" neighborhoods.

Chapter Summary

The mail-back surveys have provided a robust set of data with which to perform a variety of analyses focusing on interactions between urban form, pedestrian activity, and neighborhood livability. Specifically, the data generated by the surveys included respondent trip diaries, general travel behavior, and overall perceptions about respondents' attitudes and use of their neighborhoods (including the local shopping center cores). Analyses of this data have produced a broad range of conclusions which impact the interactions of central concern to this research, as summarized below.

1) *Overall Neighborhood Satisfaction*

Respondents in all four neighborhoods expressed a high level of overall satisfaction with the neighborhood in which they live, which is consistent with previous residential preference research. However, the exact nature of this satisfaction can be more complex; while there may be an overall emotional attachment to one's neighborhood, there is more variation in how well a neighborhood meets specific needs and desires of its residents. The subsequent variations in respondents' answers to this survey confirm this differentiation between the two aspects of neighborhood satisfaction.

2) *Major Attractants to the Neighborhoods*

Of the major attractants identified by respondents in the four neighborhoods, "convenience and central location" appears most frequently as a major factor in all four neighborhoods. More traditional suburban preference factors, such as housing amenities (lot size, house size, etc.) and housing price feature less prominently than would be expected, and in fact appear less frequently in several neighborhoods than non-traditional factors such as "pedestrian, bike, and transit amenities," and "open space, parks, and vegetation." These results suggest that when offered choices in residential locations, individuals may in fact execute a wider, and non-traditional, range of preferences because they have been given the opportunity to do so. Moreover, the results suggest that for at least some portion of the population, pedestrian, bicycle, and transit amenities are so important as to defy conventional preferences for larger lots and house size (e.g. Rockridge).

Finally, the results mark a clear distinction between Fremont and the other three neighborhoods: Fremont respondents express a noticeably narrower range of factors attracting them to their neighborhood, and these factors are primarily concentrated in the more "traditional" suburban preference variables, such as housing amenities, schools, and affordability. By contrast, Rockridge, Albany/North Berkeley, and Walnut Creek respondents identify a wider range of factors as the major attractants in their residential location choices, and these factors include both traditional and non-traditional suburban preference variables.

3) *Major Detractors to the Neighborhoods*

Traffic and parking concerns (including noise generated by traffic) stand out as the overwhelming detractors for respondents in all four neighborhoods when they were choosing to live there, confirming recent research that points to the growing dissatisfaction that residents express over these issues. The factors traditionally cited as being most important to residential location decisions - lot size and price - did not appear as frequently (either as attractants or detractors) as previous research would have suggested. Moreover, the non-traditional factor of poor pedestrian and transit amenities appeared at significant levels in all but one neighborhood, suggesting that these issues *are* noticed in residential location decisions, and can have a major impact on those decisions.

Apart from the specific responses themselves, both the type of responses across the four neighborhoods and the distribution of those responses across various categories, suggest that Fremont respondents had less complex, or interwoven, reasons for moving to their neighborhood as compared to respondents in Rockridge, Albany/North Berkeley, and to a lesser degree, Walnut Creek. Moreover, Fremont respondents were concentrated in the more traditional categories of attractants and detractors, while respondents in Rockridge, Albany/North Berkeley, and Walnut Creek covered a much broader range of issues

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4) *Overall Qualities and Use of Neighborhood "General Environs"*

Rockridge, Albany/North Berkeley, and Walnut Creek respondents generally agreed that their neighborhoods offer a good mix of services and facilities, and that they use these facilities relatively frequently. By contrast, Fremont respondents stated that they are not as satisfied with the range of neighborhood services and facilities, and use their neighborhood facilities on an infrequent basis. Respondents in all four neighborhoods appeared to have similarly mixed views about the community qualities of their neighborhoods, stating that while they are good environments for children, interactions with neighbors and proximity of friends are less consistent. Respondents in all four neighborhoods also felt that their residential neighborhoods are attractive, both in terms of architecture and landscaping, although Fremont respondents did not feel as keenly about their commercial streets.

5) *Ease of Accessibility Around Neighborhoods*

While the majority of respondents in all four neighborhoods agreed that vehicle access is easy, one-quarter or more of respondents in Albany/North Berkeley, Walnut Creek, and Fremont, felt that non-auto access (which includes walking, bicycling, public transit, scooters, etc.) is *not* easy. By contrast, a full three-quarters of Rockridge respondents felt that non-auto access in their neighborhood is very easy, a viewpoint which correlates with the independent urban form conclusions reached in Chapter Four, that Rockridge is a highly pedestrian, bicycle, and transit-friendly environment. Respondents in all four neighborhoods basically agreed that their neighborhoods are easy and enjoyable to walk in. Ease of transit use produced a wide variation in responses among the neighborhoods, with Rockridge and Albany/North Berkeley respondents in strong agreement that it is easy to use transit in their neighborhoods, while Walnut Creek and Fremont respondents displayed more disagreement about this issue.

6) *General Travel Behavior in Neighborhoods*

a) Initial assessments of trip diaries and travel behavior data indicate that the hypothesized "walkability" spectrum determined through case study selection, and the urban form surveys and analysis, is in fact confirmed for these four neighborhoods, with Rockridge at the "most walkable" end of the spectrum (and fewest vehicle trips), followed by Albany/North Berkeley, Walnut Creek, and finally, Fremont. Rockridge has the highest non-vehicle trip percentage of any of the four case study neighborhoods, and conversely, the lowest fraction of vehicle trips.

b) Trip diaries and travel data indicates that Rockridge lives up to its reputation - and this research's hypothesized "walkability" spectrum - as a highly walkable environment, and the most walkable environment of the four case studies examined. Actual walking, bicycle, and transit trips are all higher than all three other neighborhoods, as are the stated frequencies with which respondents make these trips over a period of time. Moreover, a significant fraction of Rockridge respondents include walk trips on a regular basis as part of their job commute, as opposed to the other three neighborhoods, where walking appears to be a more peripheral aspect of most respondents' job commute

c) Bicycling activity levels, as analyzed through both the one-day trip diaries and frequency of bicycle use in job commutes, appear to be relatively insignificant across all four neighborhoods. Use of transit, as analyzed through trip diaries and job commute mode questions, appears to be a more significant travel mode for Rockridge, Albany/North Berkeley, and Walnut Creek respondents. Despite the central presence of BART in Fremont, and the associated bus hub, Fremont respondents appear to rarely use transit.

d) The neighborhood shopping centers (the "site areas") for Rockridge, Walnut Creek, and - to a slightly lesser degree - Albany/North Berkeley, all factor out as highly "walkable", with Walnut Creek garnering the highest rankings for respondent perceptions about its walkability and overall attractiveness, but Rockridge positioned as the neighborhood center with the highest actual pedestrian counts, and the greatest frequency of walking trips made to and from the center. Notably, however, Albany/North Berkeley - and even more so, Walnut Creek - respondents are not walking to and from their neighborhood centers, but instead appear to drive there and then get out and walk around. By contrast, Rockridge respondents not only walk around the neighborhood center in high levels, but frequently walk to and from it as well.

e) In all categories of trip levels and travel behavior, Fremont exhibits the lowest fractions of walking, bicycling, and transit trips and frequency of use for those travel modes.

f) Based on mail-back survey perceptions, trip diary figures, and low actual pedestrian counts, it appears that Fremont is a poor walking environment, both in its general environs, and in the study center defined by the urban form survey "site area." However, this conclusion is only minimally supported by a statistical analysis of walking frequencies, where the Fremont "neighborhood effect" has a small, negative influence on home-to-shopping-are walking frequency. The small survey sample size for this neighborhood makes it impossible to determine if this minimal effect is due to actual differences in walking behavior (relative to the other three neighborhoods), or if it is simply the result of a lack of data points, particularly within on-half mile of the neighborhood center. The mail-back survey responses and low pedestrian counts suggest that if more data points existed, it is likely that the conclusion of Fremont's poor "walkability" would also be supported by lower walking frequencies, but that cannot be stated conclusively in this dissertation.

7) *Use and Attitudes About Neighborhood Shopping Center ("Site Area")*

a) Rockridge, Albany/North Berkeley, and Walnut Creek respondents use their neighborhood shopping center relatively frequently, and view it as both visually and socially attractive. By contrast, Fremont respondents patronize their local shopping core much less, with a substantial fraction feeling it is simply not attractive, and only a small percentage feeling that it offers a good social environment.

b) Rockridge, Albany/North Berkeley, and Walnut Creek all present a wide range of activities and services in their neighborhood centers, in conformance with the mixed-use New Urbanist model. Moreover, respondents in all three neighborhoods are engaging in a variety of activities in these centers, as would be predicted by the New Urbanist design prescriptions.

c) While Fremont's land use mix indicates that it offers a range of activities and services in its neighborhood center, Fremont respondents are not engaging in these activities (or using these services) at the levels or breadth that respondents are doing in the other three neighborhood centers.

8) *Statistical Relationships Among Survey Variables and Neighborhood Walkability*

a) The hypothesis that individuals may self-select into neighborhoods because they are more walkable was tested through a bivariate association. This analysis shows that although self-selection into more walkable neighborhood typologies may be occurring because the *option* to walk exists there, the self-selection does not guarantee greater walking activity from the individuals who chose neighborhoods for their perceived walkability, as some previous research has hypothesized. In other words, the relationship is not that all people who show higher walking frequencies have deliberately self-selected into more walkable neighborhoods, but rather that a substantial fraction of people may be self-selecting into more walkable neighborhoods where the *option* of walking exists.

Moreover, a significant fraction of respondents who *are* walking frequently did *not* cite this as a major attractant for residential location choice, yet are walking a great deal in more "walkable" environments. One inference from this pattern is that urban form configurations do promote certain forms of travel behavior. Thus, the bivariate association analysis also suggests that people who never considered pedestrian amenities a major factor in choosing to live in the neighborhood, are *also* walking frequently within it.

b) Bivariate associations were applied to determine the influence of specific variables on home-to-shopping-area walk frequencies. These analyses confirm that, as previous research has suggested, there is a large "distance effect" in relation to walking behavior, when looking at results across all four neighborhoods, with a high concentration of all "frequent walkers" located within one-half mile of the neighborhood center.

Equally significantly, the analysis results also suggest that not only are respondents within 0.5 miles of the neighborhood shopping area more *likely* to walk there, but in fact they are almost *certain* to walk there with some frequency. In particular, respondents living within *one-quarter* mile of the neighborhood shopping area have an extremely high probability of walking there frequently.

Finally, the results indicate that a substantial fraction of respondents living farther than one-half mile from the neighborhood center also walk frequently to the neighborhood center, supporting one hypothesis of this dissertation, that factors *other* than distance may also be impacting walking behavior, contributing to the overall "neighborhood effect" described by the general walking frequency spectrum.

c) Bivariate association was used to analyze the impacts of age on walk-to-shopping-area frequency. The initial conclusion suggested that there is a significant "age effect" for walking behavior, with a much smaller fraction of older respondents walking to their neighborhood shopping area. However, combining these "age effects" with a subsequent bivariate association of age category by distance across all four neighborhoods shows that the "age effect" is almost entirely due to the fact that most older respondents in this survey sample simply live farther away; - i.e. it is a product of distance, not age.

d) Linear regression was used to test and develop predictive models of home-to-shopping-area frequency, using previously-analyzed relationships among variables as the basis for model construction. The "best" predictive model developed through this analysis suggests that of all of the variables tested through linear regression, the ones that *most influence* respondents' home-to-shopping-area walking frequency are:

- distance (confirming prior bivariate and multivariate analysis);
- whether or not a respondent is under 31 years old;
- the actual neighborhood in which a respondent lives (i.e. the "neighborhood effect," or "walkability" spectrum described by urban form configuration);

- frequency of patronizing the neighborhood shopping area (which, as the mail-back surveys have indicated - appears to be related to urban form and the overall appeal of the area); and
- whether or not the respondent is a student (which may also partially correlate with the "under 31" category, above)

Moreover, the variables have differing levels of influence, with distance taking precedence as the most influential variable, where the greater the distance from the neighborhood shopping area, the less likelihood of respondents being "frequent walkers." A small "neighborhood effect" remains in this model, as well, in which simply being a resident of Fremont decreases the likelihood of being a "frequent walker." Being a student, as well as being under 31 years old (which are likely to variables with a higher degree of association), both increase the likelihood of walking frequently. And finally, being a frequent patron of the neighborhood shopping area also increases the likelihood of higher home-to-shopping-area walking trips.

Chapter 6: Conclusions and Implications for Urban Design, Travel Behavior, and Neighborhood Livability

This dissertation set out to test the legitimacy of New Urbanist claims that its program of more compact urban form, mixed land uses, public spaces, and greater pedestrianization will increase pedestrian activity, while stimulating greater public interaction and a higher quality of life overall. This research evaluated the accuracy of these claims by using four case studies in the San Francisco Bay Area to examine the interactions of urban form with residents' travel behavior and use of their neighborhoods, and to develop models of walking frequency based upon these relationships.

The research methodology integrated both qualitative and quantitative analytic approaches. It conducted analyses across a range of scales, from regional land use, demographic, and access data that are more typically associated with transportation policy studies, to fine-grained urban form and travel behavior characteristics at the block and parcel levels, that are generally addressed only in studies with a strong urban design or architectural emphasis.

A detailed urban form survey was developed and implemented to evaluate the specific urban form characteristics of each case study neighborhood, in order to develop a hypothesized "walkability" spectrum for the four case studies based on urban form features. As a complement to that survey, an extensive mail-back survey was developed and implemented, targeting residents' travel behavior and use of local neighborhood, providing data that was then linked to the analysis of urban form in each of the case studies.

The results of these two surveys were integrated to determine the effect that variations in urban form have on the perceived walkability of neighborhoods, travel behavior within those neighborhoods, residents' use of their neighborhood centers, and ultimately, whether this affects their perceptions of the neighborhood's overall livability. A combination of univariate, bivariate, and multivariate statistical analyses were applied to develop predictive models of walking frequency as a function of neighborhood urban form. These analyses have produced a wide range of conclusions about these interactions, all of which touch on the central issue of where people walk. Several key trends have emerged, that stand as critical conclusions of this research, as well as suggesting areas for future exploration. Specifically:

1) Detailed analysis of the urban form of both the "general environs" and the site area" of each case study neighborhood has determined that the four case studies display not only differing urban form configurations as a whole, but differ on specific characteristics and variables which may directly impact pedestrian activity levels within those neighborhoods.

   Rockridge and Albany/North Berkeley are studies of smaller mixed-use neighborhoods centered around one main street that acts as the draw for the local community, and a place where people gather to shop, meet, dine, and conduct a variety of activities. Pedestrian activity levels are high, and the street atmosphere is lively. Walnut Creek is a bigger downtown center, but has countered its bigger-city feel by building a successful, and intimately scaled downtown core, centered around several streets which form a large, dynamic, pedestrian-oriented common area. Fremont, on the other end of the spectrum, contains most of the macro-scale elements required in the mixed-use transit village concept, but has articulated them on the ground in such a way as to preclude the emergence of any center - or core - at all, while discouraging pedestrian activity and interaction.

Overall, results of the urban form surveys lead to the conclusion that these four case studies define a clear walkability spectrum for the "general environs" of each neighborhood, with Rockridge at the "most walkable," followed by Albany/North Berkeley, Walnut Creek, and after a much larger gap, Fremont. The neighborhood centers (the "site area"), fall out somewhat differently, with Rockridge and Walnut Creek sharing a position as "most walkable," followed again by Albany/North Berkeley, and at the far end of the spectrum, Fremont.

2) Initial assessments of trip diaries and travel behavior data indicate that the hypothesized walkability spectrum determined through case study selection, and the urban form surveys and analysis, is in fact confirmed for these four neighborhoods, with Rockridge at the "most walkable" end of the spectrum (and fewest vehicle trips), followed by Albany/North Berkeley, Walnut Creek, and finally, Fremont. Rockridge has the highest non-vehicle trip percentage of any of the four case study neighborhoods, and conversely, the lowest fraction of vehicle trips.

3) Statisitcal analyses were applied to refine and clarify the initial assessments of neighborhood walkability. Specifically, these analyses confirmed that there is a large "distance effect" in relation to walking behavior, when looking at results across all four neighborhoods, with a high concentration of all "frequent walkers" located within one-half mile of the neighborhood center. Equally significantly, the analysis results

also suggest that not only are respondents within one-half mile of the neighborhood shopping area more *likely* to walk there, but in fact they are almost *certain* to walk there with some frequency. In particular, respondents living within *one-quarter* mile of the neighborhood shopping area have an extremely high probability of walking there frequently. Finally, the results indicate that a substantial fraction of respondents living farther than one-half mile from the neighborhood center also walk frequently to the neighborhood center, supporting one hypothesis of this dissertation, that factors *other* than distance may also be impacting walking behavior, contributing to the overall "neighborhood effect" described by the general walking frequency spectrum.

4) A predictive model of home-to-shopping-area walking frequency developed in this research suggests that of all of the variables tested, the ones that *most influence* respondents' home-to-shopping-area walking frequency are: distance; whether or not a respondent is under 31 years old; the actual neighborhood in which a respondent lives (i.e. the "neighborhood effect," or walkability spectrum described by urban form configuration); the frequency of patronizing the neighborhood shopping area; and whether or not the respondent is a student.

Moreover, the variables have differing levels of influence, with distance taking precedence as the most influential variable, where the greater the distance from the neighborhood shopping area, the less likelihood of respondents being "frequent walkers." A small "neighborhood effect" remains in this model, as well, in which simply being a resident of Fremont decreases the likelihood of being a "frequent walker." Being a student, as well as being under 31 years old (which are likely to variables with a higher degree of association), both increase the likelihood of walking frequently. And finally, being a frequent patron of the neighborhood shopping area also increases the likelihood of higher home-to-shopping-area walking trips.

5) Based on this research, it appears that although self-selection into more walkable neighborhood typologies may be occurring because the *option* to walk exists there, the self-selection does not guarantee greater walking activity from the individuals who chose neighborhoods for their perceived walkability, as some previous research has hypothesized. In other words, the relationship is not that all people who show higher walking frequencies have deliberately self-selected into more walkable neighborhoods, but rather that a substantial fraction of people may be self-selecting into more walkable neighborhoods where the *option* of walking exists.

Moreover, a significant fraction of respondents who *are* walking frequently did *not* cite this as a major attractant for residential location choice, yet are walking a great deal in more walkable environments. One inference from this pattern is that urban form configurations do promote certain forms of travel behavior. Thus, analysis results also suggest that people who never considered pedestrian amenities a major factor in choosing to live in the neighborhood, are *also* walking frequently within it.

6) Urban form survey evaluations, combined with actual pedestrian counts, trip diary data, and travel behavior data all suggest that the Rockridge neighborhood as a whole lives up to its reputation as a highly walkable environment, and the most walkable environment of the four case studies examined. Actual walking, bicycle, and transit trips are all higher than all three other neighborhoods, as are the stated frequencies with which respondents make these trips over a period of time.

Moreover, a significant fraction of Rockridge respondents include walk trips on a regular basis as part of their job commute, as opposed to the other three neighborhoods, where walking appears to be a more peripheral aspect of most respondents' job commute.

7) The neighborhood shopping centers (the "site areas") for Rockridge, Walnut Creek, and - to a slightly lesser degree - Albany/North Berkeley, all factor out as "walkable", with Walnut Creek garnering the highest rankings for respondent perceptions about its walkability and overall attractiveness, but Rockridge positioned as the neighborhood center with the highest actual pedestrian counts, and the greatest frequency of walking trips made to and from the center. Notably, however, Albany/North Berkeley - and even more so, Walnut Creek - respondents are not walking to and from their neighborhood centers, but instead appear to drive there and then get out and walk around. By contrast, Rockridge residents not only walk around the neighborhood center in high levels, but frequently walk to and from it as well.

8) In all categories of trip levels and travel behavior, Fremont exhibits the lowest fractions of walking, bicycling, and transit trips and frequency of use for those travel modes.

9) Based on mail-back survey perceptions, trip diary figures, and low actual pedestrian counts, it appears that Fremont is a poor walking environment, both in its general environs, and in the study center defined by the urban form survey "site area."

However, this conclusion is only minimally supported by a statistical analysis of walking frequencies, where the Fremont "neighborhood effect" has a small, negative influence on home-to-shopping-are walking frequency. The small survey sample size for this neighborhood makes it impossible to determine if this minimal effect is due to actual differences in walking behavior (relative to the other three neighborhoods), or if it is simply the result of a lack of data points, particularly within on-half mile of the neighborhood center. The mail-back survey responses and low pedestrian counts suggest that if more data points existed, it is likely that the conclusion of Fremont's poor "walkability" would also be supported by lower walking frequencies, but that cannot be stated conclusively in this dissertation.

10) Rockridge, Albany/North Berkeley, and Walnut Creek respondents use their neighborhood shopping center relatively frequently, and view it as both visually and socially attractive. By contrast, Fremont respondents patronize their local shopping core much less, with a substantial fraction feeling it is simply not attractive, and only a small percentage feeling that it offers a good social environment. Rockridge, Albany/North Berkeley, and Walnut Creek all present a wide range of activities and services in their neighborhood centers, in conformance with the mixed-use New Urbanist model. Moreover, respondents in all three neighborhoods are engaging in a variety of activities in these centers, as would be predicted by the New Urbanist design prescriptions. While Fremont's land use mix indicates that it offers a range of activities and services in its neighborhood center, Fremont respondents are not engaging in these activities (or using these services) at the levels or breadth that respondents are doing in the other three neighborhood centers.

The implications of these results for the broader context of urban design and planning are significant. First, while variables such as the quantity of students in a neighborhood, and the distribution of age categories for residents, are arguably things that urban designers cannot influence to any great degree (although urban planners might), the other variables are within planning and design's scope. First, the "distance effect" evidenced in this dissertation's analysis, confirms the need for compact design, as one factor in encouraging walking activity. Moreover, the added evidence (as described by this research) that walking levels are extraordinarily high within one-half mile of the neighborhood centers, and even significant at three-quarters of a mile, suggests that more compact design may almost *guarantee* higher levels of pedestrian activity.

Second, the "neighborhood effect" remaining in the statistical models, along with the significant influence of frequency of using the local shopping area, suggests that the detailed urban form configurations of neighborhood areas *do* matter. Frequency of use of the shopping areas is clearly associated with respondents' perceptions of overall attractiveness and appeal of those areas, as shown in the mail-back survey analyses described earlier in this chapter. Moreover, respondent perceptions about their neighborhoods (and in particular, their neighborhood shopping areas) closely match the conclusions reached in the independent urban form surveys. Therefore, improving the urban form details of a site, to make it more appealing to neighborhood residents, increases the likelihood that individuals will use that site, and in turn, that a greater number of walking trips may be taken to that site, independent of distance.

Finally, as shown in the survey responses themselves, and the bivariate associations applied to this data, the existence of good pedestrian, bicycle, and transit amenities *does* matter to a significant fraction of individuals in this survey. Many of those individuals specifically looked for, and chose, neighborhoods that offered such amenities, and a significant fraction of these individuals take more frequent walk trips as well (i.e. their travel behavior matches their self-selection pattern). Equally importantly, even individuals who did not choose their neighborhoods for the pedestrian amenities, are walking frequently - *if* they are in the more "walkable" neighborhoods.

In a more general sense, this research indicates that the New Urbanist faith in physical determinism - i.e. build it and they will come and use it - is not entirely supported. Other elements are clearly at play, such as adaptation or conditioning to particular travel behaviors (e.g. Fremont, where people living next to the BART station never use it, or people who think it is "easy" to walk in their neighborhood never do), and overall accessibility (e.g. Walnut Creek, where pedestrianization works in the downtown core, but the wider general environs have not been designed with similar goals, and thus no-one walks there).

However, in spite of such qualifications, this research does offer confirmation of several New Urbanist theories. First, that density *does* matter, as indicated - in this research - by the high influence of distance on walking frequency. Second, that the level of pedestrianization *does* matter; the existence of convivial public spaces, social destinations, more intimately-scaled streetscapes, and good pedestrian amenities truly geared towards placing the pedestrian first, improve the perceived (and actual) walkability of an area, as shown by the success (on the local level) of the Walnut Creek downtown core.

Moreover, the conclusions reached from this research indicate that not every urban form detail needs to be exactly right for people to use, walk in, and enjoy places. For example, Rockridge was not described by respondents as the most visually appealing of the four neighborhood centers - Walnut Creek was - yet it's the place where people seem walk the most. This research suggests that if the basic urban form configuration is in place - density, public places and destinations, mixed uses - the exact details of pedestrianization design become more flexible, as long as a large majority of these details are implemented in any given place. Conversely, failures in urban form at both levels - the broader configurations, and the details themselves - presents insurmountable challenges from the perspective of greater pedestrian activity, as exemplified by Fremont.

The analyses and conclusions of this dissertation research also highlight several areas for suggested future research. First, the data limitations of the small Fremont survey sample impacted the certainty of conclusions related to respondents within one-half mile of the neighborhood, since that group was minimally represented in the Fremont survey sample. A closer analysis of only walking behavior within shorter distances from neighborhood centers, and the urban form details of those areas, would highlight more conclusively the degree to which urban form details influence those frequencies, supplementing the conclusions of this research. Second, similar studies (to this one) could be conducted which gather more extensive trip diary data, as well as focusing survey questions on *all* within-neighborhood walk trips (as opposed to this research, which focused on commute trips and home-to-shopping area trips), allowing for a complete characterization of all residential walking behavior.

On a more general level, research of the type conducted previously, and in this dissertation, needs to move beyond a focus on affluent neighborhoods, and apply these research questions and methodologies to analyses of urban form, travel behavior, and livability in low-income neighborhoods. Moreover, studies incorporating attitudes and perceptions of people who have moved *away* from particular neighborhoods would add a new dimension to this area of research, potentially clarifying whether urban form was a factor in those decisions, and if so, to what degree.

Finally, this research confirms what has been stated before: that the educational aspects of promoting walking activity, and more walkable designs, must occur in tandem with the development of the physical designs themselves. Our society has been conditioned for too long to accept non-walkability as the norm. Changing that norm is as essential a part of the New Urbanist program as is changing physical landscapes. Fundamentally, urban designers and planners must challenge - and shift - the basic premise of, "why would I walk there?" to a new assertion of, "why *not* walk there?"

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Appendix I. City-Level Summary of Candidate Pool Socio-Demographic Characteristics

Place/City	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Albany	1,068	16,327	7.9	15	7,468	7	$34,836
Berkeley	6,692	102,724	-0.6	15	45,735	7	$29,737
Concord	18,864	111,348	7.8	6	43,715	2	$41,675
Daly City	4,809	92,315	17.6	19	30,201	6	$41,533
El Cerrito	2,328	22,869	0.6	10	10,311	4	$39,538
Fremont	49,301	173,339	31.4	4	62,400	1	$51,231
Hayward	27,809	111,498	18.4	4	42,216	2	$36,058
Lafayette	9,728	23,501	12.6	2	9,270	1	$64,806
Oakland	35,879	372,242	9.7	10	154,737	4	$27,095
Orinda	8,057	16,642	-1.1	2	6,475	1	$80,968
Pleasant Hill	4,347	31,585	25.7	7	13,653	3	$46,885
Richmond	19,024	87,425	17.1	5	34,532	2	$32,165
San Francisco	29,888	723,959	6.6	24	328,471	11	$33,414
San Leandro	8,392	68,223	6.7	8	30,189	4	$35,681
Union City	12,003	53,762	36.4	4	16,259	1	$46,988
Walnut Creek	12,355	60,569	12.9	5	29,968	2	$45,529

(Sources: 1980, 1990 U.S. Census)

Place/City	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Albany	67.6	3	-	70.9	6.1	19.8	3.2
Berkeley	66.2	5.6	5	62.3	18.8	14.8	4.1
Concord	73.8	4.6	3.9	83.9	2.1	8.7	5.3
Daly City	70.9	5.4	-0.1	39.8	7.7	43.6	8.9
El Cerrito	61.5	3.6	-	65.6	9.2	22.5	2.6
Fremont	75.8	4.2	2.8	70.7	3.8	19.4	6.1
Hayward	68.9	6.1	2	61.8	9.8	15.6	12.8
Lafayette	68.2	2.2	-	93.0	0.7	5.8	0.5
Oakland	62.9	9.5	3.4	32.5	43.9	14.9	8.7
Orinda	63.2	3	-	91.7	0.8	6.9	0.7
Pleasant Hill	73.3	3.2	-	89.0	1.2	7.0	2.8
Richmond	91.8/64.4 *	3.7/9.5 ***	3.2 *****	36.2	43.8	11.8	8.2
San Francisco	67.2	6.3	3.3	53.6	10.9	29.1	6.3
San Leandro	63.7	5.3	1.9	74.1	5.8	13.8	6.3
Union City	73.9/73.5 **	4.4/10.7 ****	-	44.2	8.6	33.4	13.8
Walnut Creek	62.2	3.3	2.9	90.8	0.8	6.7	1.7

(Sources: 1980, 1990 U.S. Census)
* 91.8 for the Briones division (pt.); 64.4 for the Western Contra Costa division (pt.)
** 73.9 for the Fremont division (pt.); 73.5 for the Hayward division (pt.)
*** 3.7 for the Briones division (pt.); 9.5 for the Western Contra Costa division (pt.).
**** 4.4 for the Fremont division (pt.); 10.7 for the Hayward division (pt.)
***** Using 64.4 as the 1990 value.

Appendix II. Tract-Level Summary of Candidate Pool Socio-Demographic Characteristics*

Ashby	4239	176	3,308	19	10	$30,165	65.3	22.4	9.7	2.6
	4240	205	5,105	25	11	$18,738	17.6	74.6	5.0	2.8
	4005	142	3,350	24	11	$22,135	35.4	55.5	6.7	2.4
	4234	183	4,499	25	11	$26,377	32.5	54.7	7.6	5.2
	4235	152	2,956	19	9	$24,672	56.0	23.0	19.0	2.1
Balboa Park	261	175	4,683	27	9	$38,208	45.5	1.5	43.1	9.8
	255	253	6,628	26	9	$43,125	47.9	2.5	32.2	17.4
BayFair	4338	1719	5,348	3	1	$31,282	70.3	8.8	13.5	7.4
	4331	714	9,145	13	7	$32,344	68.0	10.0	15.3	6.6
Civic Center	176.01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	125	50	5,674	113	78	$7,747	42.8	15.6	37.6	4.1
	124	112	6,563	59	36	$12,754	49.7	13.7	30.9	5.8
	178	176	3,787	21	14	$9,193	36.0	9.8	46.6	7.6
Coliseum/ Oak. Airport	4088	322	4,752	15	5	$12,736	6.5	70.3	13.4	9.7
	4089	201	2,900	14	5	$14,099	2.8	80.1	4.6	12.5
Concord	3350	436	3,306	8	3	$39,481	88.5	0.7	6.3	4.4
	3310	712	6,166	9	4	$41,429	87.3	1.1	5.7	5.8
	3280	268	1,258	5	3	$17,276	87.5	3.4	7.1	2.0
	3361	341	9,129	27	12	$27,435	72.4	6.4	9.1	12.1
Daly City	262	183	6,334	35	10	$39,908	36.0	5.2	46.1	12.6
	313	271	7,422	27	10	$37,364	23.1	46.6	26.9	3.4
	6007	207	6,539	32	9	$34,795	32.4	7.2	44.6	15.8
	6009	511	3,819	7	3	$48,417	67.3	1.5	28.9	2.3
Downtown Berkeley	4229	133	2,164	16	10	$15,940	59.9	6.1	29.3	4.7
	4230	175	3,923	22	11	$28,892	61.3	17.4	17.4	3.9
	4224	116	3,386	29	18	$22,030	66.2	7.2	23.9	2.6
	4228	103	6,407	62	16	$12,381	53.8	9.4	30.6	6.2
El Cerrito del Norte	3860	241	2,932	12	6	$30,000	47.3	20.8	28.1	3.7
	3852	158	1,411	9	4	$41,382	58.2	9.6	32.2	0.0
	3840	371	3,589	10	4	$52,386	64.2	13.5	21.0	1.3
	3820	498	7,836	16	6	$29,666	11.2	78.6	7.1	3.2
	3810	477	5,750	12	4	$22,302	11.4	76.5	8.1	4.0
El Cerrito Plaza	3891	161	1,785	11	6	$31,364	75.2	7.5	13.7	3.6
	3892	63	1,568	25	12	$23,484	54.3	12.1	26.4	7.2
	3880	168	2,464	15	7	$33,292	73.9	4.5	18.5	3.0
	3830	323	4,469	14	6	$33,113	59.3	14.3	20.6	5.9
Embarcadero	176.02	141	392	3	2	$35,125	82.4	3.6	8.7	5.4
	179.01	281	2,385	8	6	$41,465	78.1	9.9	9.4	2.7
	116	86	1,542	18	17	$45,581	83.5	3.6	11.7	1.2
	117	139	2,341	17	9	$13,350	42.2	6.8	47.8	3.1
Fremont	4419.01	1252	6,124	5	2	$46,212	70.4	3.8	20.1	5.7
	4418	514	5,929	12	4	$46,216	77.4	3.9	13.1	5.5
	4419.02	831	12,101	15	6	$31,331	67.2	8.6	15.5	8.7

(Source: 1990 U.S. Census, STF3A)

* Tract selections roughly correlate with 1-2 mile "General Environs" radius around BART stations in survey.

Appendix II (Cont'd.). Tract-Level Summary of Candidate Pool Socio-Demographic Characteristics*

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fruitvale	4061	461	3,407	7	2	$26,142	31.6	8.9	9.9	49.6
	4072	173	6,350	37	10	$22,426	29.1	14.9	14.9	41.2
	4062	197	9,192	47	14	$16,817	14.9	27.5	25.3	32.3
Glen Park	218	138	4,098	30	14	$47,042	78.5	3.7	9.9	7.9
	255	253	6,628	26	9	$43,125	47.9	2.5	32.2	17.4
	311	281	5,996	21	9	$40,859	61.1	6.0	24.4	8.5
Hayward	4354	330	3,264	10	6	$23,822	66.7	11.5	8.0	13.8
	4363	441	4,753	11	4	$28,810	59.7	4.9	8.0	27.4
	4365	425	3,716	9	4	$35,028	71.7	10.9	7.7	9.7
	4366	489	8,755	18	7	$27,679	54.6	14.2	11.6	19.6
Lafayette	3500	1983	5,148	3	1	$51,626	89.8	1.0	8.2	1.0
	3480	3132	4,429	1	1	$85,749	94.4	0.3	5.3	0.0
	3490	1217	5,420	4	2	$58,832	91.0	1.8	6.5	0.7
Lake Merritt	4033	224	2,045	9	4	$21,726	11.2	5.5	83.0	0.3
	4030	84	2,133	26	14	$9,886	11.0	6.9	80.4	1.7
	4034	141	3,733	27	19	$20,300	39.8	37.1	18.4	4.7
	4060	536	3,114	6	2	$18,471	19.3	25.1	39.8	15.8
MacArthur	4011	216	3,991	18	9	$20,995	35.4	42.4	14.3	7.9
	4010	289	5,496	19	8	$17,126	9.4	83.0	4.6	3.0
Montgomery Street	176.02	141	392	3	2	$35,125	82.4	3.6	8.7	5.4
	117	139	2,341	17	9	$13,350	42.2	6.8	47.8	3.1
	179.01	281	2,385	8	6	$41,465	78.1	9.9	9.4	2.7
19th St./ Oakland	4029	96	1,041	11	9	$11,193	26.4	26.4	42.7	4.4
	4028	93	1,128	12	9	$8,566	16.0	58.7	15.0	10.4
North Berkeley	4222	166	3,169	19	10	$27,173	50.5	25.7	18.4	5.4
	4223	136	2,909	21	11	$27,109	74.1	6.6	17.6	1.7
	4231	184	3,777	21	10	$24,015	48.4	31.8	10.9	8.9
	4230	175	3,923	22	11	$28,892	61.3	17.4	17.4	3.9
Oakland City Center/12th St.	4031	85	1,273	15	2	$7,626	26.2	46.4	22.1	5.3
	4030	84	2,133	26	14	$9,886	11.0	6.9	80.4	1.7
Orinda	3530.01	3383	3,213	1	0	$80,289	91.0	0.7	6.9	1.3
	3530.02	1236	3,934	3	1	$77,962	92.3	0.2	7.2	0.3
	3540.02	3641	6,313	2	1	$95,789	94.7	0.5	4.3	0.5
Pleasant Hill	3382.02	1052	9,201	9	5	$45,000	89.9	1.9	6.4	1.8
	3240	880	7,397	8	5	$31,879	88.5	0.8	7.3	3.4
	3382.01	918	3,987	4	2	$57,129	86.2	0.6	12.0	1.2
	3400.01	695	5,507	8	4	$41,734	88.4	1.1	6.8	3.7

(Source: 1990 U.S. Census, STF3A)

* Tract selections roughly correlate with 1-2 mile "General Environs" radius around BART stations in survey.

Appendix II (Cont'd.). Tract-Level Summary of Candidate Pool Socio-Demographic Characteristics*

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Powell St.	176.01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	125	50	5,674	113	78	$7,747	42.8	15.6	37.6	4.1
	123	46	5,469	120	87	$14,075	53.4	8.5	35.1	2.9
	176.02	141	392	3	2	$35,125	82.4	3.6	8.7	5.4
	178	176	3,787	21	14	$9,193	36.0	9.8	46.6	7.6
Richmond	3750	162	3,608	22	8	$21,574	28.5	40.2	9.4	21.8
	3760	291	5,035	17	6	$14,146	7.8	72.3	8.0	11.9
	3770	331	6,196	19	7	$18,511	21.9	48.4	7.1	22.5
	3810	477	5,750	12	4	$22,302	11.4	76.5	8.1	4.0
	3740	242	3,658	15	7	$30,105	59.6	22.6	8.3	9.5
Rockridge	4002	163	2,032	12	6	$46,512	87.9	4.4	5.2	2.5
	4003	265	5,008	19	10	$32,625	75.2	16.1	5.8	3.0
	4004	172	3,857	22	11	$31,107	66.9	22.4	7.7	3.0
	4043	454	3,237	7	3	$61,171	87.7	4.7	6.5	1.1
San Leandro	4325	532	7,152	13	5	$36,925	67.3	6.6	17.9	8.2
	4326	417	5,010	12	7	$30,115	77.1	8.1	8.7	6.1
	4323	258	2,738	11	5	$30,733	80.9	3.9	8.2	7.0
16th St./ Mission	201.98	110	4,844	44	17	$16,711	40.4	5.6	25.3	28.7
	202.98	80	6,144	77	37	$26,162	59.1	9.2	17.3	14.4
	177	224	1,854	8	3	$27,550	60.4	2.1	19.3	18.2
	208	86	6,962	81	28	$19,551	50.6	3.6	20.5	25.3
South Hayward	4378	312	3,464	11	4	$44,732	59.8	7.9	21.9	10.5
	4379	547	2,434	4	2	$36,745	66.6	8.1	11.1	14.1
	4382.02	1700	6,335	4	1	$36,290	61.2	6.7	24.5	7.6
24th St. Mission	209	80	4,517	56	21	$23,514	56.5	1.6	12.8	29.1
	210	71	4,784	67	31	$30,212	69.1	4.2	9.4	17.3
	229	180	11,153	62	19	$26,083	42.7	6.2	10.9	40.1
Union City	4403.09	775	4,966	6	2	$43,245	51.0	9.1	31.6	8.2
	4403.08	438	4,873	11	4	$44,085	46.0	9.1	23.9	21.0
	4402	292	5,493	19	5	$32,140	39.5	3.1	8.5	48.9
Walnut Creek	3390	839	7,377	9	6	$31,382	86.8	2.1	6.7	4.4
	3400.02	1582	7,284	5	2	$60,000	90.5	0.3	7.6	1.6
West Oakland	4019	1096	766	1	0	$20,958	22.7	44.5	1.7	31.1
	4018	74	1,784	24	10	$10,104	5.0	79.5	14.8	0.7
	4022	78	1,534	20	8	$9,573	7.4	77.4	11.9	3.3
	4021	60	1,823	31	11	$9,802	0.8	92.7	6.5	0.0

(Source: 1990 U.S. Census, STF3A)

* Tract selections roughly correlate with 1-2 mile "General Environs" radius around BART stations in survey.

Appendix III. Windshield Survey Form

URBAN FORM SURVEY: GENERAL ENVIRONS

Survey Collected By:
Date:

SITE LOCATION NAME:

GENERAL ENVIRONS		COMMENTS
Land Use: 1. Mixed Use? (circle appropriate answer)	Yes No	(explain) (explain)
2. Predominant Single Use:		
3. Special Features/Notable Sites (other than station):	Yes No	(describe)
4. Building Type(s): (describe - include housing, retail, etc.)		
Street Characteristics: 5. Main Street(s) (list and describe briefly):		
6. Traffic Levels: (note time of day of observation)	Low Medium High	
7. Sidewalks?	Yes No	
8. Landscape Quality	Low Medium High	(describe) (describe) (describe)

Describe the area briefly (diagrams/sketches encouraged):

Appendix IV. Windshield Survey Summaries for Fourteen Candidate Neighborhoods

East Bay Neighborhoods:

Fremont

The central Fremont area is a suburban downtown configuration, located in the area containing Mowry Avenue, Walnut Street, Civic Center Drive, and Fremont Avenue. It encompasses the main Fremont civic buildings (police administration, court building, etc.), and is approximately 0.75 miles from Fremont Central Park recreational facility, in central Fremont (Figure 2.1). The Fremont BART station is located on BART Way, off of Civic Center Drive. The city of Fremont is an upper-middle income[1] suburb, with a 1990 median household income of $51,231. Tracts within a one to two-mile radius of the station exhibit a slightly lower median income than the city as a whole. Overall housing densities are low, with approximately one unit per acre, and the ethnic mix is predominantly white (>70%), along with a substantial Asian-Pacific Islander population (roughly 20%).

Predominant land uses within a one to two-mile radius of central Fremont include: institutional (civic buildings, hospital); residential (both single-family ranch style, and multi-unit condo/townhouses); commercial (smaller shopping malls, "strip" development); office parks; and recreational (Fremont Central Park). However, land uses are segregated, and distances between individual buildings (other than those within malls) are large (0.13 to 0.25 miles, and more).

The general building profile of the institutional and office park structures is one-to-three story newer buildings, constructed primarily of glass and concrete, occupying large lots of two or more acres that contain extensive surface parking areas and formally landscaped grounds. The townhouse/condominium complexes are two-to-four story postwar buildings (some are very new), constructed of various proportions of stucco, concrete, glass, and occasionally, wood. They are generally gated or walled-in, with carports and/or surface level parking, and landscaped grounds. Single-family residences are typically one story ranch-style homes, on 0.5-acre - or larger - lots, with setbacks of 15-20 feet.

The main streets in this vicinity are Walnut Street, Mowry Avenue, and along the southern border of the BART parking lot, Civic Center Drive. These streets are divided arterials (2-3 through lanes in each direction), signalized only at main intersections, with no on-street parking. Traffic speeds on these arterials are high (30 mph or greater), as are traffic volumes. The general street pattern in the area is a mixture of wide arterials and small residential cul-de-sacs ("loops and lollipops"). All streets have formal sidewalks.

Landscaping quality is of medium quality (private properties such as office parks and townhouse complexes have formal landscaping, with medium-size trees, some shrubbery, etc. However, there are also numerous "lots" or expanses that have minimal or no landscaping).

The area is of mixed quality for pedestrians. While sidewalks are present on all streets, the distances between destinations (often 0.25 miles or more) discourage pedestrian activity. The distances within the BART property itself (across building and parking lot) are often 0.25 miles or more. Crosswalks are present at major intersections, but high volumes of traffic on the wider

[1] Median Household Income (annual) levels have been categorized as follows: Low = <$20K, Lower-Middle = $20K to $30K, Middle = $30K to $45K, Upper-Middle = $45K to $60K, Upper = $60K or more.

arterials also discourages pedestrian activity. The general scale of buildings and physical appearance in the area is large, with little detail or fine grain texture. The BART property, in particular, has a bleak visual appearance, with virtually no vegetation and large, unbroken expanses of surface parking.

South Hayward

The South Hayward area is suburban, located in a residential section of South Hayward, located along and west of Route 238 (which runs along the bottom of the East Bay Regional hills, centered around Tennyson and Dixon Streets. South Hayward is a middle income neighborhood, with 1990 median household incomes ranging from $36,290 to $44,732 in the area within a one to two-mile radius. Overall housing densities are low, with one to four units per acre. The ethnic mix is predominantly white (> 50%), with some Asian-Pacific Islander presence (roughly 25%).

Predominant land uses within a one to two-mile radius are residential (both older single family and newer townhouse/condominium style), and auto-related commercial/retail (along Route 238). Notable characteristics of the area are the large number of vacant lots interspersed with residences (1-2 vacant lots per block), and the extensive stretches of chain link fences, barbed wire, etc., which surround both occupied and vacant lots.

The general residential building profiles are of two predominant types: newer (<20 years old), two-to-three story townhouse/condominium developments, with carports or garages, walls or gates around the developments, and wood and stucco-type building materials; and older, post-war ranch style single-family homes, with stucco-type exteriors, on small lots with 10-15 foot setbacks.

The main streets bounding the area are Tennyson Road, which runs along the north edge of the BART station, Route 238 (Mission Street), which runs northwest-southeast approximately 0.25 miles to the east, and Industrial Parkway, which runs northeast-southwest approximately 0.75 miles to the south, linking Route 238 with the I-880 freeway. All three roads are large arterials (two or more through lanes in each direction), with no on-street parking, infrequent signals only at major intersections, and high traffic volumes moving at high speeds (> 30 mph, on average). The general street pattern is looped residential streets combined with larger arterials. Tennyson Road has formal sidewalks, while Route 238 and Industrial Parkway appear to have sidewalks only at infrequent intervals.

The general landscape quality is low (sparse or non-existent vegetation, with poor maintenance), except for the newer, gated townhouse developments, in which the formal landscaping is of medium quality (small lawn areas, medium-sized trees, and some small shrubbery).

Pedestrian facilities and amenities are of low to medium quality. Pedestrian destinations, such as retail or food services, are absent in the area. Moreover, the presence of numerous vacant lots, chain link fences, and protective grillwork on houses indicates that safety may be a concern in this area. Finally, the presence of several large arterials with high traffic volumes and speeds in the immediate vicinity of the station (see description above) suggests strong deterrents to pedestrian activity.

Bay Fair

The Bay Fair area is suburban, centered around the Bay Fair Mall, and the Bay Fair BART station, located on Coelho Drive, approximately 0.13 miles east of Hesperian Boulevard, and 0.5 miles southwest of 14th Street, in the city of San Leandro. The Bay Fair Mall is a large, suburban mall ("mega-mall") occupying a space of at least 0.5 square miles directly north of the BART station. The station itself is a concrete, above-ground structure, with entrances at the northeast and southwest sides of the BART tracks. It is surrounded by a moderate size BART surface parking lot (approximately 0.13 square mile). The surrounding Bay Fair neighborhood is a middle income area, with 1990 median household incomes of roughly $31,000. Overall housing densities range from low to moderate, with one to seven units per acre. The ethnic mix is predominantly white (>68%), with the remaining population split relatively equally among blacks, Asian/Pacific Islanders, and "other" groups.

Predominant land uses within a one to two-mile radius include large retail (Bay Fair Mall) to the north, single-family residential to the south and east, and a multi-unit residential area approximately 0.25 miles to the west. There is some office/commercial use along Hesperian Blvd., to the west, as well. The land uses are distinctly segregated in areas around the BART properties.

The building profiles of the mall structures are typical "big box" style, 1-2 stories in height, with continuous, monotonous facades, and are surrounded by extensive surface parking. There is virtually no architectural variety or interest to these structures. The single-family residences are typically 1-2 story, postwar ranch-style homes with attached garage, with 15-foot setbacks and small yards, and relatively pleasant landscaping, including trees, well-maintained lawns, and shrubbery. The multi-family dwellings are predominantly 2 story, side-by-side attached postwar townhouse-style buildings, with 10-15 foot setbacks and garages behind or next to the residences. Primary building materials are wood and stucco (or adobe-type materials).

The main streets bounding the station vicinity are East 14th Street, a divided arterial running north-south, located approximately 0.5 miles to the east of the station, and Hesperian Boulevard, a divided arterial which runs north-south, approximately 0.13 miles west of the station. Both of these arterials have two or more through travel lanes in each direction, with additional left-hand turning lanes at major intersections, and one on-street parking lane in each direction. Traffic volumes and speeds are high on both roads, which are signalized only at major intersections. Both of these streets have formal sidewalks. The Bay Fair Mall itself acts as a northern boundary to the station vicinity, by virtue of its sheer expanse. The Route 238 highway is located approximately 0.5 miles south of the station, forming a clear southern boundary to the area. The general street pattern is looped residential streets combined with larger arterials.

Landscape quality in the area is generally low to medium, with few trees, and poor maintenance. The Bay Fair Mall is almost completely absent of vegetation, thus possessing notably poor landscaping quality. The residential areas form the exception to this generalization, with medium-quality landscaping in the yards and along the residential streets.

The pedestrian quality of the area is generally low, although within the residential sectors, the improved landscaping and quieter streets stand in contrast to the overall pedestrian characteristics. Distances between destinations are, for the most part, large (>0.25 miles), with the exception of the residential area directly south of the station, which is connected to the BART property via several pedestrian footpaths. The Bay Fair Mall, which is roughly 0.5 square miles or more in size, would appear to be a strong deterrent to pedestrian activity, due to its size and lack of visual interest.

Albany/North Berkeley

The Albany/North Berkeley area is semi-urban, centered around the eastern half of Solano Avenue, which is approximately 2 miles northwest of the downtown Berkeley area and the University of California, Berkeley, campus. This area of Albany and Berkeley contains lower-middle to upper-middle income neighborhoods, with 1990 median household incomes ranging from $24,015 to over $48,000. Overall housing densities are low to moderate, ranging from four to eleven units per acre. The ethnic mix is predominantly white, with the remaining population mostly Asian, and a small balck population.

The predominant land uses within a one-to-two mile radius are single family residential, along with several retail areas, including: Solano Avenue, a major retail/commercial street which runs through both Berkeley and Albany; a strip of retail/commercial along University Avenue; a small gourmet food services/retail area at Gilman and Hopkins Streets (Monterey Market area); and another major retail/commercial area along Shattuck Avenue, around the Vine Street intersection.

The general building profile is postwar, one to two-story single family homes, constructed of wood or stucco/concrete. Lots are small and densely packed, with well-maintained gardens and yards. The commercial and retail areas display varied architecture, ranging from older shingle-styled buildings, to more contemporary concrete and stucco structures. Buildings are small-scaled, and rarely generally range from one to three sories in height.

The main streets in the immediate vicinity of the station are Solano Avenue, The Alameda, which runs north-south, and continues into downtown Berkeley as Matin Luther King Drive, and Marin Avenue, which runs east-west, parallel to Solano Avenue.

Landscaping quality in the residential area is high, marked by lush, mature trees, well-maintained gardens and yards, and several parks. The retail/commercial area of Solano Avenue has more varied landscaping, ranging from medium to high quality.

The pedestrian quality of the area is medium to high, primarily due to the pleasant landscaping and generally high visual qualities of the surrounding neighborhoods. Buildings are small-scale, with varied architectural styles, allowing for visual interest. Solano Avenue is a major pedestrian destination, with numerous shops and restaurants lining both sides.

El Cerrito Plaza

The El Cerrito Plaza area is suburban, centered around the El Cerrito Plaza BART station, located at Central Avenue and Liberty Street, three blocks east of San Pablo Avenue, and 0.5 miles east of Interstate 80, close to the border of the cities of El Cerrito and Albany. The station is a concrete, above-ground structure, surrounded by a BART surface parking lot, and adjacent to extended surface parking for the El Cerrito Plaza mall, which borders the BART station on its south side. The area is primarily middle income, with the notable exception of one lower-middle income tract west of the station, with 1990 median household incomes ranging from $23,484 (the noted tract) to $33,292. Overall housing densities are moderate to high, with six to twelve units/acre. The ethnic mix is predominantly white (>54%), with a substantial Asian/Pacific Islander presence (approximately 20%).

The predominant land uses within a one-mile radius of the center are large retail/commercial (El Cerrito Plaza, large retail and "strip development" along San Pablo Ave.) and residential (both multi-unit and single family residences). These uses are segregated, with most residential areas to the east of the station, while the large retail/commercial is to the west.

The general building profile for the retail/commercial uses is large, one to two-story modern concrete structures, with few or no windows, excepting glass storefronts for some of the buildings along San Pablo Avenue. Single family residential homes are typically postwar, one-story, wooden or stucco ranch-style buildings, with attached garages. Setbacks are 10-15 feet, and lots are relatively small and tightly packed (6-8 units/acre). Multi-unit residences are mainly postwar, two to three-story concrete or wood apartment and condominium complexes.

The main streets in the immediate vicinity of the station are San Pablo Avenue, and farther west, Interstate 80. San Pablo Avenue is a divided arterial, with two through lanes in each direction, additional turning lanes at major intersections, plus on-street parallel parking (this is restricted in some areas). Major intersections are signalized, but traffic volumes and traffic speeds are high on this road, since it serves as a major north-south thoroughfare for East Bay traffic. Thus, it effectively acts as a strong deterrent to pedestrian activity, and forms a neighborhood "boundary" to the west of the BART station. Residential streets on the east side of the station are quieter and narrower (one through lane in each direction, with on-street parking). The general street pattern is looped residential streets combined with arterials. All streets have formal sidewalks.

Landscaping on the BART property, and in the El Cerrito Mall, is of low quality, with few trees and sparse vegetation in general. Landscaping in the residential areas to the east is of medium to high quality (trees evenly spaced along streets, with well-maintained yards), while to the west it is low to medium (sparse vegetation, with poor maintenance).

The pedestrian quality of the area is low, in part due to the expansive parking facilities bordering the station (both the BART facility and the El Cerrito Plaza facility), requiring a walk of more than 0.125 miles to the nearest pedestrian destination. This expanse (combined with sparse vegetation) also leads to a bleak visual appearance, and an overwhelming sense of scale, although not to the extreme as is evident at the Bay Fair station.

Concord

The Concord area is a suburban downtown configuration, centered around the Concord BART station in downtown Concord, located at Oakland Avenue and Mount Diablo Street, in downtown Concord. The station is an above-ground, concrete structure, surrounded by a moderate-sized BART surface parking lot, which is supplemented by a four-story BART parking structure. This area of Concord is primarily middle income, with 1990 median household incomes ranging from $27,435 to $41,429. One notable exception is a low-income tract, with a 1990 median household income of $17,276. Overall housing densities are generally low, with three to four units per acre, although one nearby tract exhibits a much higher housing density of 12 units per acre. The ethnic mix is overwhelmingly white (>72%), with relatively small fractions of Asian/Pacific-Islander and "other" populations.

Predominant land uses within a one-mile radius of the station include: corporate office park (e.g. Bank of America office building); large commercial/retail (e.g. malls and "strip" development) ; auto retail/services; and single family residential. The land uses are highly segregated, with the residential area lying to the east of the station, the corporate office buildings to the west and south of the station, and the large commercial/retail and auto retail/services to the north, west, and southwest. There is almost no vertical mixing, with the exception of several office buildings adjacent to the BART property, in which upscale cafes and restaurants occupy portions of the ground floors.

The general building profile for the corporate office structures is newer, eight-plus story, glass, concrete, and brick buildings. The commercial and retail buildings are typical "strip development" structures (large, one story buildings with monotonous facades), situated either directly along the street sidewalks, or in mini-mall areas with extensive surface parking. The single family residences are one-story, post-war wood or stucco ranch-style homes, with 15-20 foot setbacks, attached garages, and well-maintained yards.

The main streets in the immediate vicinity of the station are Clayton Road, Concord Boulevard, and, roughly 1.5 miles to the west, Interstate 680. However, there are numerous large streets in the downtown area in addition to these two - a striking characteristic of this particular station. Clayton Road and Concord Boulevard are large, divided arterials (or collectors acting as arterials), with three through lanes in each direction, no on-street parking in the downtown area, and timed, signalized intersections. Traffic volumes on these streets are high, as are traffic speeds. The residential streets, by contrast, are narrower and substantially quieter, with on-street parking. The general street pattern is large arterials combined with cul-de-sacs and looped residential streets ("loops and lollipops"). All streets have formal sidewalks.

Landscaping in the area is of medium to high quality. The BART property is formally landscaped with numerous trees and shrubbery, that are well-maintained. The residential area is likewise of high landscape quality, with numerous street trees, and well-maintained yards. However, the large commercial/retail sections are more barren, with streets that are almost entirely absent of vegetation.

The pedestrian environment is of low to medium quality. Due to the strong segregation of land uses, and the low-density nature of the area, distances between destinations are large (>0.25 miles). Moreover, the exceptionally wide, and heavily trafficked, arterials are likely to be intimidating from a pedestrian standpoint, thereby discouraging pedestrian activity.

Pleasant Hill

The Pleasant Hill area is suburban, centered around the Pleasant Hill BART station, located at Oak Road, Treat Boulevard, and Coggins Drive, less than 0.25 miles east of Interstate 680, in Pleasant Hill. The station is an above-ground, concrete structure, surrounded by a large BART surface parking lot, which is further supplemented by an eight-story BART parking facility. This area is a middle to upper-middle income neighborhood, with 1990 median household incomes ranging from $31,879 to $57,129. Overall housing densities are low to moderate, with two to five units per acre. The ethnic mix is almost exclusively white (>86%), with a small Asian/Pacific Islander presence.

The predominant land uses around the station are corporate office complexes, and residential areas, both single family and multi-unit apartment/condominium complexes. The uses are highly segregated, with a notable absence of any common retail services, such as grocery stores, restaurants, etc., in the area. In addition, the area has an unusually high proportion of upscale, multi-unit condominium/apartment complexes; virtually all of the residences directly adjacent to the BART property are of this type.

The general building profile for the corporate office structures is new, five-plus story buildings, constructed of glass, brick, and concrete, and surrounded by formally landscaped grounds. The multi-unit residences are generally post-war, two to three-story buildings, constructed of wood, concrete, or stucco, with ground-level carports or underground garages, and very well-maintained formal landscaping. The single family residences are large, ranch-style homes on large lots, with well-maintained yards and gardens.

The main streets in the immediate vicinity of the station are Treat Boulevard and Interstate 680. Treat Boulevard is a large arterial, with three through lanes in each direction, no on-street parking, and is signalized only at major intersections. Traffic volumes on Treat Boulevard are high, as are traffic speeds. Residential streets are quieter and narrower (one through lane in each direction, with on-street parallel parking). The general street pattern is large arterials combined with looped residential streets and cul-de-sacs ("loops and lollipops"). All streets have formal sidewalks.

Landscaping in the area is generally of high quality (numerous mature trees, extensive shrubbery, etc.), although the BART surface parking lot is rather sparsely vegetated.

The pedestrian environment is of medium to high quality. The visual surroundings are pleasant, particularly due to the high landscape quality, and there are numerous residential areas (apartment/condominium complexes) and office complexes within 0.25 miles of the BART station, with easy and direct access along quieter residential streets. However, the lack of retail and general services would appear to be a serious drawback in terms of pedestrian activity, as it reduces the number of potential destinations that pedestrians might otherwise walk to.

Lafayette

The Lafayette area is suburban, centered around downtown Lafayette and the Lafayette BART station, located along Route 24 (between the two directional arms of the freeway), on Happy Valley Road and Deer Hill Road, in downtown Lafayette. The topography of the area is notable, with hilly regions less than one mile to both the north and south of the BART station. The area surrounding the station is upper-middle to upper income, with 1990 median household incomes ranging from $51,626 to $85,749. Overall housing densities are low, with one to two units per acre. The ethnic mix is almost exclusively white (>89%), with a small Asian/Pacific Islander presence.

Predominant land uses in this area include: a variety of small and medium-scale retail/commercial facilities, including supermarkets, small offices, banks, auto services, restaurants, etc.; and residential areas, ranging from low-density, "rural residential" homes on large lots, to typical smaller suburban single family detached houses, to multi-unit apartment/condominium complexes in the downtown area. Land uses are horizontally mixed along and around Mt. Diablo Boulevard, but not vertically.

The general building profile of the retail/commercial facilities is one to two-story modern structures, with small to medium-scale storefront facades. There are numerous small-scale office complexes, containing businesses such as dental offices, health groups, etc. The multi-unit residences are post-war, two to three-story, wooden or stucco, moderately upscale developments, with carports or underground garages. These complexes generally have formal landscaping that is well-maintained. Single family residences range from one to two stories, on varying-sized lots, with well-maintained landscaping.

The main streets in the vicinity are Happy Valley Road, Deer Hill Road, Mount Diablo Boulevard, and Route 24. Mount Diablo Boulevard is the "main street" for Lafayette, along which most of its retail and commercial facilities are located. It is a large arterial, with two through lanes in each direction, on-street parallel parking, and signalization at major intersections. Traffic volumes on this street are high, and traffic speeds often exceed 30 mph. All streets have formal sidewalks, with the exception of several very small residential streets, which have curbless, gravel sidewalks instead. There are crosswalks at all major intersections, as well as at some of the smaller street intersections.

Landscaping in this area is of high quality, with medium and large-size street trees evenly spaced along the main streets, along with extensive shrubbery. There are several large open space areas north of the station, which are easily visible from the station area. The EBMUD Lafayette Reservoir Recreation Area, which contains picnic areas, a walking path around the reservoir, and extensive open space, is situated approximately 1.5 miles west of the BART station, off of Mount Diablo Boulevard. Residential areas are heavily vegetated, with well-maintained yards.

The quality of the pedestrian environment in this area is medium to high, with numerous and varied pedestrian destinations close to the station, appealing landscaping, and signalized intersections and crosswalks along the "downtown" portion of Mt. Diablo Blvd. While the BART surface lot on the north side of the station is expansive, and therefore might act as a deterrent to pedestrian activity, the linkage between the station and downtown Lafayette on the east side is strong, and therefore would appear to encourage pedestrian activity. Pedestrian activity is relatively high during the day and early evening, dropping off significantly after the rush hour period.

Orinda

The Orinda area is suburban centered around downtown Orinda and the Orinda BART station, located along Route 24 in downtown Orinda. The topography of the area is notable, with hilly regions less than one mile away in all directions around the BART station. The area surrounding the BART station is upper income, with 1990 median household incomes ranging from $77,962 to $95,789. Overall housing densities are low, with one, or less than one, units per acre. The ethnic mix is almost exclusively white (>91%), with a small Asian/Pacific Islander presence.

Predominant land uses in the area include the upscale Marketplace and Theater Square developments (pedestrian mall with gourmet foods, and the newly-renovated art-deco movie theater), located less than 500 feet from the station on it east side, and the civic area (police, administration, etc.) on the station's west side. The area is notable for its near absence of any residential areas within a one-mile radius of the station. The grain of the retail/commercial facilities is small to medium-scale, making for a very pleasant, compact downtown environment.

The general building profile is varied, with the new, three-story, custom-designed Marketplace building, and art-deco theater adjacent to more typical post-war one-story retail shops with glass fronts. Streets in the retail area are narrow, with numerous crosswalks, and diagonal on-street parking.

Landscaping in the area is of high quality, with medium and large-size street trees evenly spaced along the main streets, along with extensive shrubbery. There are several large open space areas north of the station, including the Briones hills, which are easily visible from the station area. Landscaping is well-maintained.

The quality of the pedestrian environment in this area is high, with strong linkages between the BART station and the Marketplace center, and hence numerous, fine-grained pedestrian destinations easily accessible within a very compact area. Moreover, the landscaping and overall visual appearance of the area is pleasant and diverse. Pedestrian activity is high both during the day and in the evening.

Rockridge

The Rockridge area is semi-urban, centered around the Rockridge BART station, located at College Avenue and Keith Avenue, in Oakland. As with the Lafayette and Orinda stations, the Rockridge station is situated along the Route 24 freeway, between the separated freeway road directions. This area of Oakland ranges from middle to upper income, with 1990 median household incomes of $31,107 to $61,171. Overall housing densities are low to moderate, with three to eleven units per acre. The ethnic mix varies with location, although it is generally predominantly white (>66%), with a substantial black population (>16%) in several tracts.

The land uses in the area are highly mixed, both vertically and horizontally, and the area is often used as a premier example of moderate-density, mixed use development. Land uses include: small retail, commercial, and service facilities; medium-density single family detached, and multi-unit residential areas; corporate office (Dreyer's); manufacturing (garment workshop); and a notable gourmet food retail sector (Market Hall).

The general building profile for retail/commercial facilities are one to two-story, tightly packed buildings, with glass storefronts and a wide variety of architectural styles. The retail environment is distinctly "pedestrian scale," with high pedestrian activity levels at almost all times during the day. Residential buildings include: one to two-story, single family detached, wooden "craftsman-style" homes, although often these may have smaller studios or apartments in basements or backyards; and older, two-story concrete or stucco apartment buildings. However, again, architectural styles range tremendously, producing a diverse array of building types.

The main streets in the area are College Avenue and Route 24. College Avenue is a minor arterial. It has one through traffic lane in each direction, on-street parallel parking, and is signalized at major intersections. Traffic volumes on this street are high, while traffic speeds are generally low to moderate, due to heavy congestion. Residential streets have one through lane in each direction, with on-street parallel parking. Traffic volumes are low to moderate on these streets. The general street pattern is a fine-grained grid. All streets have formal sidewalks, with crosswalks at major intersections.

Landscaping in this area is generally of high quality, with large, mature trees along the streets, and well-maintained yards and gardens. College Avenue possesses some stretches, particularly south of the station, that have few or no trees, and/or the trees are very young and small.

The quality of the pedestrian environment is high, with high activity levels throughout the day, varied architecture and visual interest, and numerous pedestrian destinations within a compact area.

San Francisco Neighborhoods:

Glen Park

The Glen Park area is semi-urban, centered around the Glen Park BART station, located at the corner of Bosworth and Diamond Streets in the southern part of San Francisco. There is a very small BART surface parking lot, holding 30-40 cars. This area is middle to upper-middle income, with 1990 median household incomes ranging from $40,859 to $47,042, in the nearby tracts. Overall housing densities are moderate to high, averaging nine to 14 units per acre. The ethnic mix is predominantly white (>47%), but several tracts show a substantial presence of both Asian/Pacific Islander (>24%) and "other" groups (>17%), indicating a fairly heterogeneous ethnic mix overall.

Predominant land uses within a one to two-mile radius include: fine grained retail and services in the commercial districts along Diamond Street, and 0.5 miles to the southeast, along Mission Street; and single family housing in the residential areas around Bosworth, Chenery, and Diamond Streets. These two classes of uses are not truly "mixed," but instead are separate but very close together. The general environs are sharply divided by I-280 and San Jose Avenue, which run parallel through this area. Northwest of this boundary is an area of steep hillsides and higher priced, mostly single family residential areas with views, along with a few multi-unit buildings. Southeast of the boundary is a flat area with much more modest residences, no views and very little pleasant landscaping.

The general building profile for the retail and commercial facilities is that of small-scale, one to two story buildings with varied architectural styles. Buildings on Diamond Street are built right up to the edge of the right-of-way. The streetwall is fairly continuous on the west side with more transparency and more fragmented on the south with less transparency. Chenery Street has very similar characteristics, with one side a continuous streetwall comprised of shops, while the other side has a more broken facade, with spacing between houses and other uses. that are separated. The residential buildings to the northwest of the station are mostly detached, but densely-packed, on small lots.

The main streets in the area are Diamond, Chenery, and Bosworth Streets. Diamond Street is about 40 feet wide, with no median. There is one travel lane north of the station and two south of the station, as well as one parking lane in each direction. Traffic volume is light to moderate, with about 10-15 cars/minute at 11 am. There are two bus lines. Chenery Street has the same measurements as Diamond, but is somewhat quieter with less traffic volume. There is one bus line. Bosworth Street is about 50 feet wide and has a median varying from two feet wide to six feet wide at corners. The median is planted with low, neatly trimmed bushes. Traffic volume is moderate at about 20 cars per minute at 11:30 am. There is no bus line. There is on-street parking on all streets around the station; restrictions vary from 1 hour meters to 2-hour residential permit zones. All streets have formal, concrete sidewalks.

The landscaping in the area is of medium quality. Diamond Street has deciduous trees which are moderately leafy. They are about 10 feet high and 10-12 feet in width. Spacing is erratic; the block between Bosworth and Chenery has only a few small trees. Chenery Street has young, small, thin trunked trees with small canopies. In general, both these streets are under-treed. Bosworth Street has medium-sized deciduous trees, planted roughly every 25 feet, along with some shrubbery and grass along the sidewalks.

The quality of the pedestrian environment is medium to high. While the station itself is very unattractive, with a mediocre plaza design, the fine grained retail and commercial district immediately accessed along Diamond Street offers an interesting and diverse array of destinations for pedestrians, with a similarly diverse visual appeal. However, there are very few pedestrian amenities such as benches, sitting areas, etc. Pedestrians on Chenery and Diamond Streets are primarily shoppers, with this area exhibiting light to moderate pedestrian activity. The residential area along Bosworth Street has a very scattered, and sparse pedestrian presence. There are no absolute barriers for pedestrian access anywhere, but I-280 creates a deterrent to anyone wishing to walk from the northwest to the southeast sides of the area. Bosworth Street passes under the highway with a sidewalk, but it is an unpleasant walk.

Montgomery St./ Embarcadero

The Montgomery Street (Montgomery), and Embarcadero areas are urban downtown, centered around the Montgomery and Embarcadero BART stations, located along a 0.5-mile stretch of Market Street, in downtown San Francisco. Specifically, the Montgomery station is located at the juncture of New Montgomery and Montgomery Streets, and the Embarcadero station is located at the base of Market St., at the juncture of Drumm and Main Streets. The stations are all underground structures, with no associated BART parking. The residential areas in this area are middle to upper-middle income, with median household incomes around $45,000.

Overall housing densities also cover a wide range, from two to over thirty units per acre, reflecting the presence of numerous apartment and condominium complexes in the area. The racial mix is fairly homogeneous, with tracts located around the Embarcadero and Montgomery St. stations (excluding one Montgomery St. tract which contains a portion of Chinatown), where whites comprise over seventy-eight percent of the total population.

Land uses within one-to-two miles are are varied, including: large office/commercial; civic/institutional (the Civic Center area); the new Moscone conference facility 0.25 miles from the Montgomery St. station); retail and hotel services (the Union Square district); numerous hotels directly on Market and adjoining streets; arts/theater (Opera House, Symphony Hall, etc., at the Civic Center; the new Museum of Modern Art and Yerba Buena Center less than 0.25 miles from Montgomery St.), rejuvenated industrial/warehouse uses to the south of Market St., and a variety of newer and older high-density residential structures (apartments, condominiums, lofts, etc.), all within easy walking distance. The current renovation of the waterfront area at the base of Market St. is well underway, and provides a whole new set of retail and recreational attractions for tourists and residents alike. In general, land uses are mixed vertically and horizontally, with smaller retail shops on the ground level of large office buildings, and office facilities in upper floors, while building purposes vary from retail to office to hotel, etc., within each block. In sum, the downtown San Francisco area is a diverse and dynamic environment, with an attractive mix of retail and recreational uses within a compact, easily accessible area. Daytime pedestrian activity and presence in the downtown area is very high, although this activity drops off somewhat at the end of the workday.

The general building profile for the commercial/office area is of moderately old to new multiple-story (four-plus) concrete and stonework office structures, with little or no setback from the sidewalk. Ground floor storefronts are glass, and buildings are tightly packed. There are numerous ground-level public plazas at the base of buildings and along the city blocks, with landscaped seating areas and walkways. While the overall scale is large, the many smaller retail stores at ground level (e.g. coffee shops, smaller restaurants, clothes boutiques.) are at a much finer scale, and thus the overall impression is more pedestrian-friendly. Residential buildings are primarily multi-story structures, ranging from pre-war stone and brick buildings (many of which have been renovated into upscale condominiums), to new glass and stone or concrete condominium units with some outdoor landscaping in plazas and roof decks. In the Chinatown district, residential units are prewar multi-story structures, many of which are in poor or run-down condition, and with little or no landscaping.

The main streets in the immediate vicinity of the stations are Market St. and Van Ness Avenue, while Highway 101 runs approximately 0.5 miles to the south of Market Street. Both Market St. and Van Ness Avenue appear to be acting as arterials; Van Ness serves as a major link between the southern and northern portions of the downtown city area. Market St. has two through lanes of traffic in each direction (one of which is heavily used for bus traffic), only occasional on-street parallel parking, no median divider, and numerous signalized intersections, with crosswalks at every intersection. Van Ness Avenue has three through lanes of traffic in each direction, on-street parallel parking, a median divider, and numerous signalized intersections, with crosswalks at every intersection. Traffic volumes on both streets are high, while traffic speeds are low to moderate on Market St., and moderate to high on Van Ness Avenue. The general street pattern around the stations is a moderate-size grid.

Landscaping in the area varies significantly depending on location. Landscaping in the Civic Center and Powell St. areas is sparse, with widely spaced trees and minimal levels of vegetation overall. Maintenance is poor. However, areas around Montgomery St. and the Embarcadero are more attractively landscaped, with numerous public plazas that are well-maintained, and grassy, professionally landscaped areas such as the Yerba Buena Center acting as small, outdoor downtown parks.

The pedestrian quality of the area is generally high. The compact nature of the downtown area appears to produce a dynamic pedestrian environment during the day, with high levels of pedestrian activity and multiple pedestrian destinations that are easily accessible. A notable exception to this trend is the south of Market area between the Powell St. and Civic Center stations, where a run-down physical appearance combined with safety concerns clearly acts as a deterrent for pedestrians.

Appendix V. Detailed Urban Form Survey

URBAN FORM SURVEY: SITE AREA

SITE AREA DATA
LAND USE CHARACTERISTICS WITHIN APPROX. 1/4 MILE OF THE SITE

CHARACTERISTICS	YES	COMMENTS
Land Use Mix: Single Use		types? distinctly separated? etc.
Mixed Use Horizontal Mixing (list ground story uses)		
Vertical Mixing (list upper story uses)		
Land Use Type: Residential		list approximate frequency, specific types, etc.
Office		
Retail Small		
Large		
Heavy Industrial		
Light Industrial		
Auto-Related		
Institutional		
Open Space		
Parking (off street)		
Personal Services		
Business Services		
Food Services		
Other		
Grain: Coarse		describe.
Fine		

Additional Comments/Diagrams:

SITE AREA DATA
SERVICES WITHIN WALKING DISTANCE OF THE SITE (APPROX. 1/4 MI.)

TYPE OF SERVICE	YES	FREQUENCY (# per block) DISTANCE FROM SITE
Restaurants/Coffee Shops		
Groceries		
Specialty Food Shops (e.g. Gourmet Foods)		
Banks/ATM Machines		
Parks/Open Space		
Child Care		
Other Services, e.g.: Dry Cleaning/Laundry		
Drug Stores		
Entertainment: Movies, Videos, etc.)		
Haircuts/Beauty Salons		
Health Club/Exercise/Dance		
Copies		
Post Office		
Travel Agent		
Parking Lot		
Parking Structure		
Other (list)		

Additional Comments:

SITE AREA DATA-STREET CHARACTERISTICS
(Record for each major street)

STREET NAME:

CHARACTERISTICS	YES	COMMENTS
Street Type: Minor Street		
Collector		
Arterial		
Freeway		
Design Features: Median		width? landscaped?
On-Street Parking		parallel/diagonal/perpendicular?
Other (explain)		
Traffic Volumes*: Light		give rough estimates from five-minute vehicle count.
Moderate		
Heavy		
Street Layout:** One Way		
Two Way		
Total Number of Through Travel Lanes, Both Directions (describe)		
Special Turn Lanes (describe)		
Public Transit: Bus Lines (list total number of bus lines)		
Rail (explain type)		
Noise: Quiet		
Moderate		
Loud		

* Note time of observation in Comments section
** Note approximate street width (in ft) in Comments section

SITE AREA DATA

LAND USE-SIDEWALK INTERFACE

(Record for each major street. Please use separate data forms for each streets)

STREET NAME:

CHARACTERISTICS	YES	COMMENTS
Sidewalk Edge - Built Edge: Buildings Set Back? (describe - # of ft.)		
Vacant Lots? (sketch or describe)		
Parking along Sidewalk?		
Streetwall Quality: Continuous		describe: predominant quality; notable exceptions; etc.
Fragmented		
Transparent		
Blank Wall		
Monotonous		
Interesting		
Adjacent Uses (e.g. between buildings) Are: Open		
Fenced		
Walled		
Signage - For Parcel Use (describe): Small		describe: estimate proportion of total signage, etc.
Large		
Attached to Building		
Free-Standing		
Neon		
Signage - Unrelated to Parcel Use: Billboards		describe.
Graffiti		

SITE AREA DATA
SIDEWALK CHARACTERISTICS

(Record for street on which station is located, and for each other major street, if different. Please use separate data forms for each street.)

STREET NAME:

CHARACTERISTICS	YES	COMMENTS
Formal? (list width in ft.)		
Pavement Type: Unpaved - dirt or gravel		
Asphalt		
Concrete		
Brick/Tile/Paving Stone		
Maintenance Quality: Smooth Pavement		
Poor/Broken or Tilted Slabs		
Clean		
Littered		
Sidewalk Zones: Tree/Shrub Planting Strip		
Arcades/Awnings		
Other (explain)		
Street Furniture: Benches		(describe types, condition, etc.)
Kiosks		
Newspaper Boxes		
Mailboxes		
Public Phones		
Street Lighting		

SITE AREA DATA
PEDESTRIAN CHARACTERISTICS

(Record for street on which station is located, and for each other major street, if different. Please use separate data forms for each street.)

STREET NAME:

CHARACTERISTICS	YES	COMMENTS
No Pedestrian Activity		
Characteristics of Pedestrians: Businesspeople		rough proportions of the total pedestrian group? time of day? etc.
Blue Collar/Laborers		
Shoppers		
Street People		
Other (explain)		
Pedestrian Activity: * Dynamic		rough estimates of #s of pedestrians, cyclists? other comments?
Static		
Concentrated		
Scattered		
Varies by Time of Day (describe)		

* Provide a rough estimate by counting pedestrians for five minutes at a main pedestrian traffic area on the street.
Pick an imaginary "line" on the ground in that area, and count numbers of pedestrians who cross that "line," even if a given pedestrian back-tracks or re-crosses that line. Record the time of your observation. Do the same thing for cyclists.

Additional Comments:

SITE AREA DATA
LANDSCAPING CHARACTERISTICS ALONG STREETS/SIDEWALKS

(Record for street on which station is located, and for each other major street, if different. Please use separate data forms for each street.)

STREET NAME:

CHARACTERISTICS	YES	COMMENTS
Trees: (list types)		(list types if known) deciduous? leafy? etc.
Spacing: Sparse		give rough estimate of spacing distance (in ft.)
Average		
Dense		
Interrupted		
Uniform		
Size: Small		give rough estimate of height and spread (in ft.)
Medium		
Large		
Shade: Minimal (< 30% under tree)		
Moderate (30-60% under tree)		
Heavy (>60% under tree)		
Canopy Effect?		
Other Vegetation: (describe/explain)		shrubs? flowers? describe.

Additional Comments/Diagrams/Sketches:

Appendix VI. Mail-back Survey and Cover Letter

June 1, 1999

Dear Homeowner/Occupant:

You have been selected to participate in a study on the relationship between travel behavior and neighborhood land use and design characteristics. This study is part of a larger research program at the Institute of Urban and Regional Development (IURD), located at UC Berkeley. Ultimately, the results of this research will contribute to the development of more livable communities, through improved urban planning and design strategies. Your participation will therefore benefit not only residents of East Bay communities, but communities throughout the United States.

An important part of this study is a survey of household travel behavior and household use of neighborhoods, which I have enclosed with this letter. Your household, along with approximately 1400 others, was randomly chosen from East Bay address listings to represent your neighborhood. Your participation in this survey is entirely voluntary. All information and answers will remain confidential. Addresses of those participating in the study will not be published in any reports on this study, and will not be made available to the general public. All results will be discussed in general, and anonymous, terms.

Each survey includes a questionnaire, as well as a reference map, showing the area within approximately 3 miles of your home. This area is called the "study area," or "neighborhood," in the survey questions. The survey asks you questions about how you chose to live in your neighborhood/study area, what you like and dislike about it, how you get around in it, and how you do your shopping and other personal business in this area. While you are given a choice of specific answers for most of the questions, please feel free to write in additional comments.

The success of this project depends upon a high response rate, so I would greatly appreciate your returning the completed survey to IURD in the enclosed, stamped envelope, within three days (or as soon as possible). The survey has been designed for anyone eighteen years or older to complete. To ensure that we get a random sample of respondents, please have the adult in your household with the most recent birthday complete the survey. Please follow the instructions for answering each question as closely as possible; note that questions appear on *both* sides of each page.

Again, I am well aware of the many demands on your time, and greatly appreciate your willingness to participate in this research project. I look forward to receiving your completed survey in the next few days.

Sincerely,

Juliet Lamont
Department of Environmental Planning, University of California at Berkeley

HOUSEHOLD TRAVEL AND NEIGHBORHOOD USE SURVEY
(Please have the adult - i.e. 18 years or older - with the most recent birthday complete the survey)

TODAY'S DATE (i.e. fill in date on which you are taking/filling out this survey): _____

Section 1. Information on Your Household:

1. Using the "study area" map attached to this survey as a reference, please mark the location of your home on the map (Mark with an "X").

2. What do you call the area you live in (e.g. Noe Valley, Elmwood, etc.)? ____________________

3. What is your address (house and apt. #, number, street, city)? ____________________________

4. Including yourself, how many people live in your household? _____

5. What are the ages of members of your household? (list your age first) _________________

6. Housing type (circle one)

   Single family, detached building
   2-4 unit building
   5-9 unit building
   10 or more unit building
   Other (specify): ______________________

7. Do you own or rent your home? (circle one) Own Rent Other

8. How long have you lived at your current residence? __________

9. Your Employment Status (check all that apply ; full-time means that you work more than 20 hours per week)

   _____Full time paid employment
   _____Part-time paid employment
   _____Unpaid employment
   _____Full-time student, not employed
   _____Self-employed
   _____Homemaker/child care-taker
   _____Full-time student, employed PT
   _____Part-time student, employed PT
   _____Retired
   _____Unemployed
   _____Other (specify): ___________

10. How many additional adults in the household, EXCLUDING YOURSELF, work full-time? _____

Section 2. Attitudes About Your Neighborhood/Study Area
(Use study area map, if needed)

1. When did you first move to this neighborhood/study area? ____________________________

2. Overall, do you like this neighborhood? Yes No Mixed Feelings

3. What were the top three things that made you choose to live in this area?

   1) ____
   2) ____
   3) ____

4. What were the top three things that you disliked the most about this area when you were choosing to live here?

1) ______________________________
2) ______________________________
3) ______________________________

For the following questions, please indicate whether you STRONGLY AGREE, AGREE, PARTIALLY AGREE, DISAGREE, or STRONGLY DISAGREE with the following statements by checking the appropriate box.

5. Housing Selection, Price, and Quality

"In the area where I live..."	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree	Don't Know
he housing selection (e.g. lot size, house size, etc.) is good	___	___	___	___	___	___
the housing prices are reasonable (to buy	___	___	___	___	___	___
he rental prices are reasonable	___	___	___	___	___	___
it has nice, attractive houses	___	___	___	___	___	___

6. Automobile Access Within and Around Neighborhood/Study Area

"In the area where I live..."	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree	Don't Know
I can get around easily with my car	___	___	___	___	___	___
parking is easy for residents	___	___	___	___	___	___
parking is easy for visitors	___	___	___	___	___	___

7. Pedestrian, Bicycle, and Public Transit Access Within and Around Neighborhood/Study Area

"In the area where I live..."	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree	Don't Know
I can get around easily WITHOUT my car	___	___	___	___	___	___
it is easy and enjoyable to walk in the area	___	___	___	___	___	___
t is easy and enjoyable to bicycle in the area	___	___	___	___	___	___
it is easy to get to, and use, public transit	___	___	___	___	___	___

8. Quality of Services

"In the area where I live..."	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree	Don't Know
the quality of schools/universities/etc. for adults is good	___	___	___	___	___	___
there are many cultural opportunities available	___	___	___	___	___	___
it has a good mix of local stores	___	___	___	___	___	___
I use many local neighborhood facilities (shops, parks,etc)	___	___	___	___	___	___
t has plenty of parks and open space	___	___	___	___	___	___

9. Visual/Aesthetic Quality of Neighborhood/Study Area

"In the area where I live..."	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree	Don't Know
the residential landscaping is attractive and well-maintained	___	___	___	___	___	___
residential streets are attractive and pleasant	___	___	___	___	___	___
commercial areas have attractive, pleasant streets	___	___	___	___	___	___

10. Community Qualities of Neighborhood/Study Area

"The following thing is true about the area in which I live..."	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree	Don't Know
I feel safe here during daylight hours	___	___	___	___	___	___
I feel safe here after dark	___	___	___	___	___	___
I interact with my neighbors.	___	___	___	___	___	___
it's close to my job	___	___	___	___	___	___
it's close to many of my friends	___	___	___	___	___	___
other (specify): ______________________	___	___	___	___	___	___

11. Quality of Neighborhood/Study Area Environment for Children

"The following thing is true about the area in which I live..."	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree	Don't Know
it's a good environment for children	___	___	___	___	___	___
my children have lots of friends nearby	___	___	___	___	___	___
there are many activities for my children to take part in	___	___	___	___	___	___
there are good recreational facilities for children	___	___	___	___	___	___
there are good parks for children to play in	___	___	___	___	___	___
t is a safe neighborhood for children	___	___	___	___	___	___
the quality of schools for children is good	___	___	___	___	___	___
hildren's activities are affordable	___	___	___	___	___	___
other (specify): ____________	___	___	___	___	___	___

Section 3. Getting Around Your Neighborhood/Study Area

1. How many autos, sport utility vehicles, pickups, and vans are owned/used by members of your household? ___

2. How many bicycles are owned/used by members of your household? ____________

3. Of bicycles in your household, how many are for children/teens? _____ For adults? _____

4. How far is your job from your home? (circle one; if not employed, skip to question 6)

less than 1/4 mile	2 to 5 miles
1/4 mile to one mile	5 or more miles
1 to 2 miles	

5. Do you ever travel from your home to your job using (or including) any of the following travel modes? (Circle one number category for each travel mode)

	Number of times per month			
By walking	0-1	2-3	3-5	6 or more
By bicycling	0-1	2-3	3-5	6 or more
By public transit	0-1	2-3	3-5	6 or more

Section 4. Shopping and Services in Study Area
(Use the attached study area map for reference)

1. Where do you shop most frequently for groceries? (does not have to be within study area)

   Names of cross-streets, area : ______________________________
   City: ______________________________

2. Where do you shop/go most frequently for the following items/activities? (does not have to be within study area) (briefly list location for each item; you can list multiple locations if appropriate)

   Clothing: ______________________________
   Household supplies (hardware, drugstore, etc.): ______________________________
   Restaurants: ______________________________
   Gifts, Miscellaneous (e.g. bookstores, etc.): ______________________________
   Other (please specify): ______________________________

3. Rockridge is a major shopping area within this survey's area of study (shopping area is marked on attached map). How often do you shop in Rockridge? (circle one)

   1 = rarely or never (less than once a month)
   2 = occasionally (2 or 3 times a month)
   3 = frequently (2 or 3 times a week, or more)

4. What types of activities do you do in this shopping area? (check all that apply)

   ____ Work
   ____ School (your own)
   ____ School (children delivered, picked up)
   ____ Grocery Shopping
   ____ General Shopping (e.g. clothes, hardware, etc.)
   ____ Social/Recreational
   ____ Medical/Dental
   ____ Dining Out
   ____ Entertainment (movies, theater, etc.)
   ____ Personal Business
   ____ Other (please specify): ________

5. What do you like the MOST about this shopping area? (list top three things)

   1) ______________________________
   2) ______________________________
   3) ______________________________

6. What do you like the LEAST about this shopping area? (list top three things)

   1) ______________________________
   2) ______________________________
   3) ______________________________

7. Is it easy for you to walk from your home to this shopping area? Yes No

8. Do you ever travel from your home to this shopping area using (or including) any of the following travel modes? (Circle one number category for each travel mode)

	Number of times per month			
By walking	0-1	2-3	3-5	6 or more
By bicycling	0-1	2-3	3-5	6 or more
By public transit	0-1	2-3	3-5	6 or more

9. Overall, do you think that this shopping area is attractive? Yes No

10. Do you feel like this shopping area is a good place to "hang out," socialize, etc. ? Yes No Mixed Feelings

For the following questions, please indicate whether you STRONGLY AGREE, AGREE, PARTIALLY AGREE, DISAGREE, or STRONGLY DISAGREE with the following statements by checking the appropriate box.

11. Design Aspects of Rockridge Shopping Area:

"The following thing is true about this shopping area..."	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree	Don't Know
landscaping is attractive and well-maintained	___	___	___	___	___	___
sidewalk space is adequate and easy to use	___	___	___	___	___	___
there is adequate seating (benches, etc.) around the area	___	___	___	___	___	___
there is a good mix of stores and services	___	___	___	___	___	___
the architecture is attractive and interesting	___	___	___	___	___	___
I feel like it is a safe area during the day	___	___	___	___	___	___
I feel like it is a safe area after dark	___	___	___	___	___	___
I enjoy coming to this area, and spending time here	___	___	___	___	___	___

12. Traffic Aspects of Rockridge Shopping Area

"The following thing is true about this shopping area..."	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree	Don't Know
traffic levels are usually light	___	___	___	___	___	___
traffic speeds are generally slow	___	___	___	___	___	___
parking is easy	___	___	___	___	___	___
I feel safe crossing the streets in this area	___	___	___	___	___	___
it easy to walk around in this shopping area	___	___	___	___	___	___

Section 5. Other Information (For Statistical Purposes Only):
Your answers to the following questions will allow us to verify the statistical validity of our survey. Answers will be kept confidential.

1. Sex (circle one): Female Male

2. Marital Status (circle one): Single Married Other

3. What is the highest level of education you have completed? (circle one)

junior high school	four years of college
high school	graduate school
two years of college	other (specify): ____________

4. Please indicate your approximate household income (before taxes) in 1998 (circle one):

Less than $20,000	$60,000 to $79,999
$20,000 to $39,999	$80,000 to $99,999
$40,000 to $59,999	$100,000 or more

5. Race (circle one):

African-American	Hispanic
Asian	Native American Indian
Caucasian	Other

Section 6. General Comments
Please make any general comments or suggestions about your feelings about your neighborhood (continue on back of page, if needed).

____

____

____

Thank you for your time in completing this survey. The survey results will be available during the fall of 1999.
If you are interested in obtaining these results, please send a postcard to Juliet Lamont at the Institute of Urban and Regional Deviopment,
316 Wurster Hall, University of California, Berkeley, CA 94720. (510) 642-4874.

Trip Diary:

Yesterday, how many trips did you make? (one trip = a trip starting at a particular point, e.g. home, and ending
at the next specific destination, e.g. a café, grocery store, job, etc.). Include ALL trips made - by car, bike, foot, etc.
Fill in table below, following examples described in Sample Table:
(please fill in brief addresses of the address of place you started/ended is not obvious, as done in Sample Table)

SAMPLE TABLE:

Trip #	Place Started	Place Ended	Purpose of Trip	Travel Mode
1	Home (Spruce St, Berk.)	N. Berkeley BART	connect to BART for work	car
2	N. Berk. BART	Citicenter BART	work	BART
3	Citicenter BART	Office (Broadway/14th, Oak.)	work, stop for coffee	walk
4	Office	Restaurant (12th/Broad, Oak.)	lunch	walk
5	Restaurant	Hardware store (13th/Broad, Oak.)	shopping	walk
6	Hardware store	Office	return to work	walk
7	Office	Citicenter BART station	return home	walk
8	Citicenter BART	N. Berkeley BART station	return home	BART
9	N. Berk. BART	Grocery store (Cedar/Vine, Berk.)	pick up groceries	car
10	Grocery store	drugstore (Shattuck/Rose)	shopping	walk
11	Drugstore	Grocery store	return to car	walk
12	Grocery store	Home	return home	car

Total Number of Trips: __12__

YOUR TRIP TABLE:

Trip #	Place Started	Place Ended	Purpose of Trip	Travel Mode

Total Number of Trips: _______

Appendix VII. "Best" Linear Regression Model of Home-to-Shopping-Area Walking Frequency (Full Model)

Variable	Coefficient Estimate	Standard Error	T-Value	P-Value
Rockridge	0.71323	0.09046	7.884	6.59E-14
Albany	0.69104	0.09612	7.189	5.63E-12
Walnut Creek	0.71834	0.10036	7.158	6.84E-12
Fremont	0.61830	0.10143	6.096	3.49E-09
Age factor (18-30 yrs)	0.07198	0.03861	1.864	0.06334
Live within 1/4 mile	0 by definition	0 by definition	0 by definition	0 by definition
Live 1/4 to 1/2 mile away	-0.25896	0.09755	-2.655	0.00838
Live 1/2 to 1 mile away	-0.50118	0.08951	-5.599	5.02E-08
Live 1 mile or more away	-0.75362	0.08738	-8.655	4.44E-16
Shop in area frequently	0.21808	0.03955	5.513	7.83E-08
Student	0.20889	0.10042	2.08	0.03839

Residual Standard Error:	0.325 on 288 DF (degrees of freedom)
Multiple R-Squared:	0.5888
Adjusted R-Squared:	0.5746
F-statistic:	41.25 on 10 and 288 DF
P-value:	0